AWID

Master Index

Applied Wireless Identifications Group, Inc.
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Program Instructions

UHF Long-Range Reader Settings

These instructions are for AWID's Long Range Reader Settings ("LRReaderSettings") program (V17.0630.3.3 as of this writing). The program is compatible with Microsoft Windows versions XP and newer. It works with all *AWID UHF long-range readers (LR-2000 series, LR-3000 and LR-911). The program can be run with a new reader at your shop, or at the site after you install the reader.*

The program has 3 functions. The effect of changes is visible as soon as you click on the "Apply" or "Set" button. (There is no limit to the number of times that these changes can be made.)

1. *Select the reader's* ***Read Repeat Rate****.* There are 7 rates, from 3 reads per second to 1 read per 20 seconds.
2. *Adjust the reader's* ***RF Power*** *output level*. Power drops in steps from maximum to about 10% of maximum.
3. ***Display the data*** *from the reader's RS-232 interface*. There is a separate row of 18 characters for each tag read.

A. Material Required

- PC with Microsoft operating system Windows XP or newer.
- "LongRangeReaderSettings" program (download at no cost from AWID's Web site).
- AWID's UHF long-range reader, Model LR-___.
- AWID's LR-TEK or LR-2000KIT: DC power supply, LR-Sounder test unit, cable adapters, tags and cards.

B. Downloading the "LRReaderSettings" Program

1. Go on AWID's Web site, www.awid.com<http://www.awid.com>.
2. On the home page, click on Support > Downloads > Access Control > Software Tool > LRReaderSettings.
3. Download this ZIP file (program installer + instructions) on the PC that will connect with your long-range reader.

C. Installing the Program

1. UnZIP the "LRReaderSettings" file. This shows the Windows program installer.
2. Click-Open "Setup" to install the program. (A *"Shortcut to AWIDLRReaderSettings"* appears on desktop afterwards.)

D. Wiring to Run the Program

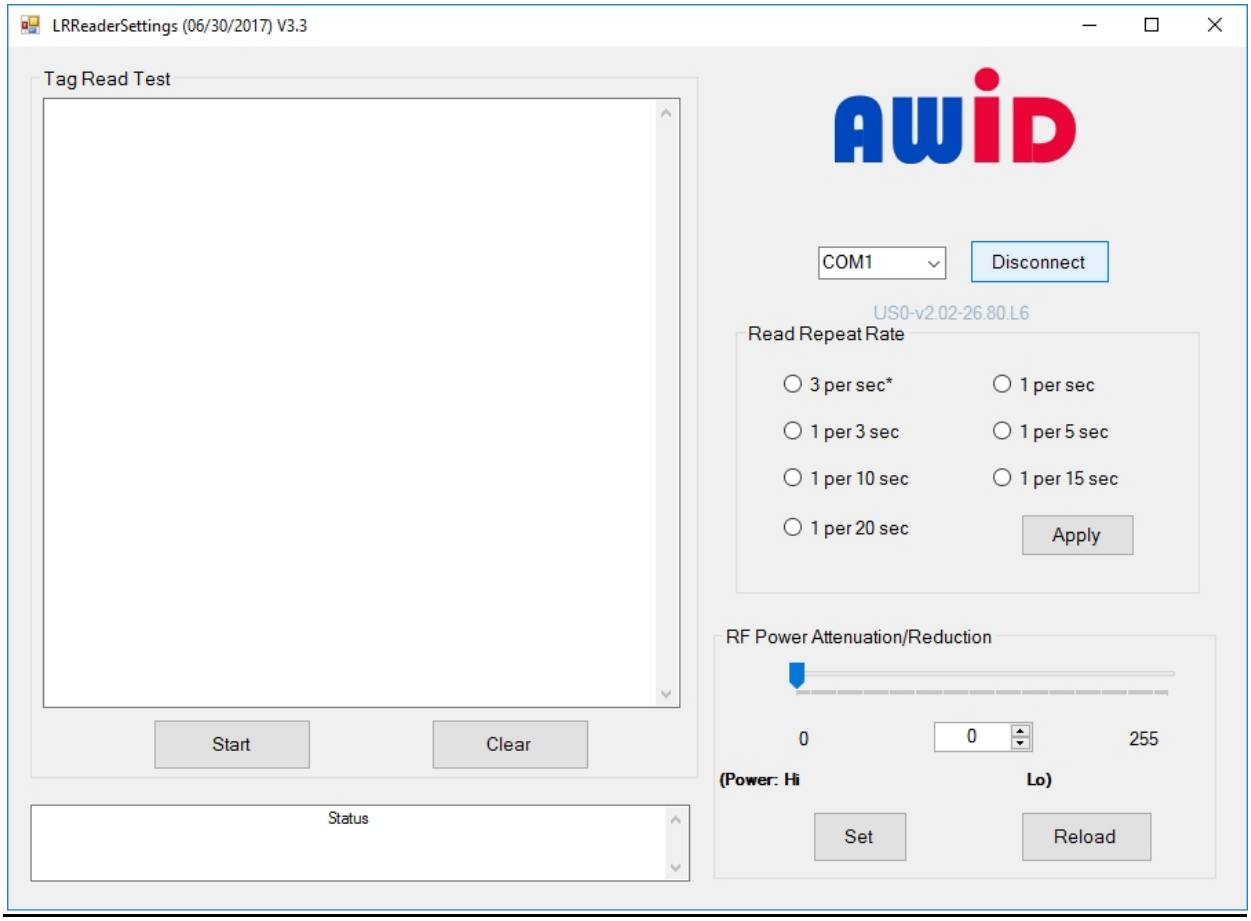
1. Use the Kit's cable adapter with gray jacket. Clip the adapter's **blue** to the LR reader's **blue**, **orange** to **orange**, and **violet** to **violet**.
2. Connect the gray cable adapter to your PC's serial data port.
   - If the PC has a 9-pin "D" serial input port, plug the gray adapter's 9-pin connector into the PC's serial port.
   - If the PC has USB ports only, connect the Kit's cable adapter with black jacket to the gray adapter's 9-pin "D" connector. Then plug the black adapter's USB connector into any USB port on the PC.
3. Power the reader using the reader's regular DC supply, or AWID's plug-in module from the Kit, or a 12 volt battery.
4. If the reader's **green** and **white** Wiegand data lines, the **yellow** arming wire, and the **gray** or bare **drain** wire are connected, they may be left connected.

E. Preparing the Reader to Read a Tag or Card

1. Connect the reader's **yellow** wire to the **black** wire. This arms the reader for RF generation, to activate the tags.
2. Hold an AWID UHF tag or card in front of the UHF reader. It may be convenient to start with the tag directly in front of the reader, then gradually move the tag away from the reader's face to see at what distance steady reading is displayed.

F. Running the Program

1. **COM Port**: Select a COM port. Then click on the "**Connect**" key.
2. **Tag Read Test**: This window displays the reader's RS-232 data when a UHF tag or card is presented to the reader.
   - Click on the "**Start**" key. Each reading of the test tag or card appears as a row of 18 hexadecimal characters. (For 26-bit code format, there are 7 significant characters, followed by 11 zeros.). Each new read is inserted as a row at the bottom of the data window. A new reader displays data at 3 reads per second, with full RF power.
   - To erase earlier tag reads from the window, click on the "**Clear**" key.
3. **Read Repeat Rate**: A new reader always reads at 3 reads per second. You can change the read rate to any of the other settings. Click the button for the new repeat rate. Then click on the "**Apply**" key. The change is transferred to the reader immediately.
4. **RF Power Attenuation**: A new reader always operates at full power, with the blue pointer at zero attenuation. You can reduce the reader's RF Power level by (a) dragging the pointer to the desired level, or (b) entering the desired level in the "textbox" beneath the pointer's scale. High power is at 0 attenuation; low power (about10% of high power) is at 255 attenuation.
   - You can save this change by clicking on "Set", or you can see the unchanged setting that is active in the reader by clicking on "Reload".
   - When you click on "Set", the change is transferred to the reader immediately.
5. **Status** of the repeat rate and power level changes is shown in the lower left window, under Tag Read Test.
6. To observe the changed functions immediately in the **Tag Read Test** window, present the tag or card to the reader.



G. Ending the Program

1. Click on the "Disconnect" key (upper right). Then close the program.
2. *Important:* After you make changes in Read Repeat Rate and RF Power, cycle the reader's DC power off for several seconds, and then restore power to the reader. The reader is now ready for use with the access control system. This locks in the changes until the next time that you run the LRReaderSettings program.

Notes – Uses of This Program

(a) The LRReaderSettings program can display RS-232 data in the Tag Read Test window for *all* AWID readers that have an RS-232 data interface.

- For wiring the interface, see AWID's Technical Reference "RS-232 Interface".
- For cable adapters that make the interface for testing easy, see AWID's product sheet and instructions for LR-TEK or LR-2000KIT test/demo kit.

(b) The UHF long-range readers use all three of the features of this program.

(c) This program displays code data exactly like the Windows HyperTerminal program.

Notes – Wiring

(a) Power and ground:
Always connect the reader's ***black*** wire to the power supply's negative *first,* before all other connections.
Connect the ***red*** wire to the power supply's positive terminal *last*, after all other connections.

(b) Connections for this program:
Connect the three RS-232 interface wires (the Cable Adapter's **orange**, **blue** and **violet**) as described in step D.1.
Use the 9-pin "D" connector (step D.2) if suitable for the PC. Use the USB Cable Adapter (step D.2) if required.
Connect ground and power (**black** and **red**).
The data and drain wires (**green**, white, and **gray** or bare) may be either connected or disconnected.
The RF arming circuit (**yellow**) may be either connected or disconnected when changing the "Read Repeat Rate" and the "RF Power" level, but it *must* be **connected** to the reader's **black** wire when reading a tag in "Tag Read Test".

(c) Connections using Wiegand interface to an access control panel:
Connect the reader using the wiring list in the reader's "Quick Installation Guide" (page 2, in words and in diagram).

(d) Connections using RS-232 interface to a controller or PC:
Connect the reader using the wiring list in AWID's Technical Reference "RS-232 Interface" (page 2, section B).

Notes – Program Operation

(a) Changes in Read Repeat Rate and RF Power level can be made as often as desired, in either direction.

(b) Be sure that the PC's serial or USB port is active. In the Desktop, check in –
My Computer → Control Panel → System → Hardware (if available) → Device Manager.

(c) If the "LRReaderSettings" program does not operate immediately, try removing power from the reader and then restoring power. Then restart the program on the PC. Or reboot the PC.

(d) If the program's pop-up message window indicates that a particular COM port is not available, try reversing the **orange** and **violet** wires – orange to violet, and violet to orange. This color reversal may be necessary on older LR-911 readers, and for the uAxcess readers.

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Instructions for Use

KT-UHF Keytag

PLEASE READ
BEFORE DISTRIBUTING TAGS

The KT-UHF Keytag is for identification of people in access control systems that use AWID's UHF long-range reader models LR-2000, LR-2200, LR-3000, and small wall-mounted UHF readers. The keytag is presented to the reader by hand. The installing dealer must give instructions to the customer for the end users.

READER LOCATION

The UHF **long-range reader** is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of vehicle-mounted tags and hand-held cards and keytags. The long-range reader may be dedicated to use with these UHF keytags only, if you want.

The UHF **wall-mounted reader** is usually installed on a wall close beside a controlled-access door or gate for pedestrians.

KEYTAG READING LOCATION

- The UHF keytag must be held by hand inside the reader's effective RF field, usually 10 feet to 12 feet in front of the long-range reader, or up to 6 inches or 12 inches in front of the small reader.
- The keytag reads best if it is in line with the reader, face-to-face, with clear line of sight between the keytag and the reader.

VEHICLE CHARACTERISTICS

To reach the rated reading distance for the KT-UHF with a long-range reader, the keytag should be held outside the vehicle's window. Either flat side of the keytag should face the reader.

TEST FOR RELIABLE KEYTAG READING (with a Long-Range Reader)

1. Move the vehicle so that the selected keytag reading location is in the reader's effective RF field. At the selected keytag location, hold the keytag by squeezing its metal tab between the thumb and forefinger. The hand should be away from the keytag. The fingers should not cover the face of the keytag. The keytag should face the reader.
2. Do not have other material near the keytag while testing. It should be in open space, with only the fingers close.
3. Keytag reads are indicated by AWID's LR-Sounder test unit clipped to the reader's wires, or by the reader's LED, or by gate or door opening.

USING THE KEYTAGS

- To hold the keytag, clamp it between fingertips at the metal tab.
  Your hand should be behind the keytag.
  Your fingers should not extend over the face of the keytag.
  Keeps keys away from the keytag.
- If the keytag is suspended from a keychain or keyring, hold the keychain or keyring between your fingertips.
- At the planned reading distance, align the keytag with the face of the reader.



FOR END USERS

- Prepare written instructions for the customer.
- Train the customer's technician in use of the keytags.

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Installation Instructions

PT-UHF Portable Tag

PLEASE READ
BEFORE ATTACHING TAGS

The PT-UHF Portable Tag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. Like a toll highway tag, it uses hook-and-loop adhesive strips for support. The tag can be used in any number of cars. The installer must give instructions to the customer.

READER LOCATION

The UHF long-range reader is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. Mount the reader above or at either side of the travel lane. For passenger cars, typical reader height is 8 feet to 9 feet. An adjustable-head bracket lets you aim the reader toward the top-center of the windshield at the reading distance.

TAG LOCATION

- The PT-UHF tag must be used inside the reader's effective RF field. See AWID's diagram for the field shape.
- Usual reading distance when the tag is fastened by hook-and-loop strip inside the windshield: up to 15 feet.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- The tag is usually attached inside the windshield, at top-center. It uses hook-and-loop strip like a toll highway tag.

APPLICATION CHARACTERISTICS

- The PT-UHF tag identifies the person to whom the tag is assigned. That person may then use it in any vehicle.
- **Secure** – the tag is supported firmly inside the vehicle. **Convenient** – the tag may be pulled off its fastener strip and carried to another vehicle. **Multiple** cars – one tag held by fastener strip on windshields in other cars as needed.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the top-center of the windshield is in the planned reading space. With the adhesive hook-and-loop strip covered by the protective paper, hold the tag in place, using your fingers at the edges of the tag.
2. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening.

ATTACHING THE TAG



1. Identify the planned location and orientation for the PT-UHF tag. The tag's orientation may be either "portrait" or "landscape".
2. Prepare the windshield – clean it with glass cleaner spray and a paper towel.
3. Peel the paper that protects the adhesive from the tag's hook-and-loop strip.
4. Press the tag's adhesive strip **firmly** against the windshield glass.
5. Program the tag's code into the host system's software.

- Allow the hook-and-loop strip's adhesive to cure for a day or more before pulling the two pieces of the hook-and-loop strip apart.
- The PT-UHF tag is shipped with 2 spare adhesive hook-and-loop strip sets. Additional strips can be used in other vehicles. The strip sets are a standard product -- 3M Dual Lock™ -- available from local suppliers.

ALTERNATIVES AWID has other tag types for installation inside and outside vehicles of all types. Please see AWID's "UHF Credentials" product sheet, or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train a technician in this installation procedure.

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Installation Instructions

SV-UHF Sideview Mirror Tag

PLEASE READ
BEFORE ATTACHING TAGS

The SV-UHF Sideview Mirror Tag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and "HiLo" variations. The tag attaches permanently on the shell of an outside mirror. The installing dealer must give instructions to the customer. Users need assistance for correct use of this tag.

READER LOCATION

- The UHF long-range reader is usually installed so that it faces a clear, open space shaped like a balloon about 30 feet long and 16 feet diameter. An adjustable-head bracket lets the installer aim the reader toward the location of tags.
- The reader may be mounted at the side of the travel lane, facing the approaching vehicles. Typical height is 8 feet.

TAG LOCATION

- The SV-UHF tag must be installed inside the reader's effective RF field, usually 20-25 feet in front of the reader.
- The tag reads best if it is away from metal, in line with the reader, with clear line of sight between the tag and reader.
- The tag should be held flat. It should be attached by its adhesive to an approximately flat surface outside the car.
- The front face of the UHF reader should be aimed directly at (a) the front of the tag or (b) either long edge of the tag.
- For least visibility and best protection of the tag, it may be attached on the bottom edge of the side mirror's shell.

The SV-UHF tag is not to be used as a portable tag. It is not to be held by hand. You must use the tag's adhesive for permanent attachment on the sideview mirror's shell. Other flat locations outside the vehicle also may work well.

VEHICLE CHARACTERISTICS

- Attaching the SV-UHF tag on a metal surface may prevent reading the tag's code. Put the tag on a plastic surface.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the side-view mirror is in the planned reading space. Put small pieces of tape over the ends of the tag, not covering the long antenna. Place the tag on the mirror's shell with the peelable paper against the shell. The tape should be easily peelable (masking or electrical tape – not clear mending or sealing or duct tape).
2. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate opening. (Do not use adhesive to hold the *test* tag on the vehicle. The same test tag may be used repeatedly.)

ATTACHING THE TAG



1. Prepare the mounting surface – clean it with glass cleaner spray and paper towels.
2. Keep the tag flat while you peel the paper sheet gently from the tag's adhesive.
3. Hold the tag against the non-metal surface at the selected location.
4. Press the tag firmly so that it is flat and smooth on the surface – no bubbles.
5. Program the tag's individual code into the host system's database.

This is a *single-use* tag for *permanent* application. After the adhesive cures, the tag will be disabled if it is ripped off the surface. The tag can not be re-used after it is attached.

ALTERNATIVES

- This tag can be installed on a surface outside a vehicle where the tag's face or either long edge faces the UHF reader.
- AWID has other tag types for installation inside and outside vehicles. Please see AWID's Credentials product sheets, or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train the customer's technician in this installation procedure. The end users may not be able to install tags well.

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Installation Instructions

ST-UHF Supertag

PLEASE READ
BEFORE ATTACHING TAGS

The ST-UHF Supertag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. This tag is specialized for rugged service conditions with extended range in industrial and commercial applications. The installing dealer must give instructions to the customer.

READER LOCATION

The UHF long-range **reader** is usually installed facing a clear, open, balloon-shaped space, about 40 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of tags. The reader must be mounted where it faces the planned location of the ST-UHF tag. A common reader location is on a post or pedestal or wall beside the lane, aimed straight across toward the side of the vehicle or container. Others reader locations can work well.

TAG LOCATION

- The ST-UHF **tag** must be installed inside the reader's effective RF field, usually 5 to 35 feet in front of the reader.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- The ST-UHF tag is usually attached permanently to a flat surface outside a truck, trailer or container. It may be exposed to weather.

The ST-UHF tag can be carried between vehicles or containers. Its uses may be temporary or permanent.

APPLICATION CHARACTERISTICS

- The ST-UHF tag may perform best when it is fastened on a large metal surface.

TEST FOR RELIABLE TAG READING

1. Move the vehicle or container so that the selected tag location is in the planned reading space. At the selected tag location, support the tag using wire or cable ties, or tape over the flat corners of the tags. Tape should be easily peelable (masking, electrical, duct tape – not clear mending or sealing tape). Keep the tag facing the reader directly.
2. Do not use adhesive behind the tag to hold it for testing. The same test tag may be used repeatedly.
3. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening.

ATTACHING THE TAG



- **By adhesive**: Use double-side adhesive tape, or sealant, or suitable liquid adhesive. Press the tag firmly against the flat surface. Allow adhesive to cure for permanence.
- **By fasteners**: Select suitable screws or rivets. Hardware should be stainless steel or brass or Nylon. Mark and drill holes in the flat mounting surface. Insert washers under screw heads.
  For **removable tag**, use round-head or hex-head machine screws.
  For **permanent tag**, apply adhesive or double-stick tape behind the tag.
  Use security-head machine screws or rivets to prevent removal of the tag.

ALTERNATIVES AWID has other tag types for installation inside and outside vehicles of all types. Please see AWID's "UHF Credentials" product sheet, or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train a technician in this installation procedure.

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Installation Instructions

HT-UHF Hangtag

PLEASE READ BEFORE ATTACHING TAGS

The HT-UHF Hangtag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. The tag may be moved easily between different vehicles. The installing dealer must give instructions to the customer. End users need assistance for correct use of this tag.

READER LOCATION

The UHF long-range **reader** is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of tags inside vehicles as they are read. The reader may be mounted at the side of the travel lane, or above the lane. For a tag hooked on the rear-view mirror, typical reader height is 8 feet if the reader is at the side of the lane, or 9 feet for clearance if the reader is above the lane.

TAG LOCATION

- The HT-UHF **tag** must be hooked or held inside the reader's effective RF field, usually 10 feet in front of the reader.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- The tag may be held by fingers at the hook, so that the large surface of the tag faces the reader directly
- If the reader is at the side of the travel lane, the driver may need to unhook the tag and hold it facing the reader.

VEHICLE CHARACTERISTICS

Most vehicles read a tag well through the windshield. A few vehicles may have **metallic coating** on the windshield, or **wires embedded** in the glass, which shorten the read range. If so, we may need to use a different tag location or tag type. A successful location may be behind **top-center** of the windshield, where most recent cars have an uncoated area.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the selected tag location is in the planned reading space. At the selected tag location, hold the HT-UHF tag by squeezing the hook between your fingers. Keep the tag facing the reader through the windshield.
2. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening. (Do not tape the test tag inside the glass. The tag reads best when it is at a distance from the glass.)

ATTACHING THE TAG



1. For security, record the tag's code, then pull the printed code label off the tag.
2. On the **rear-view mirror**, press the tag's hook over the post of the inside mirror. Either side of tag may face the reader. The tag should hang freely. If necessary, tilt the tag by fingers so that the tag faces the reader directly.
3. In the **fingers**, squeeze the tag's hook to hold the tag facing the reader.
4. When reading, the Hangtag should be away from material on either side.

The HT-UHF Hangtag can be moved easily from one vehicle to another. It can be carried in a pocket between uses. Keep the tag flat when moving it.

ALTERNATIVES

AWID has other tag types for installation inside and outside vehicles. Please see AWID's Credentials product sheet and Technical Reference "Alternatives for 'Difficult' Cars", or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train the customer's technician in this installation procedure. The end users may not be able to install tags well.

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Installation Instructions

VT-UHF Sunvisor Tag

PLEASE READ
BEFORE ATTACHING TAGS

The VT-UHF Sunvisor Tag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. The tag may be moved easily between different vehicles. The installing dealer must give instructions to the customer. End users need assistance for correct use of this tag.

READER LOCATION

The UHF long-range **reader** is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of tags inside the vehicles. The reader must be mounted at the side of the travel lane, or above the lane. For all sizes of **passenger cars**, typical mounting height is 8 feet if the reader is at the side of the lane, or 9 feet for clearance if the reader is above the lane.

TAG LOCATION

- The VT-UHF **tag** must be installed inside the reader's effective RF field, usually 12-15 feet in front of the reader.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- The tag is usually clipped on the bottom edge of the driver's sun-visor, facing the reader through the windshield.
- If the reader is at the right side of the travel lane, the sun-visor tag must be clipped on the passenger's sun-visor.

The VT-UHF tag should not be held in the fingers or inserted in a card pouch for code reading. When you test the tag, it is best to have the white plastic clip in the tag's slot, and hold the clip by your fingers with the tag away from your hand.

VEHICLE CHARACTERISTICS

Most vehicles read a tag well through the windshield. A few vehicles may have **metallic coating** on the windshield, or **wires embedded** in the glass, which shorten the read range. If so, we may need to use a different tag location or tag type. A successful location may be behind **top-center** of the windshield, where most recent cars have an uncoated area.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the selected tag location is in the planned reading space. At the selected tag location, hold the VT-UHF tag by squeezing the clip between your fingers. Keep the tag facing the reader through the windshield.
2. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening. (Do not tape the test tag inside the glass. The tag reads best when it is at a distance from the glass.)

ATTACHING THE TAG



1. For security, record the tag's code, then pull the printed code label off the tag.
2. Slip the tag under the smaller tab of the clip, with the slot at the end of the tab.
3. Press the tag away from the larger tab. This locks the tag on the clip's tab.
4. Lower the sun-visor. Push the clip over the bottom edge of the visor. The tag should face forward, toward the reader through the windshield.
5. After the tag is read, raise the sun-visor. The tag then cannot be read.

The tag reads best when it is *not* held in the fingers. It can be moved easily from one vehicle to another. It can be carried in a pocket between uses.

ALTERNATIVES

AWID has other tag types for installation inside and outside vehicles. Please see AWID's Credentials product sheet and Technical Reference "Alternatives for 'Difficult' Cars", or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train the customer's technician in this installation procedure. The end users may not be able to install tags well.

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Instructions for Use

CS-UHF and GR-UHF Cards

PLEASE READ BEFORE DISTRIBUTING CARDS

The CS-UHF Clamshell Card and the GR-UHF Graphics Card are for identification of people in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and small wall-mounted UHF readers. The cards are presented to the reader by hand. The installing dealer must give instructions to the customer for the end users.

READER LOCATION

The UHF **long-range reader** is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of vehicle tags and hand-held cards. The long-range reader may be dedicated to use with these UHF cards only.

The UHF **wall-mounted reader** is usually installed on a wall close beside a controlled-access door or gate for pedestrians.

CARD READING LOCATION

- The UHF **card** must be held by hand inside the reader's effective RF field, usually 15 to 20 feet in front of the long-range reader, or up to 6 inches in front of the small reader.
- The card reads best if it is in line with the reader, face-to-face, with clear line of sight between the card and the reader.

VEHICLE CHARACTERISTICS

With the UHF long-range reader, it is possible for the hand-held card to read through the windshield or a side window. A few vehicles may have **metallic coating** on the windshield, or **wires embedded** in the glass, which shorten the read range. If so, the card's user may need to hold the card through the open side window, facing toward the reader.

TEST FOR RELIABLE CARD READING (with a Long-Range Reader)

1. Move the vehicle so that the selected card reading location is in the reader's effective RF field. At the selected card location, hold the card squeezed between the thumb and the fingers, so that the hand is behind the card and the fingers do not cover the face of the card. The card should face the reader directly.
2. Card reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening. (Do not attach the card to any material for testing. It must be unattached, squeezed between fingers.)

USING THE CARDS

- Hold the card by supporting it between the thumb and the fingers. The hand should be behind the card. The fingers should not extend over the face of the card.
- At the planned reading distance, align the card with the face of the reader.



FOR END USERS

- Prepare written instructions for the customer.
- Train the customer's technician in use of the cards.

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Installation Instructions

MT-UHF Metal-Mount Tag

PLEASE READ BEFORE ATTACHING TAGS

The MT-UHF Metal-Mount Tag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. This tag has many applications, usually outside vehicles. Common uses are in industrial and commercial facilities. The installing dealer must give instructions to the customer.

READER LOCATION

The UHF long-range reader is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of tags. The reader must be mounted where it faces the planned location of the MT-UHF tag. **Examples** of reader locations are (a) high above the travel lane (aimed straight down), (b) 8 feet high at the side of the lane (aimed at the front of approaching vehicles), and (c) a post or pedestal beside the lane (aimed straight across toward the side of the vehicle or container). Other locations are possible.

TAG LOCATION

- The MT-UHF tag must be installed inside the reader's effective RF field, usually 4 to 15 feet in front of the reader.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- The MT-UHF tag is for permanent attachment to a flat surface outside the vehicle. It may be exposed to weather.

APPLICATION CHARACTERISTICS

1. The MT-UHF tag may read best when it is fastened flat on a large metal surface, or with ¼ inch stand-offs at the ends.
2. The MT-UHF tag reads best when it faces the reader. It may be OK if it is rotated with a long edge nearer the reader.
3. If the MT-UHF tag is located on the side of a vehicle and the reader is beside the lane, **vertical** orientation of the tag may give best reading characteristics. Vehicles may then be able to move at higher speed past the reader.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the selected tag location is in the planned reading space. At the selected tag location, support the tag using wire or cable ties, or tape over the tag's 2 screw holes. Tape should be easily peelable (masking, electrical, duct tape – not clear mending or sealing tape). Keep the tag facing the reader directly.
2. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening. (Do not use adhesive to hold the test tag in place. The same test tag may be used repeatedly.)

ATTACHING THE TAG



- **By adhesive**: Prepare the surface – clean it with glass cleaner and paper towels. Peel the protective paper from the back of the tag. Press the tag firmly against the flat surface. Allow the adhesive to cure for permanence.
- **By fasteners**: Push out the 2 screw-hole plugs from the ends of the tag. Select fasteners with a head that fits inside the screw-hole recesses. Mark and drill holes in the flat mounting surface.

  For **removable tag**: Leave the paper covering the tag's adhesive. Use machine screws or self-tapping screws to hold the tag on the surface.

  For **permanent tag**: Peel the paper cover from the adhesive on the back of the tag. Use screws or rivets to secure the tag on the surface.

  Last, press the 2 plugs back into the ends of the tag, covering the fasteners.

ALTERNATIVES AWID has other tag types for installation inside and outside the vehicles. Please see AWID's "UHF Credentials" product sheets, or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train a technician in this installation procedure.

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Installation Instructions

RV-UHF Rearview Mirror Tag

PLEASE READ BEFORE ATTACHING TAGS

The RV-UHF Rearview Mirror Tag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. The tag is attached securely on the shell of the inside mirror. The installer must give instructions to the customer. End users need assistance for correct use of this tag.

READER LOCATION

The UHF long-range reader is usually installed facing a clear, open, balloon-shaped space, about 30 feet long and 16 feet diameter. An adjustable-head bracket lets you aim the reader toward the location of tags. The reader must be mounted above the travel lane or at another location where the reader faces the tag directly. For all sizes of **passenger cars**, typical mounting height is 9 feet for clearance if the reader is above the lane, or 8 feet if the reader is at the side of the lane.

TAG LOCATION

- The RV-UHF tag must be installed inside the reader's effective RF field, usually 15-20 feet in front of the reader.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- The RV-UHF tag is usually adhered to the shell of the inside rearview mirror, where the tag faces the reader directly.
- Other locations for the RV-UHF tag: (a) inside the windshield in the dark tinted area (where the tag is not seen) and (b) outside the vehicle on a dark surface – the front bumper, or a bar on the grille, or the shell of a side-view mirror.

The RV-UHF tag has only **one application** – permanent attachment on the selected surface, using the tag's single-use self-adhesive. When reading, this tag should not be held in the fingers, or carried, or taped, or inserted into a card pouch.

VEHICLE CHARACTERISTICS

Most vehicles read a tag well through the windshield. A few vehicles may have **metallic coating** on the windshield, or **wires embedded** in the glass, which shorten the read range. If so, we may need to use a different tag location or tag type. A successful location may be behind **top-center** of the windshield, where most recent cars have an uncoated area.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the selected tag location is in the planned reading space. At the selected tag location, support the tag (black side facing the reader) using tape on the tag's outer edge. The tape should be easily peelable (masking or electrical tape – not clear mending or sealing tape). Keep the tag flat at all times, facing the reader directly.
2. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate or door opening. (Do not use adhesive to hold the test tag against the glass. The same test tag may be used repeatedly.)
3. If the RV-UHF tag is tested on the windshield or outside the vehicle, move the test tag to different positions. Try both "portrait" and "landscape" orientations. Stay several inches from the edge of the windshield to avoid tag "shading".

ATTACHING THE TAG



1. Prepare the mirror's shell – clean it with glass cleaner spray and a paper towel.
2. Keep the tag flat while you peel the plastic sheet gently from the tag's adhesive.
3. Hold the tag at the smooth surface at the selected location.
4. Press the tag firmly so that it is flat and smooth on the surface – no bubbles.

This is a *destructible* tag for *one-time* application. After the adhesive cures, the tag will be destroyed if it is ripped off the mirror. The tag has slits for tamper-evidence.

ALTERNATIVES

- This tag can be installed on the side of a vehicle if the reader is at the side, facing the tag. Attachment on a side window is OK if the window is unmovable.
- AWID has other tag types for installation inside and outside vehicles. Please see AWID's Credentials product sheets or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train the customer's technician in this installation procedure. The end users may not be able to install tags well.

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Installation Instructions
WS-UHF Windshield Tag

PLEASE READ BEFORE ATTACHING TAGS

The WS-UHF Windshield Tag is for vehicle identification in access systems that use AWID's UHF long-range readers LR-2000, LR-2200, LR-3000, and their "HiLo" variations. The tag is attached securely inside a glass windshield. The installing dealer must give instructions to the customer. End-users need assistance for correct use of this tag.

READER LOCATION

The UHF long-range reader is usually installed so that it faces a clear, open space shaped like a balloon about 30 feet long and 16 feet diameter. An adjustable-head bracket lets the installer aim the reader toward the location of tags on vehicles. The reader may be mounted at the side of the travel lane, or above the lane. For all sizes of **passenger cars**, typical mounting height is 8 feet if the reader is at the side of the lane, or 9 feet for clearance if the reader is above the lane.

TAG LOCATION

- The WS-UHF tag must be installed inside the reader's effective RF field, usually 20-25 feet in front of the reader.
- The tag reads best if it is in line with the reader, face-to-face, with clear line of sight between the tag and the reader.
- If the reader is at the **side** of the travel lane, attach the tag on the same side of the windshield, inside the glass.
- If the reader is **above** the travel lane, attach the tag inside the windshield at its top-center, facing the reader.

The WS-UHF tag has only **one application** – permanent attachment inside the windshield glass, using the tag's single-use self-adhesive. When reading, this tag may not be held in the fingers, or carried, or taped, or inserted into a card pouch.

VEHICLE CHARACTERISTICS

Most vehicles read a windshield tag very well. A few vehicles may have **metallic coating** on the windshield, or **wires embedded** in the glass, which shorten the read range. If so, we may need to use a different tag location or tag type. A successful location may be at **top-center** of the windshield, where most recent cars have an uncoated area.

TEST FOR RELIABLE TAG READING

1. Move the vehicle so that the windshield is in the planned reading space. Press the plastic-sheet side of the WS-UHF tag flat inside the windshield. Use a hand-sized block of flexible plastic foam, about 4 inches thick, to press the tag. Tag reads are indicated by AWID's LR-Sounder clipped to the reader's wires, or by the reader's LED, or by gate opening. (Do not use adhesive to hold the test tag against the glass. The same test tag may be used repeatedly.)
2. To identify the ideal tag location inside the windshield, move the test tag to different locations – high and low. Try both "portrait" and "landscape" orientations. Stay several inches from edge of windshield to avoid tag "shading".

ATTACHING THE TAG



1. Prepare the windshield – clean it with glass cleaner spray and a paper towel.
2. Keep the tag flat while you peel the plastic sheet gently from the tag's adhesive.
3. Hold the tag up to the glass inside the windshield at the selected location.
4. Press the tag firmly so that it is flat and smooth on the glass – no bubbles.
5. The tag's adhesive bonds in 24 hours. It continues curing to assure single use.

This is a *destructible* tag for *one-time* application. After the adhesive cures, the tag will be destroyed if it is ripped off the glass. The tag has slits that give evidence of tampering.



ALTERNATIVES

- This tag can be installed on a *side* window (a) if the reader is at the side, facing the tag, and (b) if the window is unmovable so that the tag is always visible to the reader.
- AWID has other tag types for installation inside and outside vehicles. Please see AWID's Credentials product sheets, or talk with the Sales or Technical staff.

FOR END USERS Prepare written instructions for the customer. Train the customer's technician in this installation procedure. The end users may not be able to install tags well.

APPLIED WIRELESS ID

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GR and GR-MAG

GRAPHICS-QUALITY ISO PROXIMITY CARDS

To: Supervisor of Card Distribution

IMPORTANT INFORMATION

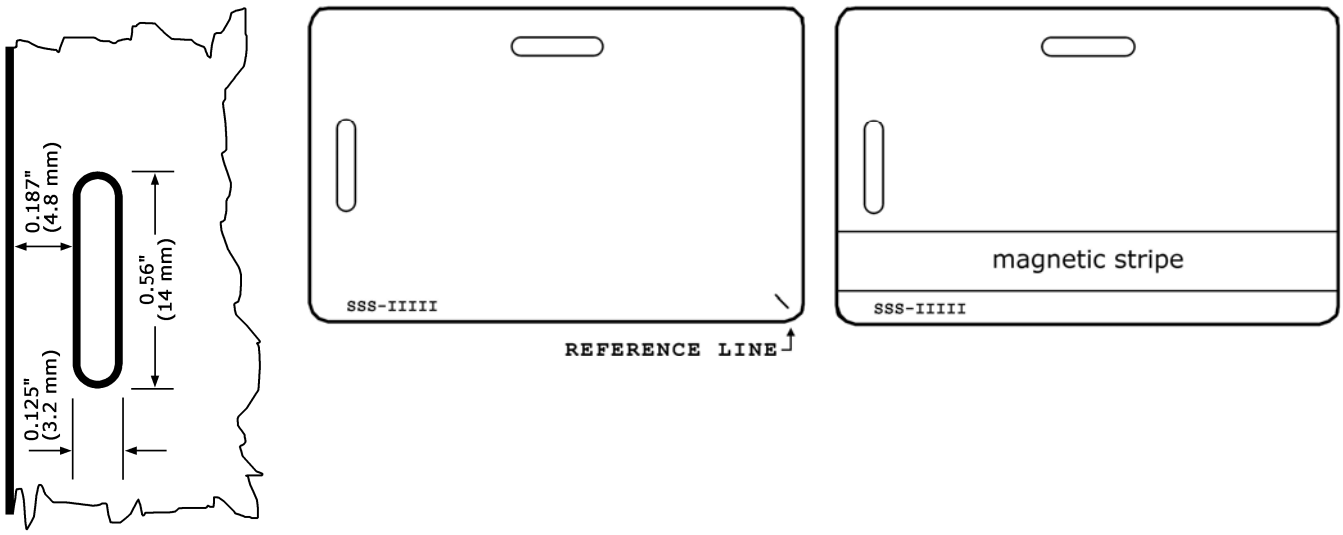
Printing Photo ID Badge Images

Good printing quality requires a clean environment and clean handling of the cards. Any dust, dirt or oil on the cards' surface will reduce the quality of the image and may damage the printer head. Observe these precautions when handling cards for printing.

1. Keep the cards in their cartons and shrink-wrap until you are ready for printing.
2. Adjust the printer settings according to the printer's instructions for ISO-type cards. (Card thickness is 0.033 inch (0.84 mm).
3. Handle cards by squeezing their edges. Wear clean cotton gloves.
4. Run a number of test cards. Check them for consistent printing quality and for correct reading with an AWID reader.
5. Test *all* cards with an AWID reader before and after printing and slot-punching.

Punching Slots for Clip-Straps or Chains

Good card performance and long life require accurate location of punched slots or holes (if used). The diagrams below show the proper placement for a slot or hole, centered on the selected edge of the card. *It is very important to follow these examples exactly.* AWID can not be responsible for cards that are punched incorrectly. Use the "Punch Guide" card that is shipped with AWID GR and GRMAG cards to assure a perfect match in slot location. For ordering pre-punched cards please specify either Portrait or Landscape.



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PROX-LINC GR AND GR-MAG
GRAPHICS-QUALITY ISO PROXIMITY CARDS

To: Supervisor of Card Distribution

IMPORTANT INFORMATION

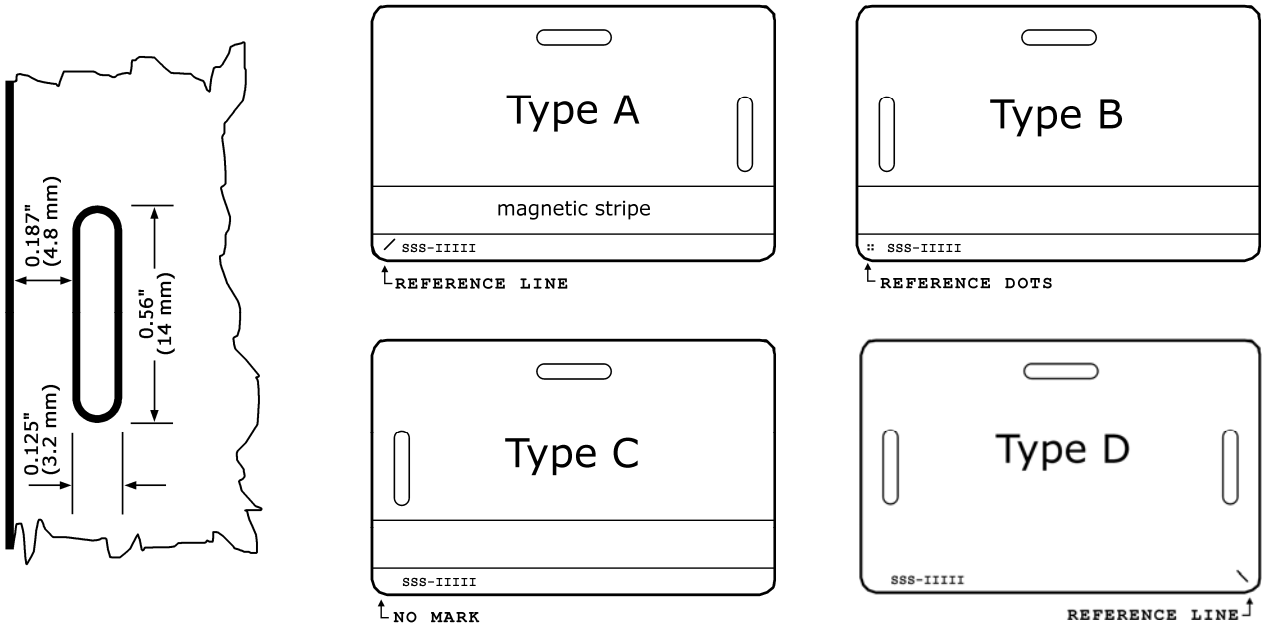
Printing Photo ID Badge Images

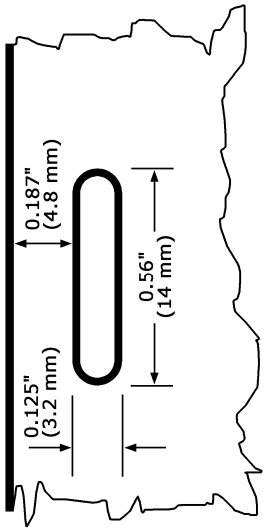
Good printing quality requires a clean environment and clean handling of the cards. Any dust, dirt or oil on the cards' surface will reduce the quality of the image and may damage the printer head. Observe these precautions when handling cards for printing.

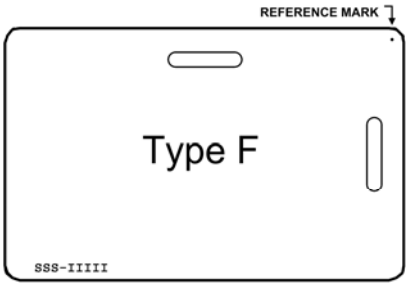
1. Keep the cards in their cartons and shrink-wrap until you are ready for printing.
2. Adjust the printer settings according to the printer's instructions for ISO-type cards. (Card thickness is 0.033 inch (0.84 mm).
3. Handle cards by squeezing their edges. Wear clean cotton gloves.
4. Run a number of test cards. Check them for consistent printing quality and for correct reading with an AWID reader.
5. Test *all* cards with an AWID reader before and after printing and slot-punching.

Punching Slots for Clip-Straps or Chains

Good card performance and long life require accurate location of punched slots or holes (if used). The diagrams below show the proper placement for a slot or hole, centered on the selected edge of the card. *It is very important to follow these examples exactly.* AWID can not be responsible for cards that are punched incorrectly. Use the "Punch Guide" card that is shipped with AWID GR and GRMAG cards to assure a perfect match in slot location.




0.187"
(4.8 mm)
0.56"
(14 mm)
0.125"
(3.2 mm)


REFERENCE MARK
Type F
SSS-IIIII

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Installation Instructions

Credentials for LR-2000/3000-Series UHF Readers

The tags and cards for AWID's LR-2000, LR-2200, LR-3000 and UA-612 Readers are easily mounted using the following instructions. It is important that the installer follows these suggestions. Contact AWID's Technical Support for applications and installation advice. For best performance, mount the reader 8 feet high or more.

GUIDELINES ➔ READ BEFORE ATTACHING TAGS

1. See AWID's product sheet "Credentials for UHF Readers" for rated reading distance between credentials and reader.
2. Check that the space between the reader and the credentials' location on vehicles is **clear of all material** (the vehicle's windshield is OK) – no wall close beside the reader – for a "balloon" 30 feet long and 18 feet diameter.
3. When the tags are at the reading distance from the reader, **align the tags and the reader**. They should face each other head-on and be approximately parallel to each other. Be **consistent** – tags on all vehicles in similar location.
4. Before attaching a tag to the vehicle, test the reader by holding the tag in your fingertips in front of the reader. Keep your fingers and hand away from the credential's antenna. Test one tag at a time, watching code input in the system.
5. If the tags' face can't be parallel to the reader, orient the tags with a **long edge** closest to the reader, not a short end.
6. Locate tags and cards inside vehicles where the windshield wipers keep the windshield free of water or snow.
7. If the windshield has embedded or coated metal, see Technical Reference "Alternatives for 'Difficult' Cars".
8. Give instructions for tag or card installation to the end user's technical person. Ask AWID's Tech Support for help.

WS-UHF-0-0 WINDSHIELD TAG



1. Move the vehicle so that the windshield is at the reading distance. Press the plastic-film side of the WS-UHF tag flat against the inside of the windshield. Use a hand-sized block of flexible plastic foam, about 4 inches thick, to press the tag.
2. Test the tag at different locations inside the windshield. Try high and low, several inches from the vehicle's door pillar, in "portrait" and "landscape" orientation. Avoid embedded wires, metal coating and RF emitting devices.
3. If metal in or on the windshield reduces tag performance, test the tag at the top center of the windshield, where the glass may be clear to accommodate toll highway tags.



4. Peel off the plastic sheet to expose the adhesive. Press the tag's adhesive flat against the inside of the windshield. This is a **one-time application**. The tag will not work after it is pulled from its original position. The tag cannot be moved between vehicles.
5. WS-UHF tag is not designed to be held in the fingers, or carried, or taped, or inserted into a card punch. It must be adhered permanently inside the windshield glass.
6. This tag can be installed on a *side* window if (a) the reader is at the side, facing the tag, and (b) the window is unmovable so that the tag is always visible to the reader.

RV-UHF-0-0 REARVIEW MIRROR TAG



1. Select the best location on the mirror's shell for the RV-UHF tag – where the tag faces the reader. Tape the tag to the shell for test reading. The tag should fit smoothly on the mirror's shell.
2. Peel off the plastic sheet to expose the adhesive. Attach the tag firmly to the mirror's shell. The tag's black side faces the reader through the windshield.

VT-UHF-0-0 SUNVISOR TAG



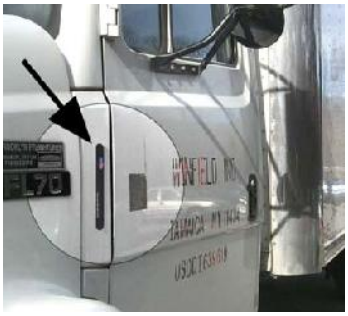
1. The most convenient location for the tag is on the driver's sun visor. This requires the reader to be at the left side of the lane, or above the driver.
2. With the visor raised, clip the tag over the upper edge of the visor. The tag lies flat against the visor, facing the driver.
3. As the vehicle approaches the reading area, lower the visor so that the tag faces the reader through the windshield. The tag should then be about parallel to the reader.
4. When the gate or door operation starts, swing the visor back to its raised position.

HT-UHF-0-0 HANG TAG



1. For a hanging tag, the reader should be over the center of the vehicle.
   For a hand-held tag, the reader should be at the left side of the lane.
2. Hook the hangtag over the stem of the inside rearview mirror. Either side of the hangtag may face the windshield. Turn the tag by your fingers to face the reader.
3. The hangtag may be read either by leaving the tag hanging from the mirror's stem, or by holding the tag between the fingers at the hook-end of the tag, with tag facing the reader.

MT-UHF-0-0 METAL-MOUNT TAG



1. The MT-UHF tag reads best when it is mounted on a large flat area of metal.
2. Locate the tag so that it faces the reader directly at the reading area. The MT-UHF is directional, so the reader must be in front of the tag when reading.
3. Fasten the tag using screws whose heads fit inside the space molded at the ends of the tag, or pop-rivets, or the tag's adhesive. Use fasteners only at the ends of tag.
4. For testing, squeeze between fingers at one end of the tag, or use tape or wire ties.
5. Try both "portrait" and "landscape" orientation. On the side of vehicles, vertical orientation may give most consistent reading.
6. When permanent installation is complete, snap the screw-hole plugs in place.
7. The MT-UHF tag is *not* a "license plate" tag. Some states do not allow any part of the registration plate to be covered. The tag and the reader must face each other.

ST-UHF-0-0 SUPERTAG



1. This passive tag may be installed directly on a metal surface, or on other material, or "free-standing" in air, with exceptional range.
2. For testing, use tape over the screw-holes at the corners of the tag. Or use double-sided adhesive tape or adhesive magnets behind the tag.
3. For permanent fastening, use stainless or Nylon fasteners in the 4 screw-holes. Use 4 fasteners only when the mounting surface is flat.

CS-UHF-0-0 CLAMSHELL BADGE and GR-UHF-0-0 GRAPHICS CARD



1. The card must be squeezed between fingertips so that the hand is behind the card (away from the reader) and the fingers do not block the front of the card.
2. The card may be held facing the reader through the windshield or a side window. Best reading may result from holding the card outside the window, facing the reader.

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Instructions

Color Changer Card for Proximity Readers

Change History

Version	Date	Author	Comments
1.0	30 April 2009	L. Hickcox	First release.

The LED in AWID's proximity readers indicates the status of the reader – reset (awaiting initialization), standby, successful card or tag reading, card or tag present in reader's field, and access granted. If the LED on AWID's proximity reader has a color sequence that is not the user's standard colors, AWID's Color Change Card will change the color sequence. The color change remains in effect until the Color Changer Card is used again on that reader.

1. Test for Need of a Color Change Card

An error in the LED's color sequence is often caused by the wiring -- for example, if the reader's brown wire for single-wire control of LED color is attached to the "Red-LED" terminal on the controller panel, or if the wires for two-wire LED control are attached to the wrong terminals.

To test the reader: (Note: Disconnect the reader's power before all wiring changes.)

(a) Disconnect the reader's brown and yellow and blue wires (the three wires that might be used for external control of the reader's functions), and let them float.

(b) Apply DC voltage to the reader's black and red wires, between +12 volts and +5 volts. It is OK to use the normal power source for the reader – the external power supply for MR-1824, and the panel's power terminals for smaller proximity readers. It is OK to leave the Wiegand or RS-232 data lines connected, as normal for the system.

(c) For most AWID proximity readers, the LED is amber when power is restored to the reader. When the LED is amber, initialize the reader by presenting any AWID proximity card briefly to the reader.

(d) Look at the LED's color. If it is steady red, this is normal. Then touch the reader's brown wire to the black wire. If the LED changes to green while the brown and black wires are touching, this is the normal LED color sequence.

(e) Now connect the reader's brown wire to the panel's LED terminal for that reader port – or to the *Green* LED terminal if there is more than one LED control terminal for that reader port. When the system is programmed for Door Locked, the reader's LED should be red. When the system is programmed for Door Unlocked, the LED should be green.

(f) If these conditions are present, the LED is normal, and the Color Changer Card is not needed.

2. Procedure for Using Color Changer Card

A possible cause of LED color sequence reversal in a new reader is application of the DC power repeatedly without the recommended 10 second pause before restoring power.

If the tests above indicate the need to use the Color Changer Card:

(a) Remove power from the reader. Disconnect the brown wire from the panel. Temporarily disconnect the reader's yellow and blue wires also, if they are used. Then restore power.

(b) While the LED is amber, present the Color Changer Card to the reader for about one second. The LED color will change to the opposite color from its former standby color – green to red, or red to green. Reconnect the brown wire.

(c) Test the LED color sequence by presenting to the reader an AWID proximity card or tag that has been programmed into the system. The LED will change to the opposite color during the door-unlock time. (This is equivalent to touching the reader's brown wire to the black wire in the testing, step 1(d), above.)

(d) The color sequence may be changed back to the other color sequence at any time. Always start the color-change procedure by removing and (after 10 seconds) restoring power. Present the Color Changer Card when the LED is amber.

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Installation Instructions

Tags for LR-911 Long-Range Reader

Change History

Version	Date	Author	Comments
1.2	20 Nov 2008	LHH	First release.

The tags for AWID's LR-911 Long-Range Reader are easily mounted using the following instructions. It is important that the installer follows these suggestions. Contact AWID's Technical Support for applications and installation advice.

GENERAL RULES

1. The relationship between the *reader's* location and aiming, and the location of the *tags* inside or outside the vehicle, is important for good performance. Plan the installation considering these factors before installation starts.
2. Start by testing the LR-911 reader using the LR-911KIT's test unit and the hand-held test tags, with no vehicle present at the reader. When good read range has been proved, proceed to mounting the tags in or on the vehicles.
3. The "*sweet spot*" reading distance for a tag in or on the vehicle is typically 8 feet, measured between the face of the reader and the location of the tag. Note: The "sweet spot" reading distance is shorter than the tag's rated "*read range*", which is the total distance between the reader and the farthest point at which a hand-held tag can be detected.
4. At the sweet spot, the tag should *face the reader*, with clear *line-of-sight* (through the windshield is OK) to the reader, and with the tag and the reader about *parallel to each other*. Aim the reader at the sweet spot.
5. Orientation of a tag may be "portrait" or "landscape" or diagonal. Reading will be most active when either *long* edge of the tag is closest to the reader as the tag first enters the effective RF field.
6. Keep your hand and body away from the tags, to avoid blocking or reducing the tag's RF field.
7. Before attaching WS-1216 tags to the windshield, clean the windshield near the tag, inside and outside.
8. To attach WS-1216 tags to side windows, select a window that does not lower into the door frame. Align tags with a reader at the side of the vehicle lane, at the same height as the tags.
9. If necessary, turn off RF sources on the vehicle, such as anti-collision sensors and UHF communications gear.
10. Prevent buildup of snow over the tags. Use windshield wipers to remove water from the windshield. Near the ocean, wash the windshield near the tag to remove salt coating.
11. Prepare instructions for the users' staff member who will oversee tag installation. Copy the suggestions in the sections below for the appropriate tag. From the LR-911 Installation Manual, copy the sub-section in Section 9 – Applications that matches this installation.

WS-1216-0-0 WINDSHIELD TAG

1. Mount the reader so that it faces the location of all windshield tags at the "sweet spot". For passenger cars the reader is typically at the side of the vehicle lane, close to the vehicles' path, 7 feet above ground level.
2. Leave the large paper label in place on the tag, to protect the tag's adhesive during location tests.
3. Use a hand-sized block of plastic foam (flexible but firm), about 2 inches thick. Press the WS-1216 tag flat against the inside of the windshield. Keep your hand away from the tag.

(continued)



Figure 1. WS-1216 tag at four optional locations.

(WS-1216-0-0 Windshield Tag – continued)

4. Move the tag to different locations inside the windshield, where the tag faces the reader. Test the reader's performance with the tag high and low on the windshield, several inches from the vehicle's door pillar, in "portrait" and "landscape" orientation.
5. Avoid items that may block the tags' transmission – embedded wires, metal coating, dark tinting, or RF emitting devices.
6. When you identify a good tag location, peel the paper label off the tag. Press the tag's adhesive flat against the inside of the windshield. This is a one-time application. The tag will not work after it is pulled from its original position.
7. *Do not* carry the WS-1216 tag in a pouch or wallet, or attach it using tape, or hold it by hand, or place it on the dashboard. *Do not* adhere the tag to anything except windshield glass. *Do not* attempt to move the tag from one vehicle to another.
8. In a small percentage of cars, metal in or on the windshield reduces the read range. If so, use the MT-1014 metal-mount tag.

MT-1014-0-0 METAL-MOUNT TAG

1. <u>Inside</u> the vehicle –

   Locate the MT-1014 tag, at the "sweet spot", on a flat surface where it is in line-of-sight through the windshield with the reader. The "AWID" logo must face the reader. The MT tag may be attached to any material or held in air. Suitable locations are the dashboard (away from the windshield), or the sun visor facing the reader when the visor is turned down, or the inside rearview mirror's frame facing the windshield, or inside the windshield if the tag is spaced away from the glass by ½ inch or more (example: heavy-duty Velcro on the *front* of the tag).

   For *holding* by hand, squeeze the tag between your thumb and forefinger, like a baton, over one of the screw-holes. Keep your hand behind the tag. Hold the tag away from your body.

   For *temporary* attachment, use tape over the 2 screw-holes at the ends of the MT tag. Do not cover the center of the tag between the screw-holes.

   For *long-term* attachment, peel the paper label from the back of the tag, and adhere the tag to the inside surface using the tags own adhesive.

   The MT tag may be moved between different vehicles if the attachment method is temporary. The MT tag may be stored in the vehicle's glove compartment when not being used.



Figure 2. MT-1014 tag on side of truck cab.

2. <u>Outside</u> the vehicle –

   Locate the MT tag, at the sweet spot, on a flat surface where it is in line-of-sight with the reader. The "AWID" logo must face the reader. Suitable locations are the top of the front bumper, the radiator grill, the edge of the hood, the lower or upper part of the windshield (away from the driver's line-of-sight), the front door pillar, the roof rack, etc.

   On trucks and buses, the MT tag may be on a fender or side door, facing a side-mounted reader.

   Fastening a tag on the front license plate *may* be acceptable. Verify performance first using the LR-911KIT.

   Attach the tag using the tag's own adhesive under its peelable label, or by sealant around the edges, or by wire ties, or by non-metal (nylon) screws or pop-rivets through the tag's screw holes.



Figure 3. MT-1014 tag on cab of front-loader.

3. Finishing the installation –

   Test the MT tag's performance before attaching it permanently. Seal moisture from the back of the tag by running a small bead of silicone sealant around the edge of the tag. Insert the screw-hole plugs over the screw heads for good appearance and security.

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Product Instructions

Card & PIN Readers -- Changing the Keypad

*These instructions are for AWID's Model **KP-6840** or **XK-3640** combination card reader and PIN-pad. Components of these readers are (a) the base reader, (b) the keypad assembly that mates with the base reader, and (c) the snap-on cover that secures the reader after it is installed.*

Removing the Original Keypad Assembly

1. Remove the cover of the Card & PIN Reader –
   (a) Insert a *wide* screwdriver blade into the slot at the bottom edge of the reader-keypad unit.
   (b) Press the screwdriver firmly against the reader's base. Twist the screwdriver handle to release the cover.
2. If the reader is installed, locate the two screws (near the top and bottom ends of the unit) that fasten the reader on the single-gang utility box or the wall or other surface. Remove these two mounting screws.
3. Grasp the keypad assembly by your thumb and fingers at the top and bottom edges, near the holes for the mounting screws. Gently pull the keypad assembly straight forward, until it is free of the base reader.
4. **KP-6840**: Protect the copper antenna, around the edge of the base unit, from any contact.
   XK-3640: Protect the wires on the base unit from any contact.
5. If the replacement keypad assembly is not immediately available, cover the base reader securely so that it is not visible, or dismount and disconnect it entirely from the wall.

Installing the New Keypad Assembly

1. If the reader's cover is on the reader, remove it as in step 1, above.
2. If the reader is installed using mounting screws, remove the screws as in step 2, above.
3. Look for the 4 alignment split-pins on the back of the new keypad assembly. (Figure 1.)
4. Hold the new keypad assembly in position in front of the base reader, with the keypad in normal orientation.
5. Align the 4 pins with the round sockets near the corners of the base reader. Gently press the keypad assembly on the base reader. (Figure 2.)
6. Insert the 2 mounting screws through the holes near the top and bottom of the reader, into the wall.
7. Hang the cover over the reader's top edge. Press the cover's bottom firmly to secure it on the base reader.
8. To initialize the new keypad assembly, remove DC power from the reader, and then restore power.



1. KP-6840 keypad assembly, back view, with alignment pins.



2. KP-6840 base reader, front view, with sockets for pins.

Installation Sheet (Wiegand Interface)
KP-6840 LF Card & PIN Reader

These instructions are for AWID's Model KP-6840 reader, using compatible proximity credentials from AWID.

Parts List

(a) 1 Installation Sheet for KP-6840
(b) 1 Model KP-6840 Reader/Keypad
(c) 2 #6-32 × 1" machine screw (for single-gang utility box)

Preparation

Reader Location: Select the reader's mounting location. The KP-6840 Reader may be screwed to a single-gang utility box like a cover plate, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The KP-6840 Reader may be installed indoors or outdoors, but needs protection from direct rain or snow.

DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use an independent power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be close to +12 volts DC (as low as +5 volts is OK); 1 ampere capacity; linear-rated; regulated DC output.

Cable to Controller and Power Supply: 4 to 7 conductors from reader to the system (2 wires for DC power, 2 wires for Wiegand data, and 1 to 3 wires for external LED, Beeper/Alarm, and Hold control, if used). 22 gauge stranded wires. Overall 100% *shield for both power and data*. 500 feet maximum length.

- If the DC power supply is separated from the panel's reader port, the reader's **black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel reader port's Ground terminal.
- If the separate DC power supply is close to the reader, run two 22-gauge cables – 2 wires for DC power, and 3 to 6 wires for Wiegand data (including Ground) and for the external control lines, if used. *Both* cables must be overall-shielded and earth-grounded (at the end far from the reader).
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Keypad Settings

The KP-6840 reader is shipped with the *keypad's* output programmed for buffered 26-bit output, and its facility code (or site code) set at 000. These two settings can be changed at your shop before you go to the installation site. Just connect DC power from a bench supply or from a 9 volt or 12 volt battery to the **red** **and** **black** wires. Start either programming routine with DC **removed** from the KP-6840 unit. Keep the KP-6840 fully assembled.

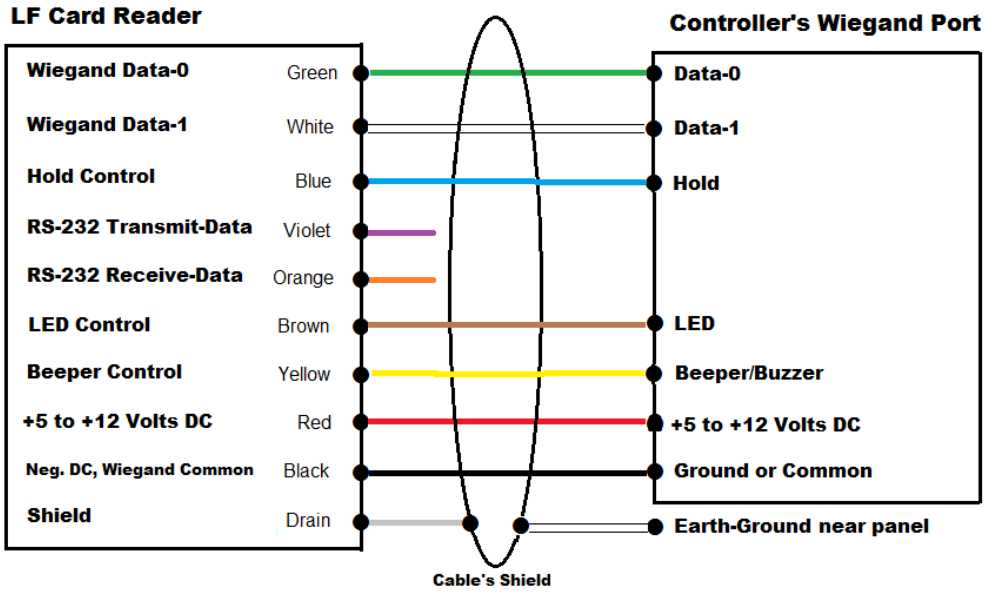
Good keypad technique: Press key in straight for about ½ second. Separate the keystrokes -- one key at a time.

- **Keypad's Output Format**
  1. While the DC power is disconnected -- Press and hold the **4** key to change the format to 4-bit data burst; or hold the **8** key to change the format to 8-bit data burst; or hold the **2** key to restore 26-bit buffered data.
  2. With the **4** or **8** or **2** key still pressed in, connect the DC power. Within 3 seconds there is a beep sequence, and the LED changes to standby-red.
  3. Now release the pressed key. The change in keypad output format has been saved.
- **Facility Code in Keypad's 26-bit Buffered Output**
  1. Connect the DC power. Watch the unit's LED. While it is amber, slowly enter the 10-digit password **9 1 4 3 6 9 8 8 0 0**; end with the # key. Press each key solidly. There is a short beep during each keystroke.
  2. Within 3 seconds, start entering the facility code's **3 digits** (between 001 and 255); end with the # key.
  3. There is a long beep and the LED color changes to standby-red. The facility code has been saved.

Keypad settings can be changed also on an installed KP-6840. The keypad's **format** can be changed anytime to any of the three formats, and the 26-bit's **facility code** can be changed to any value between decimal 001 and 255. *Note*: Selection of the **Operation Mode** (mix of card read and/or PIN) is done only in the host system's software.

Installation

1. **Connector** – Cut off the 10-pin in-line connector from the end of the reader's cable. Discard the connector.
2. **Open the Reader** – Snap open the reader's front cover by inserting a wide screwdriver blade in the slot at the bottom edge of the frame. Twist the blade gently. Do not remove the keypad assembly.
3. **Wire Connections** – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable.
   If power and data are in separate cables, connect all three drains/shields together near the reader.
   d. If the LED, Beeper/Alarm and/or Hold features are used, connect the **brown**, **yellow** and/or **blue** wires.
   e. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   f. Last, connect **red** to the DC Positive terminal.



4. **Reader Mounting** – Feed the reader's cable through the utility box or the wall's cable opening. Fasten the reader to the utility box or the wall, with screws through the holes inside the open reader. Use the supplied screws for mounting on a utility box. When mounting is finished, snap the cover on the reader.
5. **Reader Test** – When power is applied to the KP-6840, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID LF card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 8 inches.
6. **System Test** – Wire the reader to the system's controller. Program the code for the AWID proximity card or tag into the host system, with full priority, all doors groups, and all time zones. Present the card or tag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support • Call 408-825-1100, option 1. E-mail Support@awid.com.

The UL 294 performance levels to comply with are as follow:

Destructive Attack	Line Security	Endurance	Standby Power
I	I	I	I

SENTINEL-PROX LR-2000

LONG-RANGE TAG AND CARD READER

Installation & Operation Manual



If you are new to the LR-2000 reader, or this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Support at +1-408-825-1100

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The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.

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Table of Contents

1	INTRODUCTION	2
2	SPECIFICATIONS	3
PART A	**INSTALLATION**	**5**
3	PREPARING FOR INSTALLATION	5
4	TESTING READER AND TAGS BEFORE INSTALLATION	6
5	INSTALLING THE READER	7
6	INSTALLING THE CREDENTIALS	9
7	TESTING THE INSTALLED SYSTEM	10
8	INSTRUCTIONS FOR LR-2000HILOMA READER SET	11
PART B	**PLANNING**	**12**
9	APPLICATIONS	12
10	PLANNING FACTORS	13
PART C	**REFERENCE**	**16**
11	TROUBLE-SHOOTING	16
12	GLOSSARY	20

NOTE: READ AND USE THIS MANUAL.

FAILURE TO FOLLOW THE PLANNING AND INSTALLATION GUIDE MAY RESULT IN POOR PERFORMANCE AND EVEN CAUSE PERMANENT DAMAGE TO THE READER. THIS WILL VOID THE PRODUCT WARRANTY.

REVISION HISTORY

Version No.	Revised By	Date	Sections Affected	Remarks
1.4	LHH	27 August 2008	All	Revised version

1 INTRODUCTION

1.1 GENERAL DESCRIPTION

AWID's Sentinel-Prox LR-2000 Reader is an extra-long-range Radio Frequency Identification (RFID) reader that works with a selection of encoded credentials that may be clipped, hung, taped, adhered, fastened or held by hand inside or outside the vehicle. This reader comes with a unique combination of long read range, small size, and low power consumption. It has an internal power converter, allowing it to work with a wide range of supply inputs without affecting its performance. With a 12 volt DC supply, its current consumption is less than 1 ampere, making it suitable for a large selection of commercial power supplies. The LR-2000 reader has simultaneous Wiegand and RS-232 outputs. Its primary applications are automated parking garage entrance control, hands-free access control, vehicle identification, asset tracking, and asset management applications.

1.2 SPECIAL FEATURES

- Single small housing for reader electronics, RF module and antenna – blends into the landscape.
- Easy to install using a pan-and-tilt adjustable mounting bracket – available from AWID.
- Compatible with all commercial access control systems.
- Can be interfaced to a PC or to a special application controller.
- Shares code formats with other encoded cards, badges and tags.
- Allows mixing RFID products for several applications into an integrated system.
- Operates at low power level.
- Uses frequency-hopping technology in the 902-928 MHz band (standard).
- Passive tags assure small size, unlimited life, and easy mounting out of the driver's vision.
- Users do not need an FCC license.

1.3 SUGGESTED APPLICATIONS

- Automated vehicle identification for small cars, big trucks and trailers, and railcars.
- Operation of vehicle gates and garage doors for authorized vehicles.
- Tracking material assets in containers and on pallets.
- Hands-free operation of doors and elevator call buttons for handicapped users (wheelchairs, gurneys).
- Data collection using encoded cards and tags for input.

2 SPECIFICATIONS

2.1 LR-2000 READER

Input voltage:	Between +7 volts DC and +15 volts DC	
Input current (peak):	At 7 volts DC	1.5 amperes
	At 12 volts	900 milliamperes
	At 15 volts	700 milliamperes
Read distance (guaranteed):	With UHF tags and cards	From reader to 10 or 15 feet, depending upon tag type
Frequency:	Transmitter	902 MHz to 928 MHz
	Receiver	902 MHz to 928 MHz
Frequency-hopping channels:	Number of channels	50 channels (U.S.A. standard)
	Channel spacing	500 kHz
	Hopping sequence	Pseudo-random pattern of channels
Output data interfaces:	Wiegand electrical protocol, and RS-232 serial (simultaneous)	
Reader housing:	Molded ABS plastic, on 1/8 inch aluminum back-plate; beige color	
Environment:	Temperature for 100% duty cycle	-31 to 113 F (-35 to 45 C)
	Temperature for 50% duty cycle	-31 to 150 F (-35 to 65 C)
	Operating humidity	0% to 95%, non-condensing
	Protection from weather	Gasket at edge of cover, grommet at cable entrance (Use shield or housing when required.)

2.2 CABLE EXITING FROM LR-2000 READER

The cable that is integrated into the LR-2000 is 22 gauge, 10 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, 30 inches long. (The connectors on the reader's cable, when shipped, have no practical use. The installer removes these connectors and strips the insulation.)

Color assignment:

Red	DC power, positive	
Orange	RS-232 interface, Transmit Data	(Connect to controller's Receive Data.)
Yellow	Enable RF transmission	(Connect to reader's black wire for arming.)
Green	Wiegand interface, Data-0	
Blue	Data-Common	(For either Wiegand or RS-232 interface. Do not tie to black wire.)
Violet	RS-232 interface, Receive Data	(Connect to controller's Transmit Data.)
Brown	(not used)	
Black	DC power, negative	(Do not ground.)
White	Wiegand interface, Data-1	
(No insulation)	Drain wire	(Connect to shields of extended cables. Do not ground.)

2.3 EXTENDED CABLE FROM READER TO PANEL AND POWER SUPPLY

The LR-2000 reader requires cables with particular specifications. If the installation will use separate cables from the reader to the power supply, and from the reader to the reader input panel, use these specifications –

Power cable: 18 gauge, 2 conductors, stranded wire, color-coded insulation, overall 100% shielded, high quality.

Data cable: 22 gauge, 3 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

If power and data share the same cable, use these specifications –

Combined cable: 18 gauge, 5 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

The maximum allowable length of cable for **Wiegand** interface is 500 feet. The maximum specified length of the cable for **RS-232** interface at 9,600 bits per second is 75 ft; this may be stretched for certain equipment to 500 ft or more using Cat 5 cable. Length of a separate **power** cable should not exceed 500 ft.

Unlike proximity readers, the LR-2000 reader uses 2 separate wires for Power Negative (black) and for Data-Common (blue). These wires must not be connected to ground, nor to each other, nor to any other circuit.

2.4 POWER SUPPLY

- The LR-2000 reader requires a separate, independent DC power supply for each reader. Do *not* connect the reader's power wires (red and black) to the controller panel's Positive Voltage and Ground terminals.
- For multiple readers, you may use a multi-section DC supply if the sections are isolated electrically from each other, if each section has its own positive and negative terminals, and if each section has sufficient current rating for the LR-2000 reader.
- The ideal power supply has current rating of about 1.5 times the current drawn by the LR-2000 reader. This helps to assure that the direct current remains quiet and steady. (See the table, below.)
- The most common DC power supply has a nominal output voltage range of 12.0 volts to 13.8 volts (including power supplies for charging a back-up battery). To power a single LR-2000 reader, this power supply must have a current rating of 1.5 amperes or more.
- The PS-12-3.3A plug-in power module in AWID's LR-2000KIT Test & Set-up Kit is suitable for a single LR-2000 reader.
- Certain commercial power supplies require excess current rating to assure quiet DC output, for example, 2.5 amperes at nominal 12 volts for a single reader. Contact AWID's Technical Support for discussion of acceptable power supplies.

Voltage Applied to Reader	Current Load of Reader (maximum)	Current Rating of Power Supply (minimum)
7 volts DC	1.5 amperes	2.25 amperes
12 volts DC	900 milliamperes	1.5 amperes
15 volts DC	700 milliamperes	1.2 amperes

2.5 READER'S EFFECTIVE RF FIELD

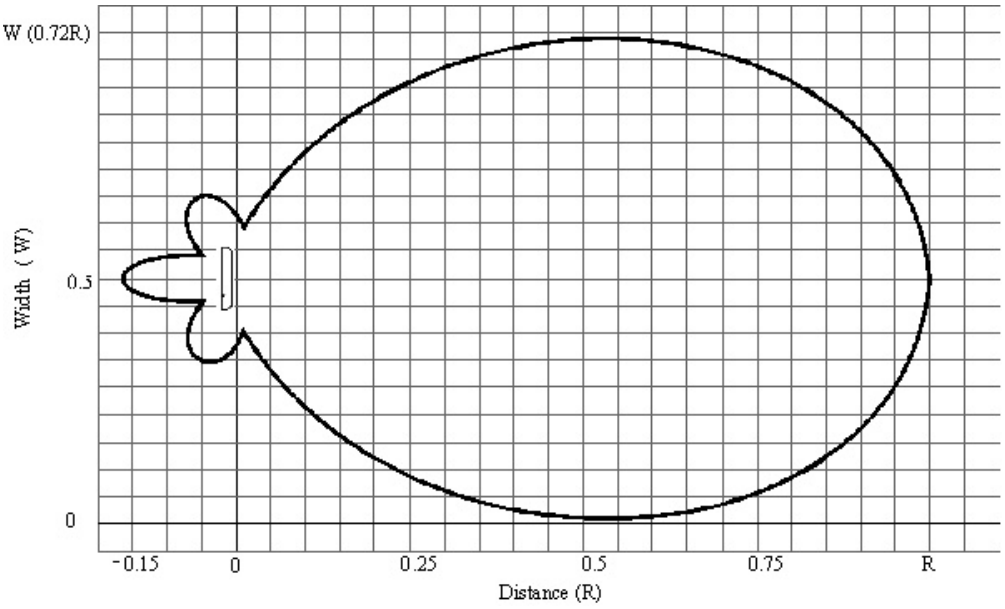


Figure 1. Effective RF field for tags with LR-2000 reader.

- The effective RF field is a figure of rotation of this diagram about its horizontal axis. Polarity of transmitted RF is circular.
- Distance R is the read range for each AWID UHF tag or card. Guaranteed reading distance of 10 feet or 15 feet, depending upon the tag or card type, is less than R.

PART A INSTALLATION

3 PREPARING FOR INSTALLATION

3.1 STUDY THE APPLICATION

- Determine what your client wants. Discuss the requirements with AWID's Technical Support.
- Visit the site; take photographs; draw diagrams; compare with similar installations. Look for unusual features.
- Study the Planning sections in this Manual to be sure that all factors have been considered. (See Part B.)
- Prepare a list of products and materials. Ask AWID's Technical Support for ideas and review.

3.2 GUIDELINES FOR THE INSTALLATION

1. Plan about *one car length* between the reader and the gate, where possible. This allows the vehicle to continue moving slowly as the tag is read and as the gate opens.
2. Select a reader location where the vehicle can move in a *straight line* for about one vehicle length as the tag is read.
3. Use an *adjustable mount* or bracket for pan and tilt-down aiming of the reader at the "sweet spot" where most of the credentials will be located in and on the vehicles.
4. Select a *reader height* that matches the location of credentials in and on the vehicles. See Section 9 for the popular combinations of reader mounting and vehicle types.
5. Locate the reader and credentials so that they are *parallel* to each other when the credentials are in the "sweet spot".
6. Experiment with *tag location* in the vehicles. Move a tag to different locations, and try both orientations ("portrait" and "landscape"). Hook the HT-UHF Hangtag behind the inside rearview mirror. Clip the VT-UHF Visor Tag to the sun visor. Hold the CS-UHF or GR-UHF card inside the vehicle. Press the WS-UHF Windshield Tag against the windshield using a block of plastic foam.
7. Restrict the vehicles to a lane that is a *single vehicle width*. Use lane markings or cones or bollards to assure that vehicles stay close to the reader.
8. Instruct drivers to move at about *5 miles per hour* as the tag is being read. Use signs and speed bumps at the "sweet spot".
9. Watch for applications that suggest use of the *LR-2000HiLoMA* set. See Sections 9.5 & 9.6 for discussion of these cases.

3.3 WIRING – GOOD PRACTICES

- Use only *shielded cable* for all readers, and for power, and for door locks or gate operator control. Unlike proximity readers, do *not* ground the LR-2000 reader's cable shields.
- Use a *separate cable* for each reader. Do not share the reader's cable with wires that carry switched power, like door locks, or power to electrically noisy devices. (But data, TTL control, and dry-contact circuits may share the LR-2000's cable.)
- Do not connect the wires for two LR-2000 readers *in parallel*. Neither power nor data lines should be in parallel. (Parallel connection changes the pulse transmission characteristics, and prevents the host system from identifying the reader addresses individually.)
- Connect the reader's negative power wire (black) *first*, and positive power wire (red) *last*. Disconnect in the opposite order.
- *Remove power* from the reader before making any wiring changes.
- The Wiegand Data-0 and Data-1 lines should not share a *twisted pair* in the cable from the reader to the controller. If it is necessary to use twisted-pair cable, separate the data lines into two different pairs. For example, combine Negative Power (black) with Data-0 (green) in one twisted pair; and combine Positive Power (red) with Data-1 (white) in a second twisted pair. This minimizes cross-talk of Wiegand data pulses from one data line to the other.
- The LR-2000 reader has *no LED*. The lens in the corner of the reader's cover is a dummy. Use the LR-2000KIT instead.
- The LR-2000 reader has 3 separate wires that serve as negative or common conductors – *black* for Power Negative, *blue* for Data-Common, and *bare wire* for cable shield Drain. These 3 wires must not be tied together anywhere in the system, and they must not be connected to ground anywhere.
- The LR-2000 reader has wiring that is different from any proximity reader, or any other technology. You must follow the *wiring diagrams* and the *instructions* in this Manual to have the reader function correctly.
- Unused wires from the reader's cable must be taped or capped *separately*, so that they touch nothing.

4 TESTING READER AND TAGS BEFORE INSTALLATION

4.1 INTRODUCTION

Careful preparation is important for successful installation of AWID's long-range readers and credentials. Simple bench-testing gives the installer confidence in the performance of the reader and the credentials, before the products are taken to the site. This testing isolates the reader and credentials from all other factors that contribute to performance of the final assembly.

4.2 ITEMS FOR BENCH TESTING

AWID's long-range reader and credentials are tested easily using only the items listed below. It is not necessary to interface the reader to a controller panel or reader-input module while conducting this test.

- LR-2000 reader (It does **not** contain an LED.)
- HT-UHF hangtag (26-bit code), or other tag *
- SP-6820-LR test unit, cable with 3 clips *
- PS-12-3.3A power module, cable with 2 clips *
- Wiring diagram, Figure 2 (below)

* *A component of the LR-2000KIT Test & Set-up Kit*

4.3 SUPPORTING THE READER

The reader's effective RF field, in which the long-range credentials can be detected, is maximized when there is no material in front of the reader or immediately to the sides of the reader. See the LR-2000 Effective RF Field diagram (Figure 1 on page 4).

- Cut off the connector from the LR-2000 reader's cable. Prepare the pigtails for the planned installation. Keep the unused wires separated from each other.
- Hang the reader on a clear vertical surface in an open space, about 4 feet above the bench top, 4 feet from a side wall, and 4 feet below the ceiling.

4.4 WIRING FOR QUICK TEST

- Connect the wires as shown in the wiring diagram, Figure 2 (below).
- Be sure that unused wires are touching nothing. Do not cut off unused wires yet.
- The *first* connection made is the reader's black (negative power) wire. The *last* step is to plug in the DC power module.

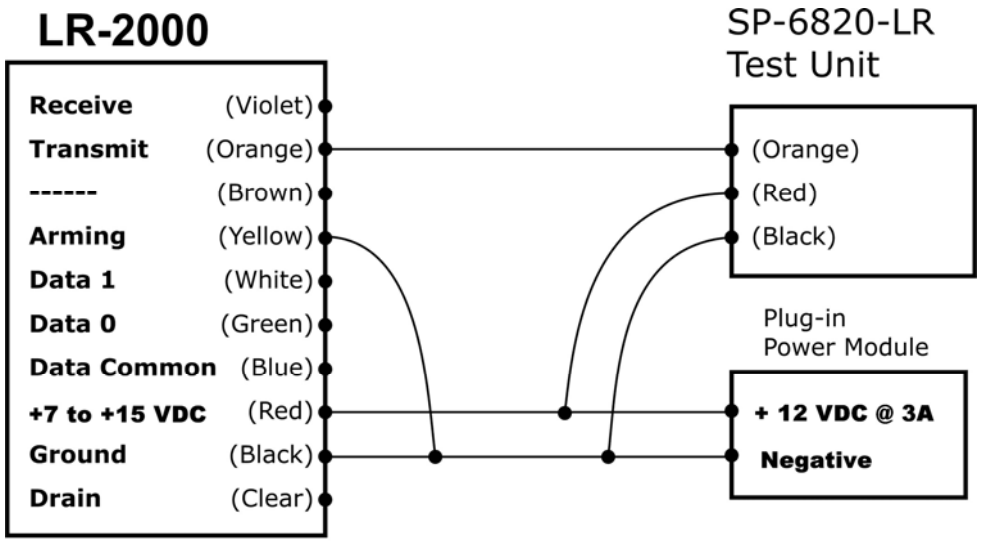


Figure 2. Wiring for quick test.

4.5 HOLDING THE TAG

- Hold the test tag by the fingertips, with the hand behind the tag. Hold the tag at arm's length, to the side of your body. Or …
- Attach the test tag to a non-metal stick. Stand to the side of the reader's RF field, and extend the tag into the reader's field.
- Hold the tag so that the face of the tag is approximately parallel with the reader's face. (The reader is circular-polarized, so the credentials may be held at any angle – up-and-down, or side-to-side, or diagonal.)
- Move the tag slowly though the effective RF field in front of the reader. Observe the edges of the zone and the point of maximum read range. The widest part of the zone is at about half of the maximum range.

4.6 TEST RESULTS

- Proper operation of the reader and credential is indicated by a signal from the SP-6820-LR test unit each time that the credential is read. The LED changes briefly from Standby red to green, and a short beep (4 kHz tone) is heard. If the card or tag remains in the reader's effective RF field, reads repeat at about 3 per second (factory default rate).
- By moving the test tag in the space in front of the LR-2000 reader, the tester can map the extent of the effective RF field that is plotted in Figure 1. The reading distance should extend from the reader's face to the guaranteed 10 feet or 15 feet with the test tags. The maximum diameter of the field's cross-section, at half of the maximum range, should be about 6 feet.

5 INSTALLING THE READER

5.1 INTRODUCTION

Before installing the long-range readers and credentials, the rest of the application system is usually in place and tested. The system components for each entrance are commonly –

- Computer with the application program (may be shared)
- Controller panel and reader-input module
- Gate or door operator (control and motor)
- Status switch for gate or door
- Request-to-exit switch or sensor
- Safety loop detector beyond the gate or door
- Buried loop to detect approaching vehicles
- Independent power source (*not* from the panel)
- Cables in conduit

These installation instructions are for the LR-2000 reader's Wiegand interface, using Data-0 and Data-1 wires (like most readers in access control). ***Note:*** *LR-2000 wiring is not the same as a 125 kHz proximity reader. Follow the instructions in Section 5.4.* If a serial interface using RS-232 protocol will be used, please download AWID's Technical Reference on RS-232 Reader Interface.

Collect these items to install the readers and credentials at the site –

- LR-2000 readers
- Mounting brackets and housings for readers
- Power supplies, cables, and other material
- UHF long-range tags and cards
- LR-2000KIT Test & Set-up Kit
- "LR-2000 Installation and Operation Manual"

For additional information, please visit AWID's Web site www.awid.com. For technical support questions, visit www.awid.com/support, or call **1-800-369-5533** (in the U.S.) or **+1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

5.2 INSTALLING THE LR-2000 READER

1. Before starting installation at the site, *plan* the project. Study Sections 9 and 10 of this Manual.
2. Keep the reader assembled. Do *not* remove the aluminum plate behind the reader. Do *not* remove the plastic cover of the reader. Do *not* tighten or loosen the screws through the cover. This preserves your Warranty.
3. Attach the LR-911MB mounting bracket to the reader's metal plate using 2 screws (1/4"-20, supplied).
4. To use a different mounting device, make an adapter plate or bracket that lets you fasten your mounting device to the two capture nuts at the center of the reader's aluminum plate (1/4"-20 thread). Do *not* drill holes through the aluminum plate. In most applications the mounting device must allow pan-and-tilt adjustment for the reader.
5. Inspect the installation space. The reader may be mounted on any material including metal, but there must be open space in front of the reader and to its sides. There must be no material interfering with the reader's effective RF field between the reader and the credentials' location.
6. Measure the mounting height. It must relate to the location of the credentials when they are read at the "sweet spot". For passenger vehicles it is typically at a height of 7 feet, to the side of the vehicle lane.
7. Be aware of the environment. Stay away from UHF communications devices. Avoid arc lighting fixtures by 3 or 4 feet. Aim neighboring readers so that their effective RF fields do not overlap. Mount readers for parallel lanes at least 12 feet apart, with their effective RF fields parallel to each other. Do not have LR-2000 readers facing each other (but "back-to-back" is OK). If mounted outdoors, provide a shield for sunlight and rain.
8. Test the site for electronic devices that may interfere with the LR-2000 reader. If interference is suspected, remove power from the other device while observing the LR-2000 reader's performance.
9. Fasten the reader's adjustable bracket or housing to the pole, post, pedestal, wall or ceiling.
10. Aim the reader at the location of the credentials (cards or tags) in the vehicle, when the credentials are at their reading distance from the reader. AWID guarantees minimum reading distance for its UHF credentials of 10 feet to 15 feet, depending upon the credential type. When the credentials are at this "sweet spot", the reader and the credentials should be about *parallel* to each other.

5.3 WIRING THE READER (FOR WIEGAND INTERFACE -- Figure 3)

1. The cable between the LR-2000 reader and the controller panel should be (see complete specifications in Section 2.3) –
   - 5 conductors for data & power
   - 18 gauge for 2 power wires; 22 gauge for 3 Wiegand data wires
   - Stranded wire
   - "Bunched" (not twisted-pair) *
   - Color-coded insulation
   - Overall 100% shielded
   - High quality
   - Maximum length – 500 feet

   * *If the cable* is *twisted pair, combine negative (black wire) with one data line (green or white wire) in one twisted pair, and combine DC power (red wire) with the other data line in a second twisted pair. This reduces crosstalk on the data lines.*
2. From reader to power supply – **Black** wire for DC negative (first connection), and **red** wire for DC positive (last connection). Each reader's power supply must be a separate supply (see specifications in Section 2.4) that is connected to nothing else.
3. Arming circuit – For continuous RF from the reader, connect its **yellow** wire to the black wire at the reader permanently. For control of the reader's RF transmission by a vehicle sensor, connect the yellow wire to the relay contacts of the vehicle sensor. To disarm the reader (no RF transmission from the reader), let its yellow wire float.
4. From reader to panel's reader input port – **Green** wire to Data-0, **white** wire to Data-1, and **blue** wire to Data-Common. For Data-Common, use a terminal with this name if available. If not, use this reader port's "Common" or "Ground" terminal.
5. Drains for shields – Tie the reader's **uninsulated** wire to the shields of the power and data cables. **Do not ground the drain**.
6. Grounds – Connect the panel's ground to earth-ground only if instructed by the panel's manufacturer. The LR-2000 reader and its power supply have **no ground connection**. Do not connect black, blue and drain wires together.
7. Unused wires – Keep the reader's **orange** wire available to connect the LR-2000KIT's test unit during set-up and tests. Wrap or cap the **violet** and **brown** wires separately.
8. Testing – While the cable terminations and junctions are still accessible, test the system for full function and performance. Then seal the terminations.

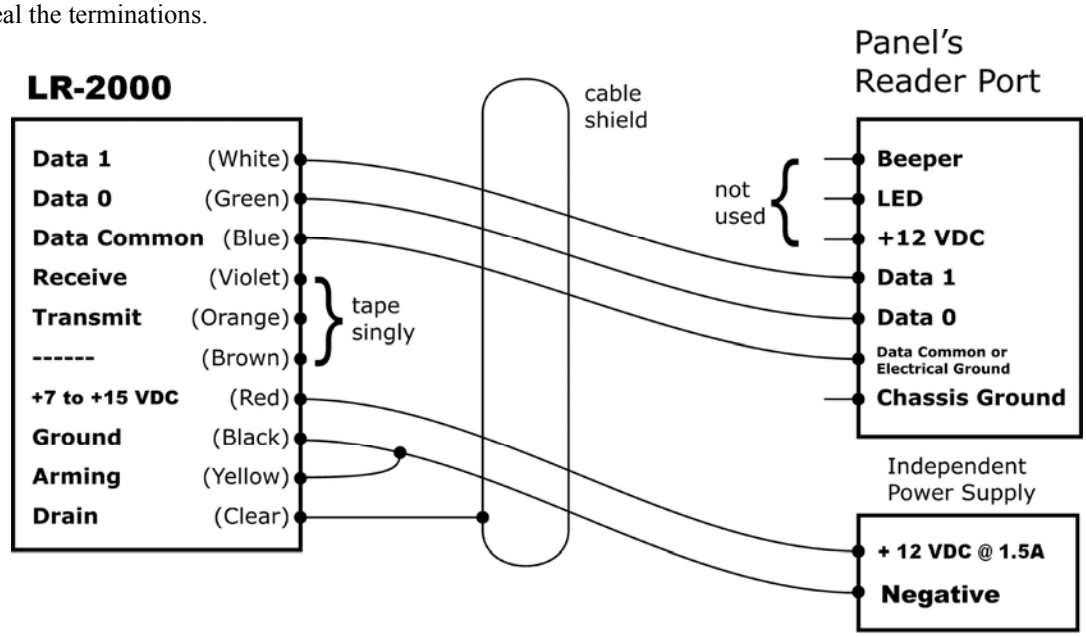


Figure 3. Wiring for LR-2000 installation.

5.4 AIMING THE READER

This step should be taken before the credentials are installed in or on the vehicles. From the LR-2000KIT Test & Set-up Kit, use the test unit, and one of the hand-held test tags, and the wiring diagram in Figure 2 on page 6. The reader does not have to be interfaced with the host system (but they *may* be connected together). Use the DC power module from the LR-2000KIT Test & Set-up Kit *only* if the independent DC power supply is not yet connected.

1. With no vehicle present, hold the hand-held test tag approximately where the vehicles' credentials will be located when they are read. This is typically at about 10 feet or 15 feet from the reader, depending upon the selected tag type.
2. With the test tag held at this "sweet spot", adjust the pan and tilt angles of the reader until the test unit indicates most robust reading. (Occasional reads will be missed normally because of the frequency-hopping feature of the LR-2000 reader.)
3. Map the outer limits of the reader's effective RF field by moving the tag side-to-side slowly through the field, and along the axis from the reader's face to the point of maximum range.

6 INSTALLING THE CREDENTIALS

6.1 GENERAL RULES

1. The relationship between the *reader's* location and aiming, and the location of the *credentials* (cards or tags) inside or outside the vehicle, is important for good performance. Plan the installation considering these factors before installation starts.
2. Start by testing the LR-2000 reader using the LR-2000KIT's test unit and the hand-held test credentials, with no vehicle present at the reader. When good read range has been proved, proceed to mounting the cards and tags in or on the vehicles.
3. The "*sweet spot*" for reading a credential in or on the vehicle is typically 10 feet to 15 feet, measured between the face of the reader and the location of the credential. Note: The sweet spot is shorter than the credential's rated "*read range*", which is the total distance between the reader and the farthest point at which a hand-held credential can be detected.
4. At the sweet spot, the credential should *face the reader*, with clear *line of sight* (through the windshield is OK) to the reader, and with the credential and the reader about *parallel to each other*. Aim the reader at the sweet spot.
5. Orientation of a credential may be "portrait" or "landscape" or diagonal. Reading will be most active when either long edge of the credential is closest to the reader as the tag approaches the sweet spot.
6. Keep the hand and the body away from the cards and tags, to avoid blocking or reducing the card's or tag's RF field.
7. Before attaching WS-UHF tags to the windshield, clean the windshield near the tag, inside and outside.
8. To attach tags to side windows, select a window that does not lower into the door frame. Align tags with a reader at the side.
9. If necessary, turn off RF sources on the vehicle, such as anti-collision sensors and UHF communications gear.
10. Prevent buildup of snow over the tags. Use windshield wipers to remove water from the windshield. Near the ocean, wash the windshield near the credential to remove salt coating.
11. Prepare instructions for the users' staff member who will oversee tag installation. Copy the suggestions in the sub-sections below for the appropriate card or tag, and copy the sub-section in Section 9 – Applications that matches this installation.

6.2 VT-UHF-0-0 VISOR TAGS

1. Mount the reader, usually over the driver's side of the vehicle, or at the left side of the lane.
2. With the visor raised, clip the tag over the upper edge of the visor. The tag faces the driver.
3. As the vehicle approaches the reader's sweet spot, lower the visor so that the tag faces the reader and is parallel to the reader.
4. When the gate or door operation starts, swing the visor back to its raised position.

6.3 HT-UHF-0-0 HANGTAGS

1. For hanging tag, mount the reader over the center of the lane. For hand-held tag, mount the reader at the left side of the lane.
2. Hook the hangtag over the stem that fastens the inside rearview mirror to the windshield. Either side of the hangtag may face the windshield.
3. The hangtag may be read either by leaving the tag hanging from the mirror's stem, or by holding the tag between the fingers at the hook-end of the tag, with the tag facing the reader.

6.4 CS-UHF-0-0 CLAMSHELL BADGE and GR-UHF-0-0 GRAPHICS CARD

1. Mount the reader so that it faces the card when the driver holds it in the sweet spot.
2. Present the card to the reader. Keep the fingers at the edge of the card. Hold the card parallel to the face of the reader.

6.5 RV-UHF-0-0 REARVIEW MIRROR TAG

1. Peel off the label that covers the tag's adhesive backing. Attach the tag to the housing of the inside rearview mirror, facing the windshield, at the driver's side of the stem that supports the mirror.
2. Mount the reader so that it is aimed at the tags at their "sweet spot". The reader's face should be about parallel to the tags.

6.6 WS-UHF-0-0 WINDSHIELD TAG

1. Mount the reader so that it faces the WS-UHF tag at the "sweet spot" reading location. See Figures 4 and 5 for typical uses.
2. Move the vehicle so that the windshield is at the reading distance. Press the plastic-film side of the WS-UHF tag flat against the inside of the windshield. Use a hand-sized block of plastic foam (flexible but firm), 2 inches thick, to press the tag.

3. Test the tag at different locations inside the windshield. Try high and low, several inches from the vehicle's door pillar, in "portrait" and "landscape" orientation. Avoid embedded wires, metal coating, dark tinting, RF emitting devices. If reading distance is too short, use a different AWID UHF card or tag.
4. Peel the plastic film off the tag. Press the tag's adhesive flat against the inside of the windshield. This is a one-time application. The tag will not work after it is pulled from its original position. The tag can not be moved between vehicles.
5. WS-UHF tags will not read if held in the fingers, or carried, or taped. It reads only when adhered to the windshield glass.

6.7 MT-UHF-0-0 METAL-MOUNT TAG

1. Mount the reader so that it faces the MT tag at the "sweet spot" reading location. See Figure 6 for an example at the left side.
2. The MT tag may be hand-held, or attached inside or outside the vehicle. Attachment may be permanent or temporary. Inside the vehicle, use Velcro dots or the tag's adhesive. Outside, use plastic screws or rivets, or adhesive, or sealant at the edges.
3. The tag must remain flat when held or attached. Do not hold or cover the tag between the two lines molded in the plastic.
4. Try vertical and horizontal orientation. Outside, vertical orientation may give best reading. Face the tag parallel to the reader.
5. Test the tag. Then finish installation by snapping the screw-hole plugs in place, for security and good appearance.

7 TESTING THE INSTALLED SYSTEM

7.1 INTRODUCTION

Install the system's components, and apply power to all components. The LR-2000 reader and the UHF credentials may be tested in several ways that look at isolated parts of the system, and at the integrated system. This helps to assure that the complete system is functioning normally, and to identify a problem area, if any. (See Section 11 – Trouble-Shooting for solutions to particular problems.)

7.2 TESTING AWID'S PRODUCTS (ISOLATED)

At any time the LR-2000 reader may be disconnected from the other components of the system, and the performance of the reader and the credentials tested by themselves.

1. Disconnect the power supply cable and the data cable from the reader. Break these circuits at the reader, not at the power supply or at the controller panel, so that problems with the cables and junctions can be detected also.
2. Use the LR-2000KIT Test & Set-up Kit at the LR-2000 reader. Follow the instructions in Section 4, but keep the reader installed and the cards and tags mounted normally.
3. If the test unit indicates normal reader performance using the hand-held test tag, continue testing using the UHF cards and tags that are mounted in the vehicles.
4. If the reader is not operating, contact your source of the AWID products for a Return Material Authorization (RMA).
5. When the LR-2000KIT indicates normal operation of the reader and credentials, connect other components of the application system one-by-one, watching for recurrence of the problem. Continue to use the LR-2000KIT as an indicator for the LR-2000 reader while the system is reconnected.

7.3 TESTING OUTPUT OF THE LR-2000 READER

The LR-2000 reader has two data outputs – Wiegand and RS-232. Wiegand is commonly used for access control systems including automated vehicle identification. RS-232 is suited for commercial systems like truck scales and supply chain management. There are simple techniques that show the condition of the reader's data interfaces

1. To test the reader's **Wiegand** output:
   - Interface the reader's 3 Wiegand data lines to this system's controller, *or*
   - Interface the reader's 3 Wiegand data lines to a different access control system that works normally with other readers and cards, *or*
   - Connect a test, display or enrollment device, such as Cypress Computer Systems' WDG-5912 Keyboard Data Wedge, *or*
   - Connect the leads for a dual-trace oscilloscope suitable for AWID's data output (40 microseconds pulse width, 2,000 microseconds interpulse spacing) between the reader's Data-0 and Data-Common wires, and between Data-1 and Data-Common wires.

2. To test the reader's **RS-232** output:

   - Interface the reader's 3 RS-232 data lines to the system's controller, *or*
   - Interface the reader's 3 RS-232 data lines to a different commercial system that works normally with other readers and cards, or with other RS-232 output devices, *or*
   - Clip the test unit from AWID's LR-2000KIT Test & Set-up Kit to the LR-2000 reader, *or*
   - Interface the reader's 3 RS-232 data lines to the serial port of a PC, and run the Windows HyperTerminal program *, *or*
   - Connect the leads for a single-trace oscilloscope suitable for AWID's data output (9,600 bits per second) between the reader's Transmit Data and Data Common wires.

     * In Microsoft Windows, the path is: Start → Programs → Accessories → Communications → HyperTerminal → Hypertrm.exe. Configuration is 9,600 bits per second, 1 start bit, 8 data bits, 1 stop bit, no parity, ASCII emulation, flow control = any. To open the port and start HyperTerminal, click on the Call tab at the top of the window, and select the option "Start Call".

7.4 TESTING AN APPLICATION SYSTEM

When the LR-2000 reader is interfaced to the reader input port of the application system, the format of displayed data depends upon the programming of the system. In a typical access control or automated vehicle identification system, the program allows selection of a code format that replicates the Wiegand-style encoding that AWID has programmed into the credentials. Therefore the system's monitor may display the code data in the same data fields, and the same number system (decimal), that AWID uses for its encoding. Testing may be as simple as reading the decimal values of the credential's data fields on the monitor.

If the system's monitor indicates that data are received from the reader but not recognized by the host ("Code format error", "Facility code error", "Parity error", etc.) –

- Check the host's programming.
- Check the reader's output.
- Check the wiring between the reader and the controller.
- Check the credential's code on a different reader or on a different system.

If the system's monitor indicates no data input from the reader –

- Test the LR-2000 reader and the credential by interfacing to a different controller that is known to work normally.
- Test the system by connecting the LR-2000 reader directly to the controller's reader port, bypassing the cable and junctions.
- Test the system's input using a different reader and compatible card or tag.

8 INSTRUCTIONS FOR LR-2000HiLoMA READER SET

AWID's **LR-2000HiLoMA** is a set of two units that work together at a reader location. One unit is a Master Reader that controls the alternation of RF transmission between the two units. The second unit is a Remote Antenna, in an identical housing. The two units are interconnected by a coaxial cable. Instructions for installing the LR-2000HiLoMA reader set can be downloaded from the public documents in AWID's Web site, www.awid.com.

- Position: The master reader and the remote antenna may be in either position at the site. The deciding factor may be the position of the master reader that results in the easiest or shortest cabling.
- Separation: AWID supplies a 6 foot long coaxial cable to connect the remote antenna to the master reader. When installed on brackets, the practical maximum separation between the master reader and the remote antenna is about 4 feet. Do not attempt to substitute a longer cable because of electrical loss in the cable.
- Accessories: All accessories for the LR-2000 reader apply also to the LR-2000HiLoMA reader set. Use the same LR-2000KIT.
- Reference Documents: o LR-2000HiLoMA Installation Sheet. o Technical Reference issues for description, applications, etc.

PART B PLANNING

9 APPLICATIONS

9.1 INTRODUCTION

The **LR-2000** reader is especially designed for Automated Vehicle Identification (AVI). The chief variables that must be considered in planning the readers and credentials for the system are –

- Lane characteristics
- Vehicle types
- Reader location
- Credential characteristics

The most important factors in planning a system are listed in Section 3.2. These must be considered carefully when laying out the plan for the installation.

The following paragraphs describe particular applications and recommend reader location and tag type for each application.

9.2 SMALL VEHICLES ONLY

If the reader is *beside the lane*, mount the reader as close to the edge of the lane as possible without damage to the reader. Choose the left side of the lane when possible, because this side is easier for the driver (in right-lane-driving countries) to judge the vehicle's location relative to the left edge of the lane. Mount the reader on an adjustable bracket at a height of about 7 feet (for small cars, 6 feet may suffice). Attach or hold a UHF card or tag on the same side of the vehicle as the reader. Aim the reader at the tags when they are at the "sweet spot" – about 10 to 15 feet direct measurement from reader to tag as the vehicle approaches the reader. See Figure 4.

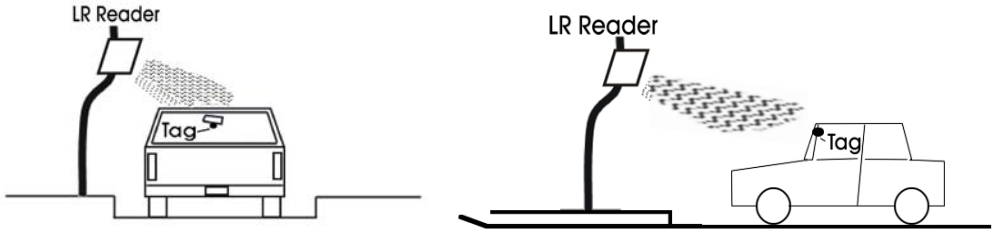


Figure 4. Passenger vehicles -- reader beside lane.

If the reader is *centered above the lane*, as inside a parking structure, mount the reader on an adjustable bracket at the lowest height that assures safe clearance between the reader and the highest vehicle. Hook a HT-UHF Hangtag over the inside rear-view mirror's stem, or attach a UHF card to the back of the mirror facing the reader, or adhere a WS-UHF Windshield Tag to the upper center of the windshield, behind the mirror. Aim the reader at the tags when they are at the "sweet spot". See Figure 5.

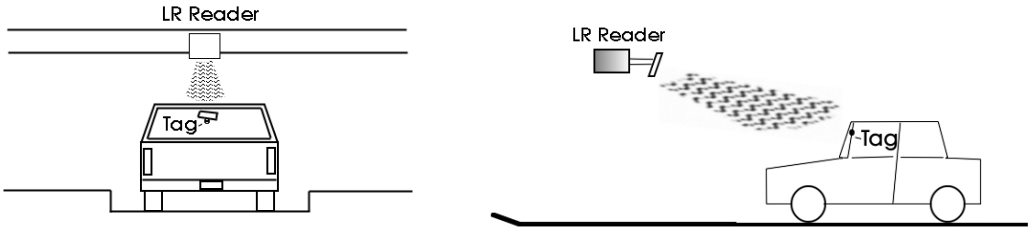


Figure 5. Passenger vehicles -- reader above lane.

9.3 MIXED PASSENGER CARS, PICKUPS, VANS AND SUVs

This application is a variation of Section 9.2. The reader beside the lane should be at about 7 feet height; the reader above the lane must be raised to clear the higher vehicles. Mount the tags and cards in small vehicles (sports cars) higher than in larger vehicles (SUVs). This places the tags and cards for all vehicles at about the same position relative to the reader. See Figure 4 and Figure 5.

9.4 LARGE TRUCKS AND BUSES

Follow the general suggestions for vehicles in Sections 9.2 and 9.3, regarding the location of the reader mounting (beside the vehicle lane or over the center of the lane). Select the UHF card or tag that performs best in the combination of vehicle lanes, vehicle types, reader locations, and credentials characteristics. See Figure 4 and Figure 5.

9.5 MIXED VEHICLES OF ALL SIZES

Use the **LR-2000HiLoMA** reader set, consisting of a Master Reader and a Remote Antenna. Mount the Master and Remote units on adjustable brackets at locations that are suitable for the type of tags and cards that will be used in the different vehicles. The reader brackets are usually supported by a single pole or pedestal, at heights that assure clear line of sight between the readers and the tags in all vehicles. (To reduce cable length, it is often best to mount the Master Reader lower than the Remote Antenna. Invert the units so that the coaxial connectors are at the *bottom* edge.)

Aim the readers individually at the locations of tags and cards when they are at the sweet spots for the two vehicle types or sizes.

9.6 SPECIAL CONDITIONS

The LR-2000HiLoMA reader set may be used also to spread out the effective RF field so that it covers a larger continuous area. (The read range does not become longer, but the cross-section size of the field may become larger.)

Spreading the field *horizontally* is helpful when –
- the vehicle lane turns – for example, the lane to the gate carries vehicles that turn off a through street, *or*
- the vehicle lane is wider than a single lane, and some vehicles may be farther from the edge of the lane where the reader is located.

Spreading the field *vertically* is helpful when –
- tags are on a mix of small and large vehicles, requiring the readers to be aimed at different heights to read all tags, *or*
- the reader is on a hill, or at the crest or dip in a hill, causing the tags to be at variable heights when they are read, *or*
- the reader is near a change in the elevation of the lane surface, as at a curb or gutter or drain.

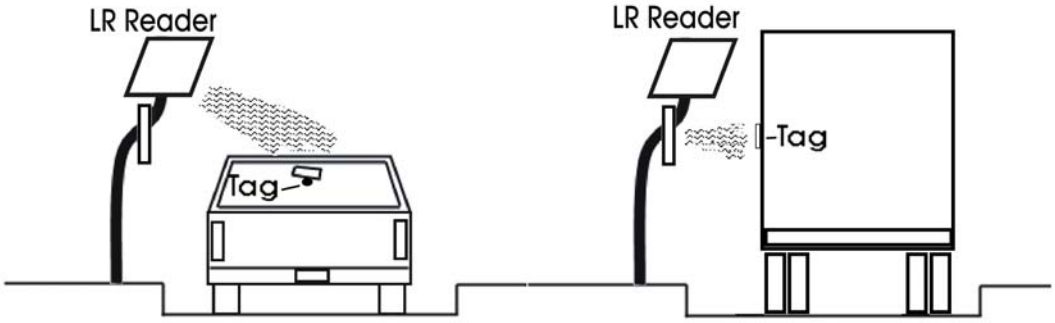


Figure 6. Mixed passenger vehicles and large trucks -- using LR-2000HiLoMA.

The LR-2000HiLoMA has a single data interface to a single reader port on the host panel. This reader set uses a single reader address in the host system.

10 PLANNING FACTORS

10.1 INTRODUCTION

Preparation for the LR-2000 installation pays dividends for the installer. The following topics cover the common questions. These topics apply generally to all forms of the LR-2000 reader. The environmental, electrical, interference and temperature range characteristics likewise apply to all forms of the LR-2000 reader. These characteristics are optimized if a buried-loop vehicle sensor arms the reader for RF transmission only when a vehicle is present at the reader.

10.2 ENVIRONMENT

- Physical obstructions: The space where the reader will be mounted and aimed must be clear.
- Weather: Provide shielding from direct rainfall (especially for LR-2000HiLoMA) and bright sunlight (especially if the reader is armed continually – yellow and black wires connected together permanently).
- RFI: Avoid sources of radio frequency emission that might interfere with the reader.

10.3 LANE LAYOUT

- Lane geometry: The lane should be straight for about a vehicle length where the reader reads the tag. Avoid sharp turns from through streets into short driveways.
- Multiple lanes: Locate and aim readers so that they do not interfere with each other. For readers in parallel lanes, pointed in the same direction, minimum centerline distance between the lanes is 12 feet.
- Reader location: If readers are above the lanes, aim neighboring readers parallel to each other. If readers are on posts beside the lanes, aim the readers so that one reader is not aimed directly at the back of the neighboring reader.
- Eliminating cross-reader interference: If readers must be close to each other so that their effective RF fields overlap, use the LR-2000HiLoMA reader set. This set of 2 units transmits RF alternatively, so that only one unit is active at any time.

10.4 VEHICLE TYPES

- All passenger car types: A single LR-2000 reader usually works for sport cars, sedans, SUVs and pickups, unless tags are in diverse locations on the vehicles.
- Mixed small and large vehicles: The LR-2000HiLoMA reader set is available when cards and tags are spaced apart on vehicles of different sizes.
- See Section 9 for details on reader selection for mixtures of vehicle types and sizes, and on reader location.

10.5 VEHICLE MOTION – IDEAL CONDITIONS

- Vehicle in motion while the tag is read at the "sweet spot".
- Vehicle moving in a straight line while the tag is read.
- Vehicle close to the reader location.
- Vehicle's tag about parallel to the reader's front face when the tag is at the sweet spot.
- Vehicle speed around 5 miles per hour for safety. (OK to experiment with higher speed.)

10.6 VEHICLE MOTION -- CONTROLS

- To enforce the vehicle speed – use signs, speed bumps, traffic signals (red/green lights), gates, instructions for drivers, .
- To enforce the vehicle path – use signs, painted stripes, cones, bollards, barriers, instructions for drivers.

10.7 READER TYPE

- Typical case: Most applications are served well by a single LR-2000 for each vehicle lane.
- Diverse vehicle sizes: For a combination of large and small vehicles in a lane, use LR-2000HiLoMA mounted *over-under* on the same post, for example. The "over" position may be for tags and cards in passenger cars. The "under" position may be for tags and cards on the side of buses and large trucks.
- Turning lanes: To increase the horizontal spread in a tight turn, use LR-2000HiLoMA mounted *side-by-side*. Aim the reader and remote antenna somewhat apart. Test for continuity of field using the LR-2000KIT Test & Set-up Kit.

10.8 READER POSITION

- Above the lane or beside it? – Either position works. If the reader is above the lane, the reader must be no higher than is required for vehicle clearance – typically less than 10 feet above the lane, unless the tags are all high on the vehicles. If the reader is beside the lane, the height and aiming depend on the type and location of tags on the vehicles.
- Which side? – Either right or left side works. Left side (driver's side) is better, because the driver finds it easier to align the vehicle with the left side of the lane, and with the reader if it is on the driver's side. (This applies to right-lane-driving countries.)

10.9 READER MOUNTING

- Adjustable bracket: The reader (and remote antenna) must be adjustable for both "pan and tilt" (in camera parlance – that is, horizontal and vertical) for proper aiming. See AWID's LR-911MB (11 inch long arm, with a two-axis adjustable head). The installer may use a camera bracket effectively.
- Fixed reader: The reader may be fastened directly to a wall, flat against the wall, in applications where the tags are on the side of vehicles facing the reader, as on buses and large trucks, and on wheelchairs, gurneys, etc. Distance between reader and tags should be about 5 feet to 10 feet.
- Distance from lane: For a reader on a side post, locate the reader close to the edge of the lane, but safe from side-mirrors and errant drivers. For a reader above the lane, locate the reader as low as possible while leaving clearance for roof-racks, etc.
- Reader aiming: The "sweet spot" for reading credentials is when the credential is typically about 10 feet to 15 feet from the reader. The goal is to have the tag about parallel to the reader's face when the tags are read.

10.10 ELECTRIC POWER

- Isolation: For each LR-2000 reader, or for each LR-2000HiLoMA set, provide an independent DC power supply that is not used for any other equipment. Use a separate DC power supply for each LR-2000 reader. A single power supply is used for LR-2000HiLoMA.
- Voltage: Voltage at the reader must be between 7 volts and 15 volts DC.
- Current: For a typical 12 volts to 13.8 volts supply, current rating must be at least 1.5 amperes.
- Quality: The power supply *must* be linear-rated (that is, not switching) and regulated.

10.11 CABLE

- Number of conductors: Depends on whether DC power for the reader is combined with data transmission in the same cable. Cables are usually specified in multiples of 2 conductors.
- Power: 2 conductors in shielded cable. Use 18 gauge wires between the reader and the power supply.
- Data: 3 conductors for either Wiegand interface or RS-232 interface. Use 22 gauge (18 gauge is OK).
  For Wiegand, use parallel wires – not twisted pairs. For RS-232, Cat 5, twisted or untwisted, is good.
- Other specifications: Overall 100% shielded. Stranded wire. Color-coded insulation. Maximum length – 500 feet for Wiegand data and power; 75 feet for RS-232 data at 9,600 bits per second (up to 500 feet with certain terminal equipment). High quality.

10.12 MOUNTING THE TAGS AND CARDS

- See the complete instructions for installing all credentials in Section 6.
- Attachment: The different credentials have different requirements for mounting in or on the vehicles, or for holding by hand. Visor Tags use a molded clip for the sun visor. Hangtags hook on the inside rearview mirror or are held by fingers. Clamshell Badges and Graphics Cards are squeezed between a finger and thumb. Windshield Tags adhere inside the windshield glass. Rearview Mirror Tags adhere to the frame of the inside mirror, facing the windshield.
- Orientation: The flat surface of the credential should be about parallel to the face of the reader. The hand should be behind the tag when the tag is held by the fingers. The tag may be held "portrait" or "landscape" relative to the reader; the angle does not matter.
- Pre-installation testing: Hold the tag as intended in normal operation, or attach it temporarily (using masking tape, for example) in the planned location. Drive the vehicle slowly through the sweet spot. Observe the LR-2000KIT's test unit for consistent reading. Adjust the reader's position and aiming, and the credentials' location, and the vehicle's path and speed, as required.

10.13 ACCESSORIES

- LR-2000KIT Test & Set-up Kit: *Absolutely required*. Installation may not be supportable by AWID if this Kit is not at the site.
- Documents: Complete instructions set must be at the site with the installer.

10.14 AVOID …

- "Toll tag mentality": If the drivers are used to high-speed tollgates with active tags, they will feel restricted by a long-range reader using passive vehicle tags. Emphasize the desired goal of having the gate at the LR-2000 installation open, by driving at reasonable speed in a reasonable fashion near the reader. Point out the long-life and the low cost of passive cards and tags.
- Metal in or on vehicle's windows: Anti-glare tinting … reflective coating … metallic coating for automatic windshield wipers … embedded wires for defrost or antenna. These metal materials can reduce or block transmission from tags to reader. ("Lead glass" does *not* reduce performance.)
- Electronics in the vehicle: Anti-collision sensors and certain communications gear, while they are active, may interfere with other RF transmission, including LR-2000's tags and cards. However, most communications devices (cell phones, portable radios) and GPS have no effect.

PART C REFERENCE

11 TROUBLE-SHOOTING

11.1 PRODUCTS AND TOOLS

AWID Products:

LR-2000 long-range reader
PS-12-3.3A DC power module *
SP-6820-LR test unit *
UHF cards or badges for LR-2000 *
Adapter cable, 3 clips to 9-pin "D" *

RF-SD Detector for RF fields *
"LR-2000 Installation Manual"

Required Tools:

Digital multimeter (20 VDC, 5 ADC)
Common hand tools
Back-up battery – 12 V, 7.5 A-hr

Desirable Tools:

Proximity reader (small) and card
Oscilloscope, dual-trace, 915 MHz
RF spectrum analyzer

* Component of the LR-2000KIT

11.2 SUMMARY

The following 4 steps summarize the trouble-shooting procedure for the LR-2000 reader, from the simplest combination of products and test tools, to the complete access control system. The detailed trouble-shooting subjects start at Section 11.3.

1. Bench-testing at your shop: Test the reader using the instructions in Section 4 with Figure 2. Follow all steps. Goal: To be confident that the LR-2000 works by itself stand-alone, communicating only with the test tags and the test unit..
2. Interfacing to a PC: Connect the reader's RS-232 output to the serial input port of a PC. Run the Microsoft Windows HyperTerminal program. Watch for a column of data in rows of 18 hexadecimal characters. Do not mount the reader yet. Goal: To see consistent data from the test tag's programmed code, at the programmed repetition rate.
3. Interfacing to the system: Connect the reader *directly* to the reader input port on the host system's controller panel. This bypasses the cable and junctions between the reader and the panel.
   Goal: To see the reader transmit the tag's code to the host system, with correct code consistently, and with access granted.
4. Connecting the complete system: Test the system as described in Section 7, using all components of the system. Goal: To confirm proper operation of the system in its final form.

11.3 GOOD IDEAS

- Do not "button up" the system mechanically or electrically until you have tested it thoroughly, and until you are confident that all components are working as specified.
  - Do not make final adjustments on the reader's mounting yet. Keep the fastener's accessible.
  - Do not cut and trim cables and wires yet. Keep all terminations available for measurements and for changes.
- Identify what the system is doing wrong, or what it isn't doing right.
  - Isolate the system's components. How does each component work alone? Decide which component is at fault.
- Keep the LR-2000KIT with you. It is absolutely necessary, and it may pay for itself in the first installation.
  - The Kit tells you when the reader reads a tag. It helps also in locating tags in the vehicle, and in aiming the reader.

11.4 POWER SUPPLY

- Use an independent power supply, not connected in any way to the controller panel or other system components.
- Do not connect other readers and other devices to the LR-2000 reader's power supply.
  - Connect only a single LR-2000 reader to a power supply, and no other electrical load – not even a small proximity reader.
  - Have a different power supply for each LR-2000 reader.
  - Multiple readers may connect to a single power source if the DC outputs are isolated electrically from each other.
- Check the power supply's specifications.
  - A separate DC power supply for every reader. Black and red wires connected only to this one power supply.
  - Voltage = between 7 volts and 15 volts DC (commonly 12.0 to 13.8 volts).
  - Current rating for a nominal 12 volt supply = at least 1.5 amperes for each LR-2000 reader.
  - AWID's PS12-3.3A plug-in power module (in the LR-2000KIT) is suitable for a single LR-2000 reader.
  - For Altronix power supplies, select "Linear" rating and minimum current rating of **2.5** amperes. Model LPS3 is good.
- Calculate voltage drop between the power supply and the reader.
  - Measure voltage at the power supply with nothing connected to the supply.
  - Then measure voltage at the reader-end of the power cable before the reader is connected.
  - Then measure voltage at the reader when it is connected to the power supply (black and red wires).
  - Voltage drop is a combination of power supply regulation, and voltage drop in the cable. This should not exceed a few tenths of a volt. Check the reader's current draw, and the cable's wire gauge, and the power supply's current rating.
- Measure DC current in the reader's red wire.
  - Set the multimeter's function to DC Amperes, and the range to 2 A or 5 A.
  - Disconnect the reader's red wire from the power cable.
  - Insert the multimeter's leads in series – positive lead toward the power supply, and negative lead toward the reader.
  - With voltage restored to the reader, its current is typically about 450 milliamperes in standby (no tag present), and about 900 milliamperes when the reader is processing a tag's code.
- To evaluate the reader's DC power supply and the power cable, substitute a back-up battery in place of the power supply.
  - Disconnect the reader from the independent DC power supply and the power cable.
  - Replace the power supply temporarily with a back-up battery (typically 12 volts, 7.5 ampere-hours, fully charged). This will power the LR-2000 reader for a working day. Alternative: Connect long clip leads to your truck's battery.
  - A charged battery has perfect DC voltage quality and plenty of current rating.

11.5 CABLE

- Check the specifications of the cable between reader and panel, and between reader and power supply. They should be –
  - Stranded wires, color-coded insulation, overall 100% shielded, outside plastic sheath, high quality.
  - For *power*: 18 gauge wires, 2 conductors, twisted-pair is OK.
  - For *data*: 22 gauge wires, 3 conductors, not twisted-pair.
  - For *power and data* in same cable: 18 gauge, 5 conductors, not twisted-pair.
  - Maximum length for *Wiegand* interface (using the reader's Data-0 and Data-1 lines) is 500 feet. For longer cable runs, use a Wiegand extender or a wireless transmitter. See Cypress Computer Systems' Web site, www.cypressworld.com.
  - Maximum length for *RS-232* serial interface is 75 feet at 9,600 bits per second. 500 feet is possible in special cases.
- If existing cable is twisted-pair (rather than "bunched" wires), run Data-0 and Data-1 through different twisted pairs.
  - Example: Run Data-0 and DC power positive in one twisted pair, and run Data-1 and DC power negative in another pair.
- Check the cable's junctions and splices.
  - Be certain that they are solid, clean, dry, insulated, shielded and *tested*.
  - Do not let the cable shield touch metal conduit. Check metal conduit's ground. Check for water inside conduit.
- If a cable problem is suspected, disconnect that cable, and run a temporary cable on the surface.
  - If the reader now works normally, pull new cable through the conduit, with no splices or junctions.
- If existing power cable has 22 gauge wires, connect spare wires in parallel for both DC positive and DC negative.

11.6 WIRING

- **Wiring an LR-2000 reader is *not* the same as wiring other reader types.** For the Wiegand interface, Data-0 and Data-1 lines are the same, but all other wires are *different*.
- Study the wiring diagram in Figure 3. Compare the actual wiring with this wiring diagram.
- The reader must be armed to transmit its RF field. To arm the reader, its *yellow* wire must be connected to its *black* wire.
  - To transmit RF only when a vehicle is present at the reader, use a buried loop or other vehicle sensor with relay contacts that connect the yellow and black wires temporarily.
- There must be no connection between the reader's power supply and the host system's panel – not even a ground connection. The power supply must be floating.
- The reader's drain wire and the cables' shields must be connected together, but they must not be grounded. These shields must be floating. (Induced noise is drained inside the LR-2000 reader.)
- *Never* connect 2 readers' data lines in parallel on one reader input port. Always use a separate port for every reader. This preserves the data pulse shape, and allows each reader to have its own address in the host system.
- To bypass a problem in the cable, wire the LR-2000 reader directly to the panel's reader input port.
  - Connect the reader's **3** data wires directly to the panel's reader input port – green to Data-0, white to Data-1, and **blue** to Data-Common on the *same reader port*. If there is no terminal labeled "Data-Common" on that reader port, connect the blue wire to the electrical Ground or Common terminal on that reader port, which serves as data-common also.
  - Use an independent DC power supply that meets AWID's specifications fully (Section 11.4). Do not connect the reader's black and red wires to the panel.
  - If the reader now operates normally, there may be a problem in the cable or its junctions, or in the conduit.
- Check the unused wires on the reader.
  - The unused wires must not touch each other or anything else. Tape them off singly.
  - The violet and brown wires are never used. They should be separately taped or capped.
  - The orange wire is used by the SP-6820-LR test unit (part of the LR-2000KIT Test & Set-up Kit). Keep this wire continually accessible for testing.
- For RS-232 serial interface, see AWID's Technical Reference "RS-232 Interface". Download it from www.awid.com/support

11.7 GROUNDING

- **The LR-2000 reader has no grounded wires.** Three wires are used as common or negative wires – *black* wire for power supply negative, *blue* wire for data-common, and *drain* (uninsulated) wire for shield draining.
  - These 3 wires *must* be wired correctly as shown in Figure 3. These 3 wires must *not* be connected to each other.
  - The reader's *yellow* wire must be connected to the *black* wire to arm the reader for RF transmission. (See Section 11.6.)
- The reader's power supply DC negative and the panel's electrical ground must be kept separate.
  - Do not wire these two negatives together. Let the power supply's secondary (DC) side float.
  - The panel and readers must be powered by different DC power supplies (or isolated outputs in a multi-channel supply).
- Check the reader's drain wire (copper stranded wire without insulation).
  - The drain must be tied to the shield of the cables between the reader and the panel, and between the reader and the power supply – **but** the shields must not be grounded anywhere. The shields must float. (Draining occurs inside the reader.)
- Measure voltage between earth-ground and the system's electrical ground.
  - Voltage must not exceed a few tenths of a volt in AC or DC. If it does, have a qualified electrical contractor check the 3-wire 120 VAC grounded power line and receptacle that feeds the DC power supply for both the panel and the reader.
  - Check that the 120 VAC green wire is at earth-ground. Check that the black and white AC wires are not reversed at a receptacle or junction.

11.8 ISOLATION

- Disconnect everything from the reader, except power. Move the reader to a remote location that has no electrical or RF noise. Use a backup battery (12 volts, 7.5 ampere-hours, fully charged) instead of the DC power supply. Test using the test unit and test tags from AWID's LR-2000KIT Test & Set-up Kit.
  - Observe the reader's performance by itself. Map the reader's effective RF field by moving the tag slowly, side to side, gradually farther from the reader. Measure the maximum width of the field, and the farthest point where the tag reads. (This is the reader's read range for that tag.)
  - Reconnect the rest of the system, one component at a time. Observe the reader's performance at each step. What is it that makes the problem re-appear?
- Disconnect other devices near the problem reader. Observe performance of the LR-2000 reader by itself.
  - Remove power temporarily from proximity card readers, communications gear, intercoms, telephone-access controllers, arc-type lamps, PCs and monitors, transformers, motors, etc., that are near the LR-2000.
  - When the LR-2000 is connected directly to the system's panel, disconnect other readers that are connected to that panel.

11.9 REPLACEMENTS AND SUBSTITUTIONS

- Try a different reader in place of the problem reader:
  - Is there a spare LR-2000 reader in your truck or at your shop? If so, use it in place of the original reader.
  - Is there another LR-2000 reader, installed at this site, operating correctly? If so, interchange the two readers, and observe if the malfunction moves with the reader or stays at the original location?
  - Do you have a different kind of reader, like a proximity reader and a compatible card or tag? If so, wire it into the panel in place of the LR-2000 reader. This may indicate a panel or system programming problem.
- Do all tags give the same results? Try other tags and compare results.
- Interface the LR-2000 reader to an access control system that has tested good previously with a different reader.

11.10 ENVIRONMENT

- Remove power temporarily from all other equipment near the reader that generates magnetic fields or electric fields.
  - Look for communications antennas, PC monitors, arc-type lighting (including fluorescent), heavy electrical equipment (elevator motors, air conditioners, etc.), RF-type telephone access panels, other RF-type readers (even 125 kHz proximity readers), high-voltage 60 Hz power lines, etc.
- If the reader's cable to the system has a junction inside the gate-motor housing, try removing power from the gate motor for the reader performance tests.
- Shield the reader from possible RF noise sources:
  - Form a large sheet of aluminum foil into a hemisphere around the reader's rear and edges, to block environmental RF interference. Leave the aluminum foil open in front of the reader so that the reader can communicate with the test tags.
- Remove power from other LR-2000 readers that are less than 12 feet from the tested reader if they are aimed parallel (as in neighboring lanes at the gates), or less than 30 feet from the tested reader if they are aimed head-on toward the tested reader.
  - Does the problem go away? Does the reader operate normally?
- To see how the reader performs when it is removed from possible RF interference, do a "greenfield" test.
  - Collect the LR-2000 reader, a back-up battery (or use your truck's battery), a tag, and the test unit from the Test & Set-up Kit. Carry them to a remote site away from interfering devices. Test the reader's performance under these conditions.

11.11 HOST SYSTEM

- Observe messages on the PC monitor while the access control program is running.
  - If no message – there may be no data input from the reader to the panel, or from the reader input module to the controller.
  - If no message – there may be input data but not with the number of bits for which the system is programmed. For example, induced noise or data collision may add bits to the normal bit stream from the reader (commonly 26 bits).
  - If the message indicates bit-count error, or format error, or parity error, or facility code error, or non-valid identification number – find the source of the error. It may be incorrect programming of the host system, or of AWID's cards or tags.
  - Watch the "Access denied: …" message. The listed reason for denying access may point to the cause of failure.

- Program the host system to configure the data input from the readers.
  - Enter the code format of the tags (usually "26-bit Wiegand standard"), the tags' facility code or site code, and (in the cardholders database) the ID number for the UHF tag.
  - Program your own test tag as an administrator, with top-priority level, access to all doors or gates, for all days and times.
- If the tag's code data shown on the PC monitor are different from the code that is printed on the tag's label –
  - *Consistently wrong* code for every read indicates that the tag is programmed wrong. Test the code from a different tag.
  - *Randomly different* code for every tag read indicates induced noise, intermittent wiring connection, or incorrect system grounding. Check for cable and wiring problems.
- If the problem is data collision in the host system because it can not process repeated code inputs quickly enough –
  - Use the reader's arming circuit to transmit a single code read to the system. Touch the yellow wire to the black wire for only about one-half second. Does the system process the single code transmission correctly, every time?
  - Contact AWID about slowing the LR-2000 reader's repetition read rate to prevent data collision in the host system.

11.12 POINTERS

- Keep the screws that fasten the aluminum plate to the reader's plastic housing in place. Do not drill holes in the plate.
- Shield the LR-2000 from heavy rain, or from bright sunshine in hot weather. Use a suitable shade, hood or cabinet.
- Remove heavy snow from the face of the LR-2000 reader.
- Wipe snow and rain from the windshield. Wash salt coating from the windshield. Avoid metal films and embedded wires.

11.13 TESTING TOOLS AND TECHNIQUES

- Digital multimeter (DMM): Absolutely necessary for voltage checks, and for current measurements at the reader.
- Oscilloscope: Useful for observing digital data output at the reader and input at the panel, and for analyzing the pulse shape.
- Test tags: Test the tags on a reader that is known to work well, to be sure that the tags work at their full rating.
- Reader substitution: Indicates whether the problem is in the reader or in the other components at the "bad" location.

12 GLOSSARY

Controller panel ..... The electronic device that contains the input data port for the LR-2000 reader. For the Wiegand interface, this may be the access control system's panel or board near the reader or gate operator, or the reader input module (RIM). For the RS-232 interface, this may be the system controller or a PC's serial input port.

Credential ..... A token, such as a card or tag, that carries data to identify the individual token, and therefore to identify the person or vehicle by which the token is carried.

Effective RF field ..... The three-dimensional space in front of the LR-2000 reader in which the vehicle tag can be read by the reader. The field is circularly polarized. It has a circular cross-section at every distance from the reader. See Figure 1 for a diagram of the effective RF field.

Isolation ..... A trouble-shooting technique that separates the components of the system temporarily so that performance of the components can be observed and measured individually.

Lane..... The roadway that leads the vehicle past the reader and toward the gate. The ideal lane is a single vehicle width, or is marked by signs, painted stripes, cones, posts, bollards or barriers that remind the drivers to stay close to the reader.

Power supply, switching .... A DC power supply whose DC output is generated by a circuit that produces interrupted current flow, at a rate of around 25 kilohertz.

Read range The space along the axis of the reader's effective RF field in which the tag can be read in hand-held testing. This extends from the LR-2000 reader's face to the maximum distance – typically between 10 feet and 15 feet, depending upon the tag. (See Figure 1, "Effective RF field".)

Substitution ..... A trouble-shooting technique that replaces a component of uncertain performance with a similar component that you know works well.

Sweet spot ..... The space in front of the LR-2000 reader where most credentials in a given installation are read. This is typically about 10 feet to 15 feet direct measurement from the face of the reader. At the sweet spot, the reader's effective RF field has a cross-section with a diameter of about 3 feet or more.

Tag orientation..... Direction ("landscape" or "portrait") that tags are mounted in or on vehicles. If the reader looks down on a tag, landscape may give best reading. If the reader is at the side of the vehicle, portrait may be best.

SENTINEL-PROX LR-2000

LONG-RANGE TAG AND CARD READER

Installation & Operation Manual



If you are new to the LR-2000 reader, or this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100

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COMPLIANCE

FCC: This equipment has been tested and found to be in compliance with the limits for FCC Part 15 digital device. 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 with radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's expense.

The users are prohibited from making any change or modification to this product. Any modification to this product shall void the user's authority to operate under FCC Part 15 regulations.

This device complies with Part 15 of the FCC Rules. 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 operation.

Industry Canada: Operation is subject to the following two conditions: (1) This device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

CAUTION:

The reader should be positioned so that personnel in the area for prolonged periods may safely remain at least 20 cm (8 in) in an uncontrolled environment from the reader's surface. Observe FCC OET Bulletin 56, "Hazards of radio frequency and electromagnetic fields" and Bulletin 65, "Human exposure to radio frequency electromagnetic fields".

Table of Contents

1	INTRODUCTION	2
2	SPECIFICATIONS	3
PART A	INSTALLATION	5
3	PREPARING FOR INSTALLATION	5
4	TESTING READER AND TAGS BEFORE INSTALLATION	6
5	INSTALLING THE READER	7
6	INSTALLING THE CREDENTIALS	9
7	TESTING THE INSTALLED SYSTEM	10
8	INSTRUCTIONS FOR LR-2000HILOMA READER SET	11
PART B	PLANNING	12
9	APPLICATIONS	12
10	PLANNING FACTORS	13
PART C	REFERENCE	16
11	TROUBLE-SHOOTING	16
12	GLOSSARY	20

NOTE: READ AND USE THIS MANUAL.

FAILURE TO FOLLOW THE PLANNING AND INSTALLATION GUIDE MAY RESULT IN POOR PERFORMANCE AND EVEN CAUSE PERMANENT DAMAGE TO THE READER. THIS WILL VOID THE PRODUCT WARRANTY.

REVISION HISTORY

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1.5	LHH	01 July 2009	All	General review.

1 INTRODUCTION

1.1 GENERAL DESCRIPTION

AWID's Sentinel-Prox LR-2000 Reader is an extra-long-range Radio Frequency Identification (RFID) reader that works with a selection of encoded credentials that may be clipped, hung, taped, adhered, fastened or held by hand inside or outside the vehicle. This reader comes with a unique combination of long read range, small size, and low power consumption. It has an internal power converter, allowing it to work with a wide range of supply inputs without affecting its performance. With a 12 volt DC supply, its current consumption is less than 1 ampere, making it suitable for a large selection of commercial power supplies. The LR-2000 reader has simultaneous Wiegand and RS-232 outputs. Its primary applications are automated parking garage entrance control, hands-free access control, vehicle identification, asset tracking, and asset management applications.

1.2 SPECIAL FEATURES

- Single small housing for reader electronics, RF module and antenna – blends into the landscape.
- Easy to install using a pan-and-tilt adjustable mounting bracket – available from AWID.
- Compatible with all commercial access control systems.
- Can be interfaced to a PC or to a special application controller.
- Shares code formats with other encoded cards, badges and tags.
- Allows mixing RFID products for several applications into an integrated system.
- Operates at low power level.
- Uses frequency-hopping technology in the 902-928 MHz band (standard).
- Passive tags assure small size, unlimited life, and easy mounting out of the driver's vision.
- Users do not need an FCC license.

1.3 SUGGESTED APPLICATIONS

- Automated vehicle identification for passenger cars, small trucks, big trucks and trailers, and railcars.
- Operation of vehicle gates and garage doors for authorized vehicles.
- Tracking material assets in containers and on pallets.
- Hands-free operation of doors and elevator call buttons for handicapped users (wheelchairs, gurneys) in ADA situations.
- Data collection using encoded cards and tags for input.

2 SPECIFICATIONS

2.1 LR-2000 READER

Input voltage:	Between +7 volts DC and +15 volts DC	
Input current (peak load):	At 7 volts DC	1.5 amperes
	At 12 volts	900 milliamperes
	At 15 volts	700 milliamperes
Read distance (guaranteed):	With UHF tags and cards	From reader to 15 feet or more, depending upon tag
Frequency:	Transmitter	902 MHz to 928 MHz
	Receiver	902 MHz to 928 MHz
Frequency-hopping channels:	Number of channels	50 channels (U.S.A. standard)
	Channel spacing	500 kHz
	Hopping sequence	Pseudo-random pattern of channels
Output data interfaces:	Wiegand electrical protocol, and RS-232 serial (simultaneous transmission)	
Reader housing:	Molded ABS plastic, on 1/8 inch aluminum back-plate; beige color	
Environment:	Temperature for 100% duty cycle	-31 to 113 F (-35 to 45 C)
	Temperature for 50% duty cycle	-31 to 150 F (-35 to 65 C)
	Operating humidity	0% to 95%, non-condensing
	Protection from weather	Gasket at edge of cover, grommet at cable entrance (Use shield or housing when required – Section 2.5.)

2.2 CABLE EXITING FROM LR-2000 READER

The cable that is integrated into the LR-2000 is 22 gauge, 10 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, 32 inches long. (The connectors on the reader's cable, when shipped, have no practical use. The installer removes these connectors and strips the insulation.)

Color assignment:

Red	DC power, positive	---
Orange	RS-232 interface, Transmit Data	Connect to controller's Receive Data.
Yellow	Enable RF transmission	Connect to reader's black wire for arming the RF generator.
Green	Wiegand interface, Data-0	---
Blue	Data-Common	For either Wiegand or RS-232 interface. Do not tie to black wire.
Violet	RS-232 interface, Receive Data	Connect to controller's Transmit Data.
Brown	(not used)	---
Black	DC power, negative	Do not ground.
White	Wiegand interface, Data-1	---
(No insulation)	Drain wire	Connect to shields of extended cables. Do not ground.

2.3 EXTENDED CABLE FROM READER TO PANEL AND POWER SUPPLY

The LR-2000 reader requires cables with particular specifications. If the installation will use separate cables from the reader to the power supply, and from the reader to the reader input panel, use these specifications –

Power cable: 18 gauge, 2 conductors, stranded wire, color-coded insulation, overall 100% shielded, high quality.

Data cable: 22 gauge, 3 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

If power and data share the same cable, use these specifications –

Combined cable: 18 gauge, 5 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

The maximum allowable length of cable for **Wiegand** interface is 500 feet. The maximum specified length of the cable for **RS-232** interface at 9,600 bits per second is 75 ft; this may be stretched for certain equipment to 500 ft or more using Cat 5 cable. Length of a separate **power** cable should not exceed 500 ft.

Unlike proximity readers, the LR-2000 reader uses 2 separate wires for Power Negative (black) and for Data-Common (blue). These wires must not be connected to ground, nor to each other, nor to any other circuit.

2.4 POWER SUPPLY

- The LR-2000 reader requires a separate, dedicated DC power supply for each reader. Do *not* connect the reader's power wires (red and black) to the panel's + DC Power and Ground terminals. Connect only the reader to its power supply.
- For multiple readers, you may use a multi-section DC supply if the sections are isolated electrically from each other, if each section has its own positive and negative terminals, and if each section has sufficient current rating for the LR-2000 reader.
- The ideal power supply has current rating of about 1.5 times the current drawn by the LR-2000 reader. This helps to assure that the direct current remains quiet and steady. (See the table, below.)
- The most common DC power supply has a nominal output voltage range of 12.0 volts to 13.8 volts (including power supplies for charging a back-up battery). To power a single LR-2000 reader, this power supply must have a current rating of 1.5 amperes or more.
- The PS-12-3.3A plug-in power module in AWID's LR-2000KIT Test & Set-up Kit is suitable for a single LR-2000 reader.
- Certain commercial power supplies require excess current rating to assure quiet DC output, for example, 2.5 amperes at nominal 12 volts for a single reader. Contact AWID's Technical Support for discussion of acceptable power supplies.

Voltage Applied to Reader	Current Load of Reader (maximum)	Current Rating of Power Supply (minimum)
7 volts DC	1.5 amperes	2.25 amperes
12 volts DC	900 milliamperes	1.5 amperes
15 volts DC	700 milliamperes	1.2 amperes

2.5 PROTECTIVE HOUSING

The LR-2000 reader should be mounted inside a protective, non-metal housing for certain characteristics of the installation site – if the reader is mounted outdoors, and if it is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example of a suitable housing: The Housing Company, Model PCH196 (Lexan, hinged and locked door, 14 inches by 14 inches by 3 inches).

2.6 READER'S EFFECTIVE RF FIELD

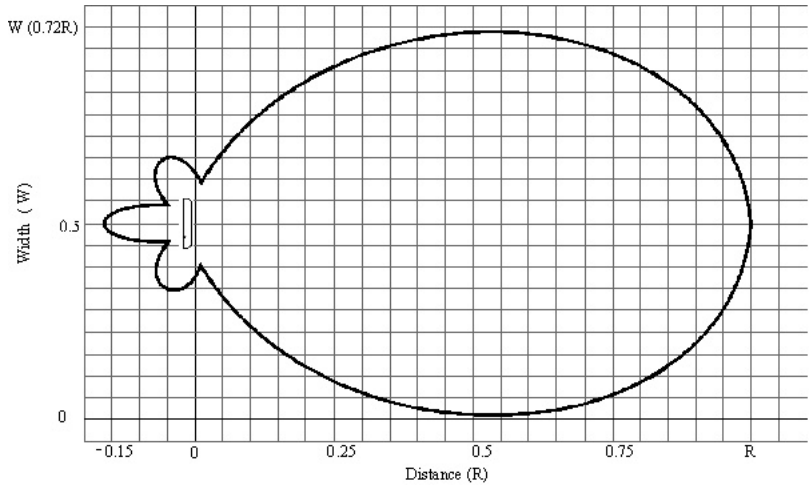


Figure 1. Effective RF field for tags with LR-2000 reader.

- The effective RF field is a figure of rotation of this diagram about its horizontal axis. Polarity of transmitted RF is circular.
- "R" is the read range (maximum distance) for each AWID UHF tag or card. The typical reading distance is 10 feet to 15 feet, depending upon the tag or card type and the reader mounting. The field's diameter "W" is about 6 feet at the reading distance.

PART A INSTALLATION

3 PREPARING FOR INSTALLATION

3.1 STUDY THE APPLICATION

- Determine what your client wants. Discuss the requirements with AWID's Technical Support.
- Visit the site; take photographs; draw diagrams; compare with similar installations. Look for unusual features.
- Study the Planning sections in this Manual to be sure that all factors have been considered. (See Part B.)
- Prepare a list of products and materials. Ask AWID's Technical Support for ideas and review.

3.2 GUIDELINES FOR THE INSTALLATION

1. Plan about *one car length* between the reader and the gate, where possible. This allows the vehicle to continue moving slowly as the tag is read and as the gate opens.
2. Select a reader location where the vehicle can move in a *straight line* for about one vehicle length as the tag is read.
3. Use an *adjustable mount* or bracket for pan and tilt-down aiming of the reader at the "sweet spot" where most of the credentials will be located in and on the vehicles.
4. Select a *reader height* that matches the location of credentials in and on the vehicles. See Section 9 for the popular combinations of reader mounting and vehicle types.
5. Locate the reader and credentials so that they are facing and *parallel* to each other when credentials are in the "sweet spot".
6. Experiment with *tag location* in the vehicles. Move a tag to different locations, and try both orientations ("portrait" and landscape"). Hook the HT-UHF Hangtag behind the inside rearview mirror. Hold the RV-UHF Rearview Mirror Tag against the mirror's frame. Clip the VT-UHF Visor Tag to the sun visor. Press the WS-UHF Windshield Tag against the windshield using a block of plastic foam. Hold the MT Metal-Mount Tag in place by tape over the screw-holes, or by a Velcro dot.
7. Restrict the vehicles to a lane that is a *single vehicle width*. Use lane markings, cones, bollards or barriers to assure that vehicles stay close to the reader.
8. Instruct drivers to move at about *5 miles per hour* as the tag is being read. Use signs and speed bumps at the "sweet spot".
9. Watch for applications that suggest use of the *LR-2000HiLoMA* set. See Sections 9.5 & 9.6 for discussion of these cases.

3.3 WIRING – GOOD PRACTICES

- Use only *shielded cable* for all readers, and for power, and for door locks or gate operator control. Unlike proximity readers, do *not* ground the LR-2000 reader's cable shields.
- Use a *separate cable* for each reader. Do not share the reader's cable with wires that carry switched power, like door locks, or power to electrically noisy devices. (But data, TTL control, and dry-contact circuits may share the LR-2000's cable.)
- Do not connect the wires for two LR-2000 readers *in parallel*. Neither power nor data lines should be in parallel. (Parallel connection changes the pulse transmission characteristics, and prevents the host system from identifying the reader addresses individually.)
- Connect the reader's negative power wire (black) *first*, and positive power wire (red) *last*. Disconnect in the opposite order.
- *Remove power* from the reader before making any wiring changes.
- The Wiegand Data-0 and Data-1 lines should not share a *twisted pair* in the cable from the reader to the controller. If it is necessary to use twisted-pair cable, separate the data lines into two different pairs. For example, combine Negative Power (black) with Data-0 (green) in one twisted pair; and combine Positive Power (red) with Data-1 (white) in a second twisted pair. This minimizes cross-talk of Wiegand data pulses from one data line to the other.
- The LR-2000 reader has *no LED*. The lens in the corner of the reader's cover is a dummy. Use the LR-2000KIT instead.
- The LR-2000 reader has 3 separate wires that serve as negative or common conductors – *black* for Power Negative, *blue* for Data-Common, and *bare silver* wire for cable shield Drain. These 3 wires must not be tied together anywhere in the system, and they must not be connected to ground anywhere.
- The LR-2000 reader has wiring that is different from any proximity reader, or any other technology. You must follow the *wiring diagrams* and the *instructions* in this Manual to have the reader function correctly.
- Unused wires from the reader's cable must be taped or capped *separately*, so that they touch nothing.

4 TESTING READER AND TAGS BEFORE INSTALLATION

4.1 INTRODUCTION

Careful preparation is important for successful installation of AWID's long-range readers and credentials. Simple bench-testing gives the installer confidence in the performance of the reader and the credentials, before the products are taken to the site. This testing isolates the reader and credentials from all other factors that contribute to performance of the final assembly.

4.2 ITEMS FOR BENCH TESTING

AWID's long-range reader and credentials are tested easily using only the items listed below. It is not necessary to interface the reader to a controller panel or reader-input module while conducting this test.

- LR-2000 reader (It does **not** contain an LED.)
- HT-UHF hangtag (26-bit code), or other tag *
- SP-6820-LR test unit, cable with 3 clips *
- PS-12-3.3A power module, cable with 2 clips *
- Wiring diagram, Figure 2 (below)

* *A component of the LR-2000KIT Test & Set-up Kit*

4.3 SUPPORTING THE READER

The reader's effective RF field, in which the long-range credentials can be detected, is maximized when there is no material in front of the reader or immediately to the sides of the reader. See the LR-2000 Effective RF Field diagram (Figure 1 on page 4).

- Cut off the connector from the LR-2000 reader's cable. Prepare the pigtails for the planned installation. Keep the unused wires separated from each other.
- Hang the reader on a clear vertical surface in an open space, about 4 feet above the bench top, 4 feet from a side wall, and 4 feet below the ceiling.

4.4 WIRING FOR QUICK TEST

- Connect the wires as shown in the wiring diagram, Figure 2 (below).
- Be sure that unused wires are touching nothing. Do not cut off unused wires yet.
- The *first* connection made is the reader's black (negative power) wire. The *last* step is to plug in the DC power module.

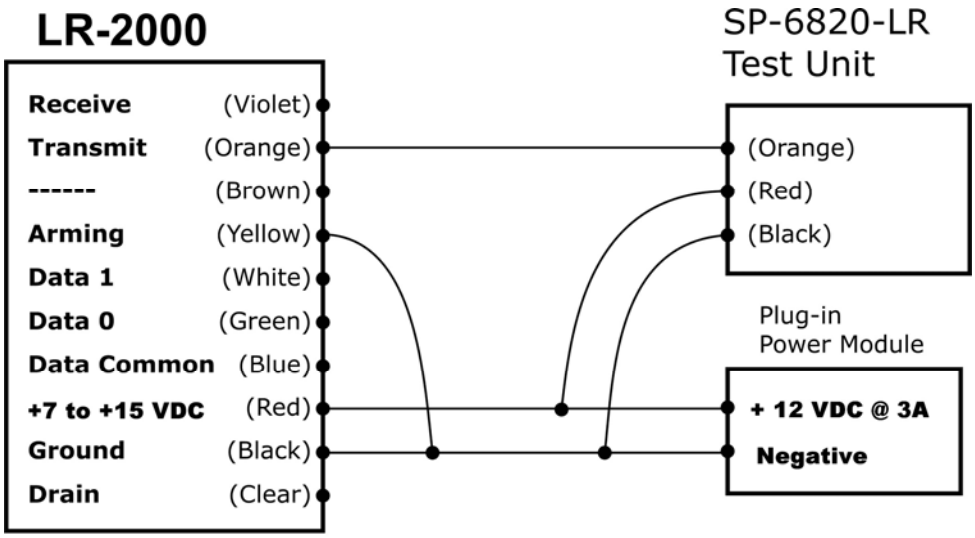


Figure 2. Wiring for quick test.

4.5 HOLDING THE TAG

- Hold the test tag by the fingertips, with the hand behind the tag. Hold the tag at arm's length, to the side of your body. Or …
- Attach the test tag to a non-metal stick. Stand to the side of the reader's RF field, and extend the tag into the reader's field.
- Hold the tag so that the face of the tag is approximately parallel with the reader's face. (The reader is circular-polarized, so the credentials may be held at any angle – up-and-down, or side-to-side, or diagonal.)
- Move the tag slowly though the effective RF field in front of the reader. Observe the edges of the zone and the point of maximum read range. The widest part of the zone is at about half of the maximum range.

4.6 TEST RESULTS

- Proper operation of the reader and credential is indicated by a signal from the SP-6820-LR test unit each time that the credential is read. The LED changes briefly from Standby red to green, and a short beep (4 kHz tone) is heard. If the card or tag remains in the reader's effective RF field, reads repeat at about 3 per second (factory default rate).
- By moving the test tag in the space in front of the LR-2000 reader, the tester can map the extent of the effective RF field that is plotted in Figure 1. The reading distance should extend from the reader's face to the guaranteed 10 feet or 15 feet with the test tags. The maximum diameter of the field's cross-section, at half of the maximum range, should be about 6 feet.

5 INSTALLING THE READER

5.1 INTRODUCTION

Before installing the long-range readers and credentials, the rest of the application system is usually in place and tested. The system components for each entrance are commonly –

- Computer with the application program (may be shared)
- Controller panel and reader-input module
- Gate or door operator (control and motor)
- Status switch for gate or door
- Request-to-exit switch or sensor
- Safety loop detector beyond the gate or door
- Buried loop to detect approaching vehicles
- Independent power source (*not* from the panel)
- Cables in conduit

These installation instructions are for the LR-2000 reader's Wiegand interface, using Data-0 and Data-1 wires (like most readers in access control). ***Note:*** *LR-2000 wiring is not the same as a 125 kHz proximity reader. Follow the instructions in Section 5.3.* If a serial interface using RS-232 protocol will be used, please download AWID's Technical Reference on RS-232 Reader Interface.

Collect these items to install the readers and credentials at the site –

- LR-2000 readers
- Mounting brackets and housings for readers
- Power supplies, cables, and other material
- UHF long-range tags and cards
- LR-2000KIT Test & Set-up Kit
- "LR-2000 Installation and Operation Manual"

For additional information, please visit AWID's Web site www.awid.com. For technical support questions, visit www.awid.com/support, or call **1-800-369-5533** (in the U.S.) or **+1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

5.2 INSTALLING THE LR-2000 READER

1. Before starting installation at the site, *plan* the project. Study Sections 9 and 10 of this Manual.
2. Keep the reader assembled. Do *not* remove the aluminum plate behind the reader. Do *not* remove the plastic cover of the reader. Do *not* tighten or loosen the screws through the cover. This preserves your Warranty.
3. Attach the LR-MB mounting bracket to the reader's metal plate using 2 screws (1/4"-20, supplied).
4. To use a different mounting device, make an adapter plate or bracket that lets you fasten your mounting device to the two capture nuts at the center of the reader's aluminum plate (1/4"-20 thread). Do *not* drill holes through the aluminum plate. In most applications the mounting device must allow pan-and-tilt adjustment for the reader.
5. Inspect the installation space. The reader may be mounted on any material including metal, but there must be open space in front of the reader and to its sides. There must be no material interfering with the reader's effective RF field between the reader and the credentials' location.
6. Measure the mounting height. It must relate to the location of the credentials when they are read at the "sweet spot". For passenger vehicles it is typically at a height of 7 feet, to the side of the vehicle lane.
7. Be aware of the environment. Stay away from UHF communications devices. Avoid arc lighting fixtures by 3 or 4 feet. Aim neighboring readers so that their effective RF fields do not overlap. Mount readers for parallel lanes at least 12 feet apart, with the axes of their effective RF fields parallel to each other. Do not have LR-2000 readers facing each other (but "back-to-back" is OK). If reader is outdoors, mount it inside a plastic housing to protect it from direct sunlight and rain.
8. Test the site for electronic devices that may interfere with the LR-2000 reader. If interference is suspected, remove power from the other device while observing the LR-2000 reader's performance.
9. Fasten the reader's adjustable bracket or housing to the pole, post, pedestal, wall, beam or ceiling.
10. Aim the reader at the location of the credentials (cards or tags) in the vehicle, when the credentials are at their reading distance from the reader. AWID guarantees minimum reading distance for its UHF credentials of 10 feet to 15 feet, depending upon the credential type. When the credentials are at this "sweet spot", the reader and the credentials should be facing each other, and about *parallel* to each other.

5.3 WIRING THE READER (FOR WIEGAND INTERFACE -- Figure 3)

1. The cable between the LR-2000 reader and the controller panel should be (see complete specifications in Section 2.3) –
   - 5 conductors for data & power
   - 18 gauge for 2 power wires; 22 gauge for 3 Wiegand data wires
   - Stranded wire
   - "Bunched" (not twisted-pair) *
   - Color-coded insulation
   - Overall 100% shielded
   - High quality
   - Maximum length – 500 feet

   * *If the cable* is *twisted pair, combine negative (black wire) with one data line (green or white wire) in one twisted pair, and combine + DC power (red wire) with the other data line in a second twisted pair. This reduces crosstalk on the data lines.*
2. From reader to power supply – **Black** wire for DC negative (first connection), and **red** wire for DC positive (last connection). Each reader's power supply must be a separate supply (see specifications in Section 2.4) that is connected to nothing else.
3. Arming circuit – For continuous RF from the reader, connect its **yellow** wire to the black wire at the reader permanently. For control of the reader's RF transmission by a vehicle sensor, connect the yellow wire to the relay contacts of the vehicle sensor. To disarm the reader (no RF transmission from the reader), let its yellow wire float.
4. From reader to panel's reader input port – **Green** wire to Data-0, **white** wire to Data-1, and **blue** wire to Data-Common. For Data-Common, use a terminal with this name if available. If not, use this reader port's "Common" or "Ground" terminal.
5. Drains for shields – Tie the reader's **bare silver** wire to the shields of the power and data cables. **Do not ground the drain**.
6. Grounds – Connect the panel's ground to earth-ground only if instructed by the panel's manufacturer. The LR-2000 reader and its power supply have **no ground connection**. Do not connect black, blue and drain wires together.
7. Unused wires – Keep the reader's **orange** wire available to connect the LR-2000KIT's test unit during set-up and tests. Wrap or cap the **violet** and **brown** wires separately.
8. Testing – While the cable terminations and junctions are still accessible, test the system for full function and performance. Then seal the terminations.

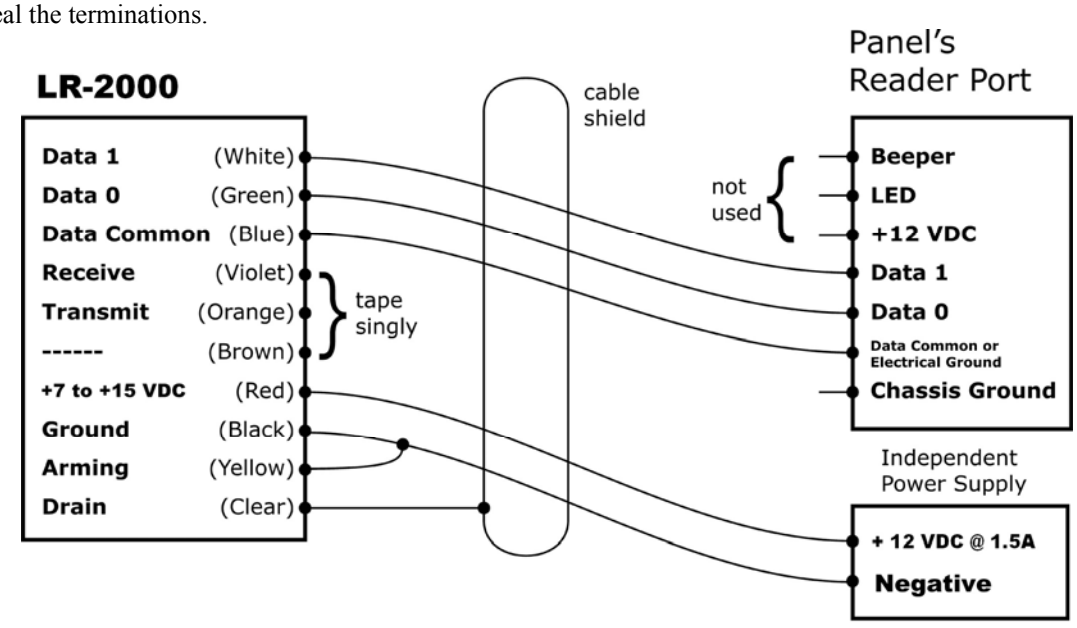


Figure 3. Wiring for LR-2000 installation.

5.4 AIMING THE READER

This step should be taken before the credentials are installed in or on the vehicles. From the LR-2000KIT Test & Set-up Kit, use the test unit, and one of the hand-held test tags, and the wiring diagram in Figure 2 on page 6. The reader does not have to be interfaced with the host system (but they *may* be connected together). Use the DC power module from the LR-2000KIT Test & Set-up Kit *only* if the independent DC power supply is not yet connected.

1. With no vehicle present, hold the hand-held test tag approximately where the vehicles' credentials will be located when they are read. This is typically at about 10 feet or 15 feet from the reader, depending upon the selected tag type.
2. With the test tag held at this "sweet spot", adjust the pan and tilt angles of the reader until the test unit indicates most robust reading. (Occasional reads will be missed normally because of the frequency-hopping feature of the LR-2000 reader.)
3. Map the outer limits of the reader's effective RF field by moving the tag slowly up-and-down and side-to-side through the field, and along the axis from the reader's face to the point of maximum range.

6 INSTALLING THE CREDENTIALS

6.1 GENERAL RULES

1. The relationship between the *reader's* location and aiming, and the location of the *credentials* (cards or tags) inside or outside the vehicle, is important for good performance. Plan the installation considering these factors before installation starts.
2. Start by testing the LR-2000 reader using the LR-2000KIT's test unit and the hand-held test credentials, with no vehicle present at the reader. When good read range has been proved, proceed to mounting the cards and tags in or on the vehicles.
3. The "*sweet spot*" for reading a credential in or on the vehicle is typically 10 feet to 15 feet, measured between the face of the reader and the location of the credential. Note: The sweet spot is shorter than the credential's rated "*read range*", which is the total distance between the reader and the farthest point at which a hand-held credential can be detected.
4. At the sweet spot, the credential should *face the reader*, with clear *line of sight* (through the windshield is OK) to the reader, and with the credential and the reader about *parallel to each other*. Aim the reader at the sweet spot.
5. Orientation of a credential may be "portrait" or "landscape" or diagonal. Reading will be most active when either long edge of the credential is closest to the reader as the tag approaches the reader's effective RF field.
6. Keep your hand and your body away from the cards and tags, to avoid blocking or reducing the card's or tag's RF field.
7. Before attaching WS-UHF tags to the windshield, clean the windshield near the tag, inside and outside.
8. To attach tags to side windows, select a window that does not lower into the door frame. Align tags with a reader at the side.
9. If necessary, turn off RF sources on the vehicle, such as pre-collision warning sensors and UHF communications gear.
10. Prevent buildup of snow over the tags. Use windshield wipers to remove water from the windshield. Near the ocean, wash the windshield near the credential to remove salt coating.
11. Prepare instructions for the users' staff member who will oversee tag installation. Copy the suggestions in the sub-sections below for the appropriate card or tag, and copy the sub-section in Section 9 – Applications that matches this installation.

6.2 VT-UHF-0-0 VISOR TAGS

1. Mount the reader, usually over the driver's side of the vehicle, or at the left side of the lane.
2. With the visor raised, clip the tag over the upper edge of the visor. The tag faces the driver.
3. As the vehicle approaches the reader's sweet spot, lower the visor so that the tag faces the reader and is parallel to the reader.
4. When the gate or door operation starts, swing the visor back to its raised position.

6.3 HT-UHF-0-0 HANGTAGS

1. For hanging tag, mount the reader over the center of the lane. For hand-held tag, mount the reader at the left side of the lane.
2. Hook the hangtag over the stem that fastens the inside rearview mirror to the windshield. Either side of the hangtag may face the windshield.
3. The hangtag may be read either by leaving the tag hanging from the mirror's stem, or by holding the tag between the fingers at the hook-end of the tag, with the tag facing the reader.

6.4 CS-UHF-0-0 CLAMSHELL BADGE and GR-UHF-0-0 GRAPHICS CARD

1. Mount the reader so that it faces the card when the driver holds it in the sweet spot through the driver's open window.
2. Present the card to the reader. Keep the fingers at the edge of the card. Hold the card parallel to the face of the reader.

6.5 RV-UHF-0-0 REARVIEW MIRROR TAG

1. Peel off the label that covers the tag's adhesive backing. Attach the tag to the housing of the inside rearview mirror, facing the windshield, at the driver's side of the stem that supports the mirror.
2. Mount the reader so that it is aimed at the tags at their "sweet spot". The reader's face should be about parallel to the tags.

6.6 WS-UHF-0-0 WINDSHIELD TAG

1. Mount the reader so that it faces the WS-UHF tag at the "sweet spot" reading location. See Figures 4 and 5 for typical uses.
2. Move the vehicle so that the windshield is at the reading distance. Press the large paper label of the WS-UHF tag flat against the inside of the windshield. Use a hand-sized block of plastic foam (flexible but firm), 2 inches thick, to press the tag.

3. Test the tag at different locations inside the windshield. Try high and low, several inches from the vehicle's door pillar, in "portrait" and "landscape" orientation. Avoid embedded wires, metal coating, dark tinting, RF emitting devices. If reading distance is too short, use a different AWID UHF card or tag.
4. Peel the paper label off the tag. Press the tag's adhesive flat against the inside of the windshield. This is a one-time application. The tag will not work after it is pulled from its original position. The tag can not be moved between vehicles.
5. WS-UHF tags will not read if held in the fingers, or carried, or taped. It reads only when adhered to the windshield glass.

6.7 MT-UHF-0-0 METAL-MOUNT TAG

1. Mount the reader so that it faces the MT tag at the "sweet spot" reading location. See Figure 6 for an example at the left side.
2. The MT tag may be hand-held, or attached inside or outside the vehicle. Attachment may be permanent or temporary. Inside the vehicle, use Velcro dots or the tag's adhesive. Outside, use rivets or plastic screws, or the tag's adhesive, or sealant.
3. The tag must remain flat when held or attached. Do not hold or cover the tag between the two lines molded in the plastic.
4. Try vertical and horizontal orientation. Outside, vertical orientation may give best reading. Face the tag parallel to the reader.
5. Test the tag. Then finish installation by snapping the screw-hole plugs in place, for security and good appearance.

7 TESTING THE INSTALLED SYSTEM

7.1 INTRODUCTION

Install the system's components, and apply power to all components. The LR-2000 reader and the UHF credentials may be tested in several ways that look at isolated parts of the system, and at the integrated system. This helps to assure that the complete system is functioning normally, and to identify a problem area, if any. (See Section 11 – Trouble-Shooting for solutions to particular problems.)

7.2 TESTING AWID'S PRODUCTS (ISOLATED)

At any time the LR-2000 reader may be disconnected from the other components of the system, and the performance of the reader and the credentials tested by themselves.

1. Disconnect the power supply cable and the data cable from the reader. Break these circuits at the reader, not at the power supply or at the controller panel, so that problems with the cables and junctions can be detected also.
2. Use the LR-2000KIT Test & Set-up Kit at the LR-2000 reader. Follow the instructions in Section 4, but keep the reader installed and the cards and tags mounted normally.
3. If the test unit indicates normal reader performance using the hand-held test tag, continue testing using the UHF cards, and tags that are mounted in the vehicles.
4. If the reader is not operating, contact your source of the AWID products for a Return Material Authorization (RMA).
5. When the LR-2000KIT indicates normal operation of the reader and credentials, connect other components of the application system one-by-one, watching for recurrence of the problem. Continue to use the LR-2000KIT as an indicator for the LR-2000 reader while the system is reconnected.

7.3 TESTING OUTPUT OF THE LR-2000 READER

The LR-2000 reader has two data outputs – Wiegand and RS-232. Wiegand is commonly used for access control systems including automated vehicle identification. RS-232 is suited for commercial systems like truck scales and supply chain management. There are simple techniques that show the condition of the reader's data interfaces.

1. To test the reader's **Wiegand** output:
   - Interface the reader's 3 Wiegand data lines to this system's controller, *or*
   - Interface the reader's 3 Wiegand data lines to a different access control system that works normally with other readers and cards, *or*
   - Connect a test, display or enrollment device, such as Cypress Computer Systems' WDG-5912 Keyboard Data Wedge, *or*
   - Use a dual-trace oscilloscope suitable for AWID's data output (100 microseconds pulse width, 2,000 microseconds interpulse spacing). Connect the oscilloscope's leads for Data-0 (green and black wires) and for Data-1 (white and black wires).

2. To test the reader's **RS-232** output:

   - Interface the reader's 3 RS-232 data lines to the system's controller, *or*
   - Interface the reader's 3 RS-232 data lines to a different commercial system that works normally with other readers and cards, or with other RS-232 output devices, *or*
   - Clip the test unit from AWID's LR-2000KIT Test & Set-up Kit to the LR-2000 reader, *or*
   - Interface the reader's 3 RS-232 data lines to the serial port of a PC, and run the Windows HyperTerminal program *, *or*
   - Connect the leads for a single-trace oscilloscope suitable for AWID's data output (9,600 bits per second) between the reader's Transmit Data and Data Common (Ground) wires.

     * In Microsoft Windows, the path is: Start → Programs → Accessories → Communications → HyperTerminal → Hypertrm.exe. Configuration is 9,600 bits per second, 1 start bit, 8 data bits, 1 stop bit, no parity, ANSI emulation, flow control = any. To open the port and start HyperTerminal, click on the Call tab at the top of the window, and select the option "Start Call".

7.4 TESTING AN APPLICATION SYSTEM

When the LR-2000 reader is interfaced to the reader input port of the application system, the format of displayed data depends upon the programming of the system. In a typical access control or automated vehicle identification system, the program allows selection of a code format that replicates the Wiegand-style encoding that AWID has programmed into the credentials. Therefore the system's monitor may display the code data in the same data fields, and the same number system (decimal), that AWID uses for its encoding. Testing may be as simple as reading the decimal values of the credential's data fields on the monitor.

If the system's monitor indicates that data are received from the reader but not recognized by the host ("Code format error", "Facility code error", "Parity error", etc.) –

- Check the host's programming.
- Check the reader's output.
- Check the wiring between the reader and the controller.
- Check the credential's code on a different reader or on a different system.

If the system's monitor indicates no data input from the reader –

- Test the LR-2000 reader and the credential by interfacing to a different controller that is known to work normally.
- Test the system by connecting the LR-2000 reader directly to the controller's reader port, bypassing the cable and junctions.
- Test the system's input substituting a different reader and a compatible card or tag.

8 INSTRUCTIONS FOR LR-2000HiLoMA READER SET

AWID's **LR-2000HiLoMA** is a set of two units that work together at a reader location. One unit is a Master Reader that controls the alternation of RF transmission between the two units. The second unit is a Remote Antenna, in an identical housing. The two units are interconnected by a coaxial cable. Instructions for installing the LR-2000HiLoMA reader set can be downloaded from the public documents in AWID's Web site, www.awid.com/support.

- Position: The master reader and the remote antenna may be in either position at the site. The deciding factor may be the position of the master reader that results in the easiest or shortest cabling.
- Protection: If you mount the reader units upside down, the coaxial connectors will have added protection from rain and snow.
- Separation: AWID supplies a 6 foot long coaxial cable to connect the remote antenna to the master reader. When installed on brackets, the practical maximum separation between the master reader and the remote antenna is about 4 feet. Do not attempt to substitute a longer cable, because electrical loss in the cable will reduce the emote antenna's read range.
- Accessories: All accessories for the LR-2000 reader apply also to the LR-2000HiLoMA reader set. Use the same LR-2000KIT.
- Reference Documents: o LR-2000HiLoMA Installation Sheet. o Technical Reference issues for description, applications, etc.

PART B PLANNING

9 APPLICATIONS

9.1 INTRODUCTION

The **LR-2000** reader is especially designed for Automated Vehicle Identification (AVI). The chief variables that must be considered in planning the readers and credentials for the system are –

- Lane characteristics
- Vehicle types
- Reader location
- Credential characteristics

The most important factors in planning a system are listed in Section 3.2. These must be considered carefully when laying out the plan for the installation.

The following paragraphs describe particular applications and recommend reader location and tag type for each application.

9.2 SMALL VEHICLES ONLY

If the reader is *beside the lane*, mount the reader as close to the edge of the lane as possible without damage to the reader. Choose the left side of the lane when possible, because this side is easier for the driver (in right-lane-driving countries) to judge the vehicle's location relative to the left edge of the lane. Mount the reader on an adjustable bracket at a height of about 7 feet (for small cars, 6 feet may suffice). Attach or hold a UHF card or tag on the same side of the vehicle as the reader. Aim the reader at the tags when they are at the "sweet spot" – about 10 to 15 feet direct measurement from reader to tag as the vehicle approaches the reader. See Figure 4.

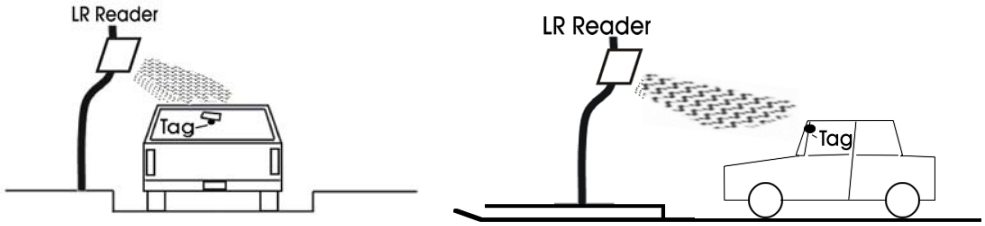


Figure 4. Passenger vehicles -- reader beside lane.

If the reader is *centered above the lane*, as inside a parking structure, mount the reader on an adjustable bracket at the lowest height that assures safe clearance between the reader and the highest vehicle. Hook a HT-UHF Hangtag over the inside rear-view mirror's stem, or attach an RV-UHF tag to the back of the mirror facing the reader, or adhere a WS-UHF Windshield Tag to the upper center of the windshield, behind the mirror, several inches below the top of the windshield. Aim the reader at the tags when they are at the "sweet spot". See Figure 5.

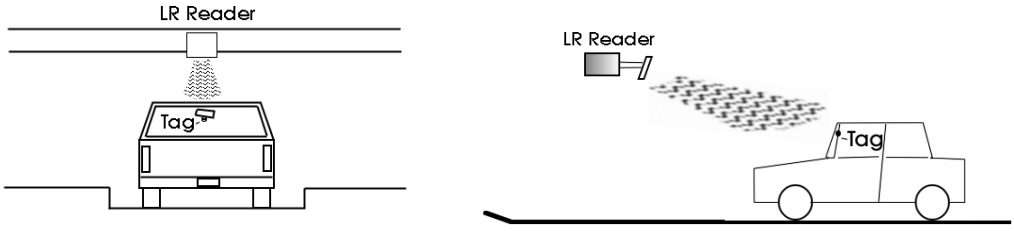


Figure 5. Passenger vehicles -- reader above lane.

9.3 MIXED PASSENGER CARS, PICKUPS, VANS AND SUVs

This application is a variation of Section 9.2. The reader beside the lane should be at about 7 feet height; the reader above the lane must be raised to clear the higher vehicles. Mount the tags and cards in small vehicles (sports cars) higher than in larger vehicles (SUVs). This places the tags and cards for all vehicles at about the same position relative to the reader. See Figure 4 and Figure 5.

9.4 LARGE TRUCKS AND BUSES

Follow the general suggestions for vehicles in Sections 9.2 and 9.3, regarding the location of the reader mounting (beside the vehicle lane or over the center of the lane). Select the UHF card or tag that performs best in the combination of vehicle lanes, vehicle types, reader locations, and credentials characteristics. See Figure 4 and Figure 5.

9.5 MIXED VEHICLES OF ALL SIZES

Use the **LR-2000HiLoMA** reader set, consisting of a Master Reader and a Remote Antenna. Mount the Master and Remote units on adjustable brackets at locations that are suitable for the type of tags and cards that will be used in the different vehicles. The reader brackets are usually supported by a single pole or pedestal, at heights that assure clear line of sight between the readers and the tags in all vehicles. (To reduce cable length, it is often best to mount the Master Reader lower than the Remote Antenna. Invert the units so that the coaxial connectors are at the *bottom* edge.)

Aim the readers individually at the locations of tags and cards when they are at the sweet spots for the two vehicle types or sizes.

9.6 SPECIAL CONDITIONS

The LR-2000HiLoMA reader set may be used also to spread out the effective RF field so that it covers a larger continuous area. (The read range does not become longer, but the cross-section size of the field may become larger.)

Spreading the field *horizontally* is helpful when –

- the vehicle lane turns – for example, the lane to the gate carries vehicles that turn off a through street, *or*
- the vehicle lane is wider than a single lane, and some vehicles may be farther from the edge of the lane where the reader is located.

Spreading the field *vertically* is helpful when –

- tags are on a mix of small and large vehicles, requiring the readers to be aimed at different heights to read all tags, *or*
- the reader is on a hill, or at the crest or dip in a hill, causing the tags to be at variable heights when they are read, *or*
- the reader is near a change in the elevation of the lane surface, as at a curb or gutter or drain.

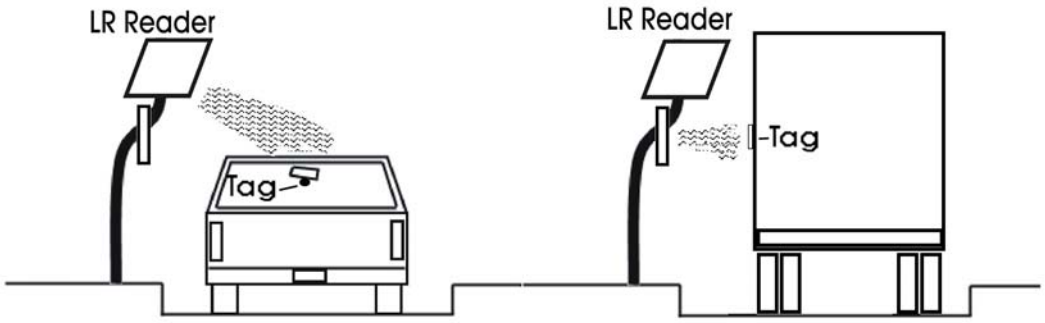


Figure 6. Mixed passenger vehicles and large trucks -- using LR-2000HiLoMA.

The LR-2000HiLoMA has a single data interface to a single reader port on the host panel. This reader set uses a single reader address in the host system.

10 PLANNING FACTORS

10.1 INTRODUCTION

Preparation for the LR-2000 installation pays dividends for the installer. The following topics cover the common questions. These topics apply generally to all forms of the LR-2000 reader. The environmental, electrical, interference and temperature range characteristics likewise apply to all forms of the LR-2000 reader. These characteristics are optimized if a buried-loop vehicle sensor arms the reader for RF transmission only when a vehicle is present at the reader.

10.2 ENVIRONMENT

- Physical obstructions: The space where the reader will be mounted and aimed must be clear.
- Weather: If the reader is installed outdoors, mount it inside a non-metal housing to protect the reader from direct rainfall and snow, and to shade the reader from bright sunlight. If ambient temperature is very high, use a vehicle sensor to arm the reader.
- RFI: Avoid sources of radio frequency emission that might interfere with the reader. Stay 3 or 4 feet from fluorescent lights.

10.3 LANE LAYOUT

- Lane geometry: The lane should be straight for about a vehicle length where the reader reads the tag. Avoid sharp turns from through streets into short driveways.
- Multiple lanes: Locate and aim readers so that they do not interfere with each other. For readers in parallel lanes, pointed in the same direction, minimum centerline distance between the lanes is 12 feet.
- Reader location: If readers are above the lanes, aim neighboring readers parallel to each other. If readers are on posts beside the lanes, aim the readers so that one reader is not aimed directly at the back of the neighboring reader.
- Eliminating cross-reader interference: If readers must be close to each other so that their effective RF fields overlap, use the LR-2000HiLoMA reader set. This set of 2 units transmits RF alternatively, so that only one unit is active at any time.

10.4 VEHICLE TYPES

- All passenger car types: A single LR-2000 reader usually works for sport cars, sedans, SUVs and pickups, unless tags are in diverse locations on the vehicles.
- Mixed small and large vehicles: The LR-2000HiLoMA reader set is available when cards and tags are spaced apart on vehicles of different sizes.
- See Section 9 for details on reader selection for mixtures of vehicle types and sizes, and on reader location.

10.5 VEHICLE MOTION – IDEAL CONDITIONS

- Vehicle in motion while the tag is read at the "sweet spot".
- Vehicle moving in a straight line while the tag is read.
- Vehicle close to the reader location.
- Vehicle's tag facing the reader's front face, and about parallel to it, when the tag is at the sweet spot.
- Vehicle speed around 5 miles per hour for safety. (OK to experiment with higher speed.)

10.6 VEHICLE MOTION -- CONTROLS

- To enforce the vehicle speed – use signs, speed bumps, traffic signals (red/green lights), gates, instructions for drivers, .
- To enforce the vehicle path – use signs, painted stripes, cones, bollards, barriers, instructions for drivers.

10.7 READER TYPE

- Typical case: Most applications are served well by a single LR-2000 for each vehicle lane.
- Diverse vehicle sizes: For a combination of large and small vehicles in a lane, use LR-2000HiLoMA mounted *over-under* on the same post, for example. The "over" position may be for tags and cards in passenger cars. The "under" position may be for tags and cards on the side of buses and large trucks.
- Turning lanes: To increase the horizontal spread in a tight turn, use LR-2000HiLoMA mounted *side-by-side*. Aim the reader and remote antenna somewhat apart. Test for continuity of field using the LR-2000KIT Test & Set-up Kit.

10.8 READER POSITION

- Above the lane or beside it? – Either position works. If the reader is above the lane, the reader must be no higher than is required for vehicle clearance – typically less than 10 feet above the lane, unless the tags are all high on the vehicles. If the reader is beside the lane, the height and aiming depend on the type and location of tags on the vehicles.
- Which side? – Either right or left side works. Left side (driver's side) is better, because the driver finds it easier to align the vehicle with the left side of the lane, and with the reader if it is on the driver's side. (This applies to right-lane-driving countries.)

10.9 READER MOUNTING

- Adjustable bracket: The reader (and remote antenna) must be adjustable for both "pan and tilt" (in camera parlance – that is, horizontal and vertical panning) for proper aiming. See AWID's LR-MB (11 inch long arm, with a two-axis adjustable head). The installer may use a camera bracket effectively.
- Fixed reader: The reader may be fastened directly to a wall, flat against the wall, in applications where the tags are on the side of vehicles facing the reader, as on buses, large trucks and trailers, and on wheelchairs, gurneys, containers, etc. Distance between reader and tags should be about 4 feet to 10 feet.
- Distance from lane: For a reader on a side post, locate the reader close to the edge of the lane, but safe from side-mirrors and errant drivers. For a reader above the lane, locate the reader as low as possible while leaving clearance for roof-racks, etc.
- Reader aiming: The "sweet spot" for reading credentials is when the credential is typically about 10 feet to 15 feet from the reader. The goal is to have the tag facing and about parallel to the reader's face when the tags are read.

10.10 ELECTRIC POWER

- Isolation: For each LR-2000 reader, or for each LR-2000HiLoMA set, provide an independent DC power supply that is not used to power any other equipment. Use a separate DC power supply for each LR-2000 reader. A single power supply is used for LR-2000HiLoMA.
- Quality: The power supply should be regulated, linear-rated (where allowed). Use a switching power supply if required, 8 feet or more from the reader.
- Voltage: Voltage at the reader must be between 7 volts and 15 volts DC. Prevent voltage drop of more than several tenths of 1 volt between power supply and reader.
- Current: For a typical 12 volts to 13.8 volts supply, the current rating must be 1.5 amperes or more with a linear power supply, and 2.5 amperes or more with a switching power supply.

10.11 CABLE

- Number of conductors: Depends on whether DC power for the reader is combined with data transmission in the same cable. Cables are usually specified in multiples of 2 conductors.
- Power: 2 conductors in shielded cable. Use 18 gauge wires between the reader and the power supply.
- Data: 3 conductors for either Wiegand interface or RS-232 interface. Use 22 gauge (18 gauge is OK).
  For Wiegand, use parallel wires – not twisted pairs. For RS-232, Cat 5, twisted or untwisted, is good.
- Other specifications: Overall 100% shielded. Stranded wire. Color-coded insulation. Maximum length – 500 feet for Wiegand data and power; 75 feet for RS-232 data at 9,600 bits per second (up to 500 feet with certain terminal equipment). High quality.

10.12 MOUNTING THE TAGS AND CARDS

- See the complete instructions for installing all credentials in Section 6.
- Attachment: The different credentials have different requirements for mounting in or on the vehicles, or for holding by hand. Visor Tags use a molded clip for the sun visor. Hangtags hook on the inside rearview mirror or are held by fingers. Clamshell Badges and Graphics Cards are squeezed between a finger and thumb. Windshield Tags adhere inside the windshield glass. Rearview Mirror Tags adhere to the frame of the inside mirror, facing the windshield.
- Orientation: The flat surface of the credential should be about parallel to the face of the reader. The hand should be behind the tag when the tag is held by the fingers. The tag may be held "portrait" or "landscape" relative to the reader; the angle does not matter.
- Pre-installation testing: Hold the tag as intended in normal operation, or attach it temporarily (using masking tape, for example) in the planned location. Drive the vehicle slowly through the sweet spot. Observe the LR-2000KIT's test unit for consistent reading. Adjust the reader's position and aiming, and the credentials' location, and the vehicle's path and speed, as required.

10.13 ACCESSORIES

- LR-2000KIT Test & Set-up Kit: *Absolutely required*. AWID may not be able to support the installer if the Kit is not at the site.
- Documents: The complete LR-2000 Installation & Operation Manual must be at the site with the installer.

10.14 AVOID …

- "Toll-tag attitude": If the drivers are used to high-speed tollgates with active tags, they will feel restricted by a long-range reader using passive vehicle tags. Emphasize the desired goal of having the gate at the LR-2000 installation open, by driving at reasonable speed in a reasonable fashion near the reader. Point out the long life and the low cost of passive cards and tags.
- Metal in or on vehicle's windows: Anti-glare tinting … reflective coating … metallic coating for automatic windshield wipers … embedded wires for defrost or antenna. These metal materials can reduce or block transmission from tags to reader. ("Lead glass" does *not* reduce performance.)
- Electronics in the vehicle: Pre-collision warning sensors and certain communications gear, while they are active, may interfere with other RF transmission, including LR-2000's tags and cards. However, most communications devices (cell phones, portable radios) and GPS have no effect on the tags.

PART C REFERENCE

11 TROUBLE-SHOOTING

11.1 PRODUCTS AND TOOLS

AWID Products:

LR-2000 long-range reader
PS-12-3.3A DC power module *
SP-6820-LR test unit *
UHF cards or badges for LR-2000 *
Adapter cable, 3 clips to 9-pin "D" *

RF-SD Detector for RF fields *
"LR-2000 Installation Manual"

Required Tools:

Digital multimeter (20 VDC, 5 ADC)
Common hand tools
Back-up battery – 12 V, 7.5 A-hr

Desirable Tools:

Proximity reader (small) and card
Oscilloscope, dual-trace, 915 MHz
RF spectrum analyzer

* Component of the LR-2000KIT

11.2 SUMMARY

The following 4 steps summarize the trouble-shooting procedure for the LR-2000 reader, from the simplest combination of products and test tools, to the complete access control system. The detailed trouble-shooting subjects start at Section 11.3.

1. Bench-testing at your shop: Test the reader using the instructions in Section 4 with Figure 2. Follow all steps. Goal: To be confident that the LR-2000 works by itself stand-alone, communicating only with the test tags and the test unit..
2. Interfacing to a PC: Connect the reader's RS-232 output to the serial input port of a PC. Run the Microsoft Windows HyperTerminal program. Watch for a column of data in rows of 18 hexadecimal characters. Do not mount the reader yet. Goal: To see consistent data from the test tag's programmed code, at the programmed repetition rate.
3. Interfacing to the system: Connect the reader *directly* to the reader input port on the host system's controller panel. This bypasses the cable and junctions between the reader and the panel.
   Goal: To see the reader transmit the tag's code to the host system, with correct code consistently, and with access granted.
4. Connecting the complete system: Test the system as described in Section 7, using all components of the system. Goal: To confirm proper operation of the system in its final form.

11.3 GOOD IDEAS

- Do not "button up" the system mechanically or electrically until you have tested it thoroughly, and until you are confident that all components are working as specified.
  - Do not make final adjustments on the reader's mounting yet. Keep the fastener's accessible.
  - Do not cut and trim cables and wires yet. Keep all terminations available for measurements and for changes.
- Identify what the system is doing wrong, or what it isn't doing right.
  - Isolate the system's components. How does each component work alone? Decide which component is at fault.
- Keep the LR-2000KIT with you. It is absolutely necessary, and it may pay for itself in the first installation.
  - The Kit tells you when the reader reads a tag. It helps also in locating tags in the vehicle, and in aiming the reader.

11.4 POWER SUPPLY

- Use an independent power supply, not connected in any way to the controller panel or other system components.
- Do not connect other readers and other devices to the LR-2000 reader's power supply.
  - Connect only a single LR-2000 reader to a power supply, and no other electrical load – not even a small proximity reader.
  - Have a different power supply for each LR-2000 reader.
  - Multiple readers may connect to a single power source if the DC outputs are isolated electrically from each other.
- Check the power supply's specifications.
  - A separate DC power supply for every reader. Black and red wires connected only to this one power supply.
  - Voltage = between 7 volts and 15 volts DC (commonly 12.0 to 13.8 volts).
  - Current rating for a nominal 12 volt power supply: For a linear supply, at least 1.5 amperes for each LR-2000 reader. For a switching supply, at least 2.5 amperes; locate the supply at least 8 feet from the reader.
  - AWID's PS-12-3.3A plug-in power module (in the LR-2000KIT) is suitable for a single LR-2000 reader.
  - For Altronix power supplies, select "Linear" rating and minimum current rating of **2.5** amperes. Model LPS3 is good.
- Calculate voltage drop between the power supply and the reader. The 4-point test is --
  1. Measure voltage at the power supply with nothing connected to the supply (no-load test).
  2. Connect the cable to the power supply (but with the reader not connected). Measure voltage at the power supply.
  3. Measure voltage at the reader-end of the power cable before the reader is connected.
  4. Measure voltage at the reader when it is connected to the power supply (black and red wires).
  - Voltage drop is a combination of power supply regulation, and voltage drop in the cable. This should not exceed a few tenths of a volt. Check the reader's current draw, and the cable's wire gauge, and the power supply's current rating.
- Measure DC current in the reader's red wire.
  - Set the multimeter's function to DC Amperes, and the range to 2 A or 5 A or 10 A.
  - Disconnect the reader's red wire from the power cable.
  - Insert the multimeter's leads in series – positive lead toward the power supply, and negative lead toward the reader.
  - With voltage restored to the reader, its current is typically about 450 milliamperes in standby (no tag present), and about 900 milliamperes momentarily when the reader is processing and transmitting a tag's code.
- To evaluate the reader's DC power supply and the power cable, substitute a back-up battery in place of the power supply.
  - Disconnect the reader from the independent DC power supply and the power cable.
  - Replace the power supply temporarily with a back-up battery (typically 12 volts, 7.5 ampere-hours, fully charged). This will power the LR-2000 reader for a working day. Alternative: Connect long clip leads to your truck's battery.
  - A charged battery has perfect DC voltage quality and plenty of current rating.

11.5 CABLE

- Check the specifications of the cable between reader and panel, and between reader and power supply. They should be –
  - Stranded wires, color-coded insulation, overall 100% shielded, outside plastic sheath, high quality.
  - For *power*: 18 gauge wires, 2 conductors, twisted-pair is OK.
  - For *data*: 22 gauge wires, 3 conductors, not twisted-pair.
  - For *power and data* in same cable: 18 gauge, 5 conductors, not twisted-pair.
  - Maximum length for *Wiegand* interface (using the reader's Data-0 and Data-1 lines) is 500 feet. For longer cable runs, use a Wiegand extender or a wireless transmitter. See Cypress Computer Systems' Web site, www.cypressworld.com.
  - Maximum length for *RS-232* serial interface is 75 feet at 9,600 bits per second. 500 feet is possible in special cases.
- If existing cable is twisted-pair (rather than "bunched" wires), run Data-0 and Data-1 through different twisted pairs.
  - Example: Run Data-0 and DC power positive in one twisted pair, and run Data-1 and DC power negative in another pair.
- Check the cable's junctions and splices.
  - Be certain that they are solid, clean, dry, insulated, shielded and *tested*.
  - Do not let the cable shield touch metal conduit. Check metal conduit's ground. Check for water inside conduit.
- If a cable problem is suspected, disconnect that cable, and run a temporary cable on the surface.
  - If the reader now works normally, pull new cable through the conduit, with no splices or junctions.
- If existing power cable has 22 gauge wires, connect spare wires in parallel for both DC positive and DC negative.

11.6 WIRING

- **Wiring an LR-2000 reader is *not* the same as wiring other reader types.** For the Wiegand interface, Data-0 and Data-1 lines are the same, but all other wires are *different*. 8 of the reader's 10 wires must be used or reserved; 2 wires ate not used.
- Study the wiring diagram in Figure 3. Compare the actual wiring with this wiring diagram.
- The reader must be armed to transmit its RF field. To arm the reader, its *yellow* wire must be connected to its *black* wire.
  - To transmit RF only when a vehicle is present at the reader, use a buried loop or other vehicle sensor with relay contacts that connect the yellow and black wires temporarily.
- There must be no connection between the reader's power supply and the host system's panel – not even a ground connection. The power supply must be floating.
- The reader's drain wire and the cables' shields must be connected together, but they must not be grounded. These shields must be floating. (Induced noise is drained inside the LR-2000 reader.)
- *Never* connect 2 readers' data lines in parallel on one reader input port. Always use a separate port for every reader. This preserves the data pulse shape, and allows each reader to have its own address in the host system.
- To bypass a problem in the cable, wire the LR-2000 reader directly to the panel's reader input port.
  - Connect the reader's **3** data wires directly to the panel's reader input port – green to Data-0, white to Data-1, and **blue** to Data-Common on the *same reader port*. If there is no terminal labeled "Data-Common" on that reader port, connect the blue wire to the electrical Ground or Common terminal on that reader port, which serves as data-common also.
  - Use an independent DC power supply that meets AWID's specifications fully (Section 11.4). Do not connect the reader's black and red wires to the controller panel.
  - If the reader now operates normally, there may be a problem in the cable or its junctions, or in the conduit.
- Check the unused wires on the reader.
  - The unused wires must not touch each other or anything else. Tape them off singly.
  - The violet and brown wires are never used. They should be separately taped or capped.
  - The orange wire is used by the SP-6820-LR test unit (part of the LR-2000KIT Test & Set-up Kit). Keep this wire continually accessible for testing.
- For RS-232 serial interface, see AWID's Technical Reference "RS-232 Interface". Download it from www.awid.com/support.

11.7 GROUNDING

- **The LR-2000 reader has no grounded wires.** Three wires are used as common or negative wires – *black* wire for power supply negative, *blue* wire for data-common, and *drain* (bare silver) wire for shield draining.
  - These 3 wires *must* be wired correctly as shown in Figure 3. These 3 wires must *not* be connected to each other.
  - The reader's *yellow* wire must be connected to the *black* wire to arm the reader for RF transmission. (See Section 11.6.)
- The reader's power supply DC negative and the panel's electrical ground must be kept separate.
  - Do not wire these two negatives together. Let the power supply's secondary (DC) side float.
  - The panel and readers must be powered by different DC power supplies (or isolated outputs in a multi-channel supply).
- Check the reader's drain wire (silver stranded wire without insulation).
  - The drain must be tied to the shield of the cables between the reader and the panel, and between the reader and the power supply – **but** the shields must not be grounded anywhere. The shields must float. (Draining occurs inside the reader.)
- Measure voltage between earth-ground and the system's electrical ground.
  - Voltage must not exceed a few tenths of a volt in AC or DC. If it does, have a qualified electrical contractor check the 3-wire 120 VAC grounded power line and receptacle that feeds the DC power supply for both the panel and the reader.
  - Check that the 120 VAC green wire is at earth-ground. Check that the black and white AC wires are not reversed at a receptacle or junction.

11.8 ISOLATION

- “Green field test” = Disconnect everything from the reader, except power. Move the reader to a remote location that has no electrical or RF noise. Use a backup battery (12 volts, 7.5 ampere-hours, fully charged) instead of the DC power supply. Test using the test unit and test tags from AWID’s LR-2000KIT Test & Set-up Kit.
  - Observe the reader’s performance by itself. Map the reader’s effective RF field by moving the tag slowly, side to side, gradually farther from the reader. Measure the maximum width of the field, and the farthest point where the tag reads. (This is the reader’s read range for that tag.)
  - Reconnect the rest of the system, one component at a time. Observe the reader’s performance at each step. What is it that makes the problem re-appear?
- Disconnect other devices near the problem reader. Observe performance of the LR-2000 reader by itself.
  - Remove power temporarily from proximity card readers, communications gear, intercoms, telephone-access controllers, fluorescent and other arc-type lamps, PCs and monitors, transformers, motors, etc., that are near the LR-2000.
  - When the LR-2000 is connected directly to the system’s panel, disconnect other readers that are connected to that panel.

11.9 REPLACEMENTS AND SUBSTITUTIONS

- Try a different reader in place of the problem reader:
  - Is there a spare LR-2000 reader in your truck or at your shop? If so, use it in place of the original reader.
  - Is there another LR-2000 reader, installed at this site, operating correctly? If so, interchange the two readers, and observe if the malfunction moves with the reader or stays at the original location?
  - Do you have a different kind of reader, like a proximity reader and a compatible card or tag? If so, wire it into the panel in place of the LR-2000 reader. This may indicate a panel or system programming problem.
- Do all tags give the same results? Try other tags and compare results.
- Interface the LR-2000 reader to an access control system that has tested good previously with a different reader.

11.10 ENVIRONMENT

- Remove power temporarily from all other equipment near the reader that generates magnetic fields or electric fields.
  - Look for communications antennas, PC monitors, arc-type lighting (including fluorescent), heavy electrical equipment (elevator motors, air conditioners, etc.), RF-type telephone access panels, other RF-type readers (even 125 kHz proximity readers), high-voltage 60 Hz power lines, etc.
- If the reader’s cable to the system has a junction inside the gate-motor housing, try removing power from the gate motor for the reader performance tests.
- Shield the reader from possible RF noise sources:
  - Form a large sheet of aluminum foil into a hemisphere around the reader’s rear and edges, to block environmental RF interference. Leave the aluminum foil open in front of the reader so that the reader can communicate with the test tags.
- Remove power from other LR-2000 readers that are less than 12 feet from the tested reader if they are aimed parallel (as in neighboring lanes at the gates), or less than 30 feet from the tested reader if they are aimed head-on toward the tested reader.
  - Does the problem go away? Does the reader operate normally?
- To see how the reader performs when it is removed from possible RF interference, do a “green field” test.
  - Collect the LR-2000 reader, a back-up battery (or use your truck’s battery), a tag, and the test unit from the Test & Set-up Kit. Carry them to a remote site away from interfering devices. Test the reader’s performance under these conditions.

11.11 HOST SYSTEM

- Observe messages on the PC monitor while the access control program is running.
  - If no message – there may be no data input from the reader to the panel, or from the reader input module to the controller.
  - If no message – there may be input data but not with the number of bits for which the system is programmed. For example, induced noise or data collision may add bits to the normal bit stream from the reader (commonly 26 bits).
  - If the message indicates bit-count error, or format error, or parity error, or facility code error, or non-valid identification number – find the source of the error. It may be incorrect programming of the host system, or of AWID’s cards or tags.
  - Watch the “Access denied: …” message. The listed reason for denying access may point to the cause of failure.

- Program the host system to configure the data input from the readers.
  - Enter the code format of the tags (usually "26-bit Wiegand standard"), the tags' facility code or site code, and (in the cardholders database) the ID number for the individual tag.
  - Program your own test tag as an administrator, with top-priority level, access to all doors or gates, for all days and times.
- If the tag's code data shown on the PC monitor are different from the code that is printed on the tag's label –
  - *Consistently wrong* code for every read indicates that the tag is programmed wrong. Test the code from a different tag.
  - *Randomly different* code for every tag read indicates induced noise, intermittent wiring connection, or incorrect system grounding. Check for cable and wiring problems.
- If the problem is data collision in the host system because it can not process repeated code inputs quickly enough –
  - Use the reader's arming circuit to transmit a single code read to the system. Touch the yellow wire to the black wire for only about one-half second. Does the system process the single code transmission correctly, every time?
  - Contact AWID about slowing the LR-2000 reader's repetition read rate to prevent data collision in the host system.

11.12 POINTERS

- Keep the screws that fasten the aluminum plate to the reader's plastic housing in place. Do not drill holes in the plate.
- Shield the LR-2000 from direct rain, or from bright sunshine in hot weather. Mount the reader inside a plastic housing.
- Remove heavy snow from the face of the LR-2000 reader, and from the windshield over tags inside the vehicle.
- Wipe rain from the windshield. Wash salt coating from the windshield. Avoid metal films and embedded wires.

11.13 TESTING TOOLS AND TECHNIQUES

- Digital multimeter (DMM): Absolutely necessary for voltage checks, and for current measurements at the reader.
- Oscilloscope: Useful for observing digital data output at the reader and input at the panel, and for analyzing the pulse shape.
- Test tags: Test the tags on a reader that is known to work well, to be sure that the tags work at their full rating.
- Reader substitution: Indicates whether the problem is in the reader or in the other components at the "bad" location.

12 GLOSSARY

Controller panel ..... The electronic device that contains the input data port for the LR-2000 reader. For the Wiegand interface, this may be the access control system's panel or board near the reader or gate operator, or the reader input module (RIM). For the RS-232 interface, this may be the system controller or a PC's serial input port.

Credential ..... A token, such as a card or tag or wafer, that carries data to identify the individual token, and therefore to identify the person or vehicle by which the token is carried.

Effective RF field ..... The three-dimensional space in front of the LR-2000 reader in which the vehicle tag can be read by the reader. The field is circularly polarized. It has a circular cross-section at every distance from the reader. See Figure 1 for a diagram of the effective RF field.

Isolation ..... A trouble-shooting technique that separates the components of the system temporarily so that performance of the components can be observed and measured individually.

Lane..... The roadway that leads the vehicle past the reader and toward the gate. The ideal lane is a single vehicle width, or is marked by signs, painted stripes, cones, posts, bollards or barriers that remind the drivers to stay close to the reader.

Power supply, switching .... A DC power supply whose DC output is generated by a circuit that produces interrupted current flow, at a rate of around 25 kilohertz. (A **linear** power supply has continuous DC output, like a battery.)

Read range..... The space along the axis of the reader's effective RF field in which the tag can be read in hand-held testing. This extends from the LR-2000 reader's face to the maximum distance – typically between 10 feet and 15 feet, depending upon the tag. (See Figure 1, "Effective RF field".)

Substitution ..... A trouble-shooting technique that replaces a component of uncertain performance with a similar component that you know works well.

Sweet spot ..... The space in front of the LR-2000 reader where most credentials in a given installation are read. This is typically about 10 feet to 15 feet direct measurement from the face of the reader. At the sweet spot, the reader's effective RF field has a cross-section with a diameter of about 4 feet or more.

Tag orientation..... Direction ("landscape" or "portrait") that tags are mounted in or on vehicles. If the reader looks down on a tag, landscape may give best reading. If the reader is at the side of the vehicle, portrait may be best.

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Quick Installation Guide – LR-2000 & LR-2000HiLoMA Readers and Tags

If you are new to the LR-2000 and LR-2000HiLoMA readers, or if this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100.

The LR-2000-series Readers are long-range Radio Frequency Identification readers that use AWID's encoded vehicle-mounted tags and hand-held cards. This Guide describes the Wiegand interface. For RS-232 interface, see AWID's Technical Reference.

Before you start the installation, download and study the LR-2000 Installation & Operation Manual.

Preparation

- **Layout Plan**: Ideal conditions for the installation site are –
  - ► 1 car length between reader and gate;
  - ► Vehicles driving in the lane that is nearest the reader, in a straight line, at up to 15 miles per hour;
  - ► Reader mounted on a bracket with pan-and-tilt-adjustable head for aiming the reader;
  - ► Reader location and height to match vehicle and tag types;
  - ► Reader and tags aimed toward each other, and parallel, when tags are 15 foot from the reader (the "sweet spot");
  - ► Good tag location in vehicles determined by tests before attaching the tags; and
  - ► Using the LR-2000HiLoMA reader set if the lane turns at the "sweet spot", or if vehicles are both big trucks and small cars.
- **Power Supply**: A separate dedicated DC power supply for each LR-2000 reader or "HiLo" reader set, connected to nothing else. For a 12-14 volt DC supply, rating = 1.5 amperes or more, linear, regulated supply. Locate 12 feet or more from the reader.
- **Housing:** Mount the reader inside a Lexan housing if the reader is mounted outdoors *and* is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example: The Housing Company, Model PCH196 (14 inches by 14 inches by 3 inches).
- **Cable**: May be separate cables for data and for power, or may be combined for data and power together. Max. length = 500 feet.
  For *power* alone – 18 gauge, 2 conductors, stranded wires, color-coded, overall 100% shielded, high quality.
  For *data* alone – 22 gauge, 3 conductors, stranded wires, color-coded, not twisted pairs, overall 100% shielded, high quality.
  For *combined* cable – 18 gauge, 5 conductors, stranded wires, color-coded, not twisted pairs, overall 100% shielded, high quality.
- **Mounting**: Adjustable pan-and-tilt brackets (Pt.No. LR-MB-0-0) in most installations, to aim the readers at the tags for reading.

Pre-Installation Testing *(See Quick Installation Guide for LR-2000KIT Installation Kit)*

- *Before* installing at the site, run these tests on the bench at your shop, or in your van at the site – almost anywhere.

1. Installation Kit (Pt.No. LR-2000KIT-0-0): Provides beep and LED color. No need to mount the reader or interface to the system.
2. Connections: Connect together the 3 negatives (black wires) on the reader, test unit, and power supply, plus reader's yellow wire. Connect together the reader's orange wire to the test unit's orange wire.
   Connect together the 3 positive power lines (red wires) on the reader, test unit, and power supply. See Figure 1 for test wiring.
3. Holding test tags: Squeeze in fingertips at edge of tag. Hold tag at arm's length to your side. Tag and reader facing each other.
4. Procedure: When the test unit's LED shows red, present one of the test tags from the Kit to the reader. Measure (a) the maximum distance "R" where reads occur, and (b) the width "W" of the effective RF field at half of maximum reading distance.
5. Results: Tags should read about 3 reads per second, inside the "balloon" (Figure 2). All tags should read to 15 feet or more.

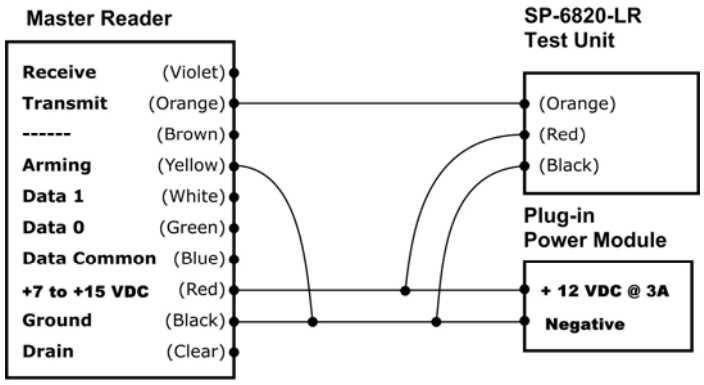


Figure 1. Connections for Pre-Installation Testing

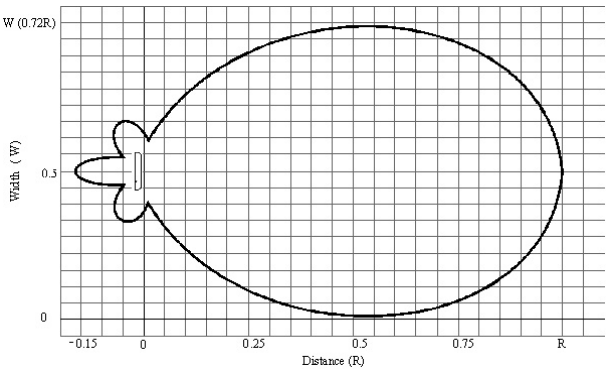


Figure 2. Effective RF Field for LR-2000 Reader

Mounting the Reader and the Remote Antenna *(See LR-2000 Installation & Operation Manual, Sections 5, 8 and 9)*

1. Fasten the mounting bracket to the pole, post, pedestal, wall or beam. Leave space for the reader unit's pan-and-tilt adjustment.
2. Fasten the reader to the bracket with 2 ¼"-20 screws. The LR-MB bracket includes fasteners. With a housing, use longer screws.
3. Cut off the connector from the reader's cable. For LR-2000HiLoMA, locate the 6 foot coaxial cable that will connect the 2 units.
4. Aim the reader (and "HiLo" antenna) toward the location of tags when they are mounted on vehicles, at the "sweet spot" distance.

Wiring the Reader (for Wiegand Interface) *(Study Figure 3 carefully)*

1. Check the power supply and cable(s) for power and data to be certain that they meet AWID's specifications ("Preparation", p. 1).
2. Connect the wires -- *yellow* to *black* at the reader; *black* and *red* to the power supply; *green* and *white* and *blue* to the controller.
3. Connect the reader's *drain* (bare silver) wire to the shields of all cables. **Do not ground** drain and shield wires – they must float.
4. Keep the reader's *orange* wire available for connecting the LR-2000KIT's test unit. Tape off *violet* and *brown* wires separately.
5. For LR-2000HiLoMA, screw the coaxial cable's rings to the brass connectors on the reader and the antenna. Seal the connectors.
6. Do not tape or bead the wire junctions until the complete system has been tested thoroughly. Keep all junctions accessible.
7. Test the reader (and antenna) using the LR-2000KIT Test Kit. The hand-held test tags should read on the test unit at 15 feet.

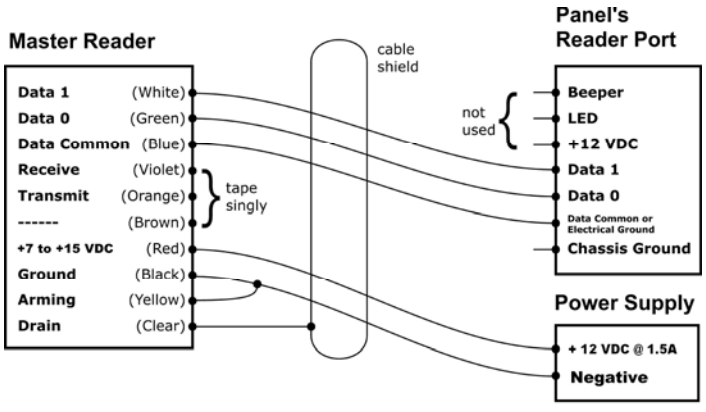


Figure 3. Wiring the Complete System for Wiegand Interface

Using Tags and Cards

- Select a location for the tags that has clear line-of-sight between the tags and the reader. Tags should be about parallel to the face of the reader at the reading distance (the "sweet spot" – 15 feet). Test the tags with both "landscape" and "portrait" orientation.

VT-UHF Visor Tag: Clip the tag on the sun visor. At about 15 feet, the driver lowers the visor so the tag faces the reader.

HT-UHF Hangtag: Hang the tag on the inside rearview mirror's post. Or hold the tag, by fingertips at its hook, inside the vehicle.

RV-UHF Mirror Tag: Using the tag's adhesive, press the tag smoothly on the frame of the inside mirror, facing the reader.

WS-UHF Windshield Tag: Using the tag's adhesive, press the tag firmly inside the glass, at least 2 inches from edge of windshield.

MT-UHF Metal-Mount Tag: Fasten tag outside or inside the vehicle, using screws, pop-rivets, Velcro dots, or the tag's adhesive.

CS-UHF Clamshell Card and **GR-UHF Graphics Card**: Hold facing reader with fingers at edge of card. (Read on UA-612 also.)

Programming the System

1. Complete the LR-2000 reader's (or "HiLo" master reader's) interface to the host access control or vehicle identification system.
2. Program the applications system for the type of reader, and for the tags' code format, facility (or site) code, and card numbers.
3. Assign suitable programming for the individual tags in the cardholders' database – gate groups, time zones, priority levels, etc.
4. Program the applications for the action to be taken for each valid read – gate motor operation, data recording, reports generation.

Testing the Completed System

1. Drive a vehicle with a mounted tag into the read range on the lane. Observe the code registered by the system for accuracy.
2. Test operation of all functions by driving a vehicle with an authorized tag code past the reader and through the gate repeatedly.
3. Study the PC monitor's data display for full and correct information about events on the system. Watch for "Access granted".
4. Enter the command for a report of events in the system – for individual vehicles in a time period and for history at a single gate.

If a Problem Occurs

1. Use the LR-2000KIT Installation Kit to measure performance of the reader with hand-held test tags. Isolate the problem.
2. Study the LR-2000 Installation Manual, Part C – Trouble-Shooting, for an organized way to identify a problem source.
3. Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions visit … www.awid.com/support or call +**1-800-369-5533** (in the U.S.) or +**1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

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Quick Installation Guide – LR-2000KIT Installation Kit

If you are new to the LR-2000 reader, or this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100.

The LR-2000KIT Installation Kit is **required** for planning, installing and testing the LR-2000 reader and vehicle tags. Keep this Kit together, with this Guide, for quick access in your truck or at your shop. It is your prime tool for building confidence in performance of the LR-2000 reader and its tags. The LR-2000KIT is a first-time, one-time-only purchase.

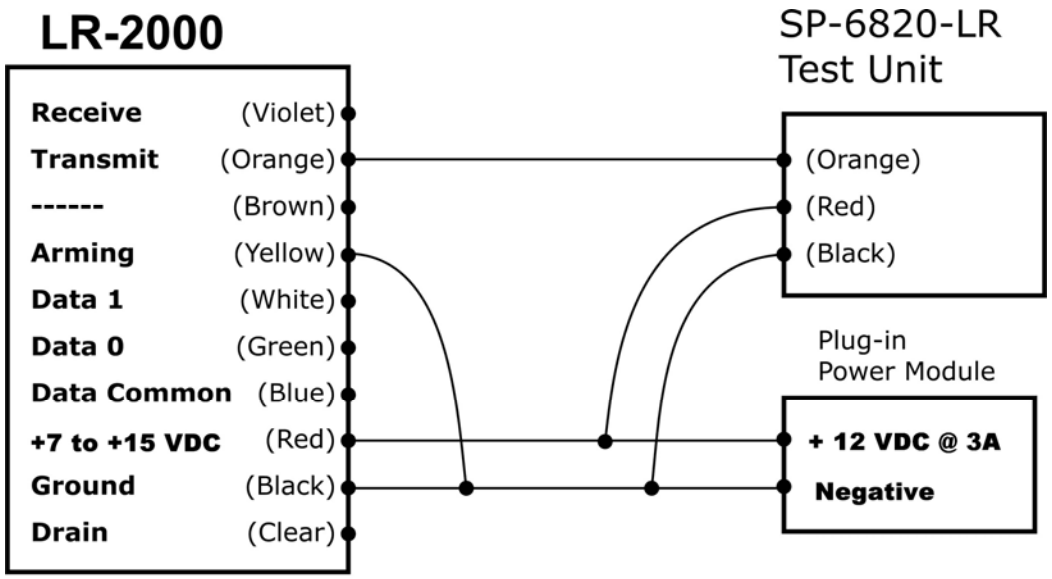
*Before you start the installation, download and study the complete **LR-2000 Installation & Operation Manual**.*

Uses for the LR-2000 Installation Kit

- Demonstrating the LR-2000 to your sales prospects and customers.
- Testing the planned location, to assure uninterrupted operation of the long-range reader at the site.
- Observing the performance of a regular LR-2000, either in bench-testing or when installed at the site.
- Selecting the ideal location for mounting the vehicle tags inside the windshield or outside the vehicle.
- Proving that the vehicle tags operate well after they are mounted in or on the vehicle.
- Substituting for the installed LR-2000 reader in a service call.

Inside the Kit's Case

- **"EVAL" Reader** – This is the 8 inch by 8 inch reader. It is a permanent part of this Kit. It has no data output. It can not interface to your system. It is for testing only. The "EVAL" reader contains *no* LED or beeper.
- **RF Signal Detector** – You may carry this thumb-sized tester to detect RF from the "EVAL" reader, or to detect and locate interfering RF from other sources. It chirps steadily to indicate when the reader is transmitting RF.
- **Test Unit** – This small unit (about 3 inches by 4-1/2 inches) alerts you to every read of the tag by the reader. It beeps and changes LED color with every read. It is your ears and eyes in demoing and testing an installation.
- **Adapter Cable** – It connects an LR-2000 reader to a PC or controller, for output tests and software commands.
- **DC Power Module** – It provides 12 volts DC for testing 1 LR-2000 reader, or for demoing the "Eval" reader.
- **Credentials** – A set of GR-UHF Graphics Card, CS-UHF Clamshell Card, HT-UHF Hangtag, VT-UHF Visor Tag, WS-UHF Windshield Tag mounted on a piece of windshield glass, MT-UHF Metal-Mount Tag, and RV-UHF Rearview Mirror Tag.



Connections for Testing with "EVAL" Reader

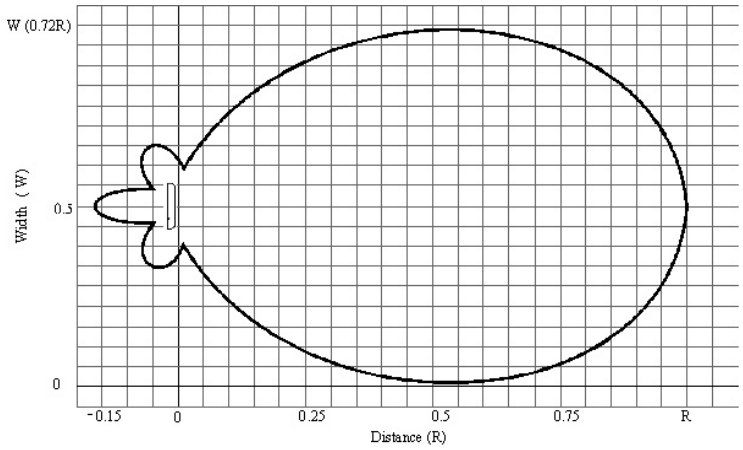
Use only the parts from this LR-2000KIT Installation Kit, including the "EVAL" Reader.

1. Clip the test unit's black lead, the power module's black clip, and the reader's black and yellow wires together.
2. Clip the test unit's orange lead to the "EVAL" reader's orange wire.
3. Clip the test unit's red lead, the power module's red clip, and the "EVAL" reader's red wire together.
4. Plug the power module into a 120 volt AC receptacle.

Connections to Test a "Production" LR-2000 Reader

Use an LR-2000 reader that is installed and interfaced to the access control system, or being tested before installation.

1. Clip the test unit's black lead, the power module's black clip, and the reader's black and yellow wires together.
2. Clip the test unit's orange lead to the LR-2000 reader's orange wire.
3. Clip the test unit's red lead, the power module's red clip, and the LR-2000 reader's red wire together.
4. Plug the power module into a 120 volts AC receptacle.



Measuring Performance

Test for these standard performance parameters.

(Note: Avoid holding the reader by hand. You will measure best read range when the reader and tags are away from your hands and body.)

- Hang the "EVAL" reader so that it is in a clear area, at least 4 feet from the floor and walls.
- Starting close to the "EVAL" reader, move the test tag back along an imaginary axis from the front of the reader. Search for the farthest point at which a read is indicated by the test unit – typically 10-15 feet or more for the vehicle-mounted tags, and 9 feet or more for the hand-held tags. This determines the full range of the reader.
- Holding the tag at half of the maximum range, move the tag up and down, and side to side, to determine the height and width of the effective RF field. This is typically a 6 feet diameter of the field's circular cross-section.
- Hold the test tag at 10 feet in front of the reader. Move the tag around to measure the cross-section of the effective RF field. This is the "sweet spot" at which most vehicle tags will be read after the reader is installed.
- Attach the vehicle tag temporarily inside the vehicle at the proposed location. Hold the "EVAL" reader in front of the tag, with the face of the reader parallel to the tag. Move the reader away from the tag to find the maximum reading distance. (When holding the reader for portable testing, keep your fingers far to the edge of the reader.)

PROTECTIVE HOUSING

The LR-2000 ***needs*** *be mounted inside a protective, non-metal* ***housing*** *for certain characteristics of the installation site – if the reader is mounted outdoors, and if it is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example of a suitable housing: The Housing Company, Model PCH196 (Lexan, hinged and locked door, 14 inches by 14 inches by 3 inches).*

More Information

Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions, contact www.awid.com/support, or call in the U.S. +1-408-825-1100 from 8:00 a.m. to 5:00 p.m. Pacific Time.

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FREQUENTLY ASKED QUESTIONS (FAQ)
AWID LR-2000
LONG-RANGE RFID READER

The purpose of this document is to provide the prospect a thorough non-technical understanding of the AWID long-range reader designed for Automated Vehicle Identification (AVI) applications. This document is divided into two main sub-headings: (1) a discussion focused on the reader system itself, and (2) a discussion of application-related issues, both in an FAQ format. For further clarification, the user is referred to AWID technical support at support@awid.com or AWID's Regional Sales Managers.

LR-2000 Specific Equipment FAQ's:

1. Q: What exactly is AWID's LR-2000 RFID reader?

A: The LR-2000 RFID reader is the successor to the original AWID LR-911 AVI reader. Identical in form, fit and function but with more state-of-the-art application-specific RFID tags, the LR-2000 has better reliability, longer tag-read distance, and better ROI. The LR-2000 operates in the same license-free Ultra-High Frequency (UHF) 902-928 MHz band as does the LR-911.

2. Q: Does the LR-2000 looks exactly like the older version LR-911 reader?

A: In order to answer this question, one must understand that, like the LR-911 reader, the "system" consists of three main modules: (a) the actual reader transmitter-receiver, (b) the required accessories, and (c) the RFID credentials (tags) that go with the reader. One cannot tell the difference by looking at the reader's transmitter-receiver housing. The LR-2000 uses the same enclosure as the LR-911; therefore the LR-2000 mounts the same way as the LR-911 did, utilizing the same mounting bracket. The only change made to the LR-2000's transmitter-receiver was new firmware to read the new RFID tags.

3. Q: Are there other changes in the new LR-2000 "system" compared to the older LR-911?

A: AWID has introduced a new power supply that we sell optionally for LR-2000 operation. This is a smaller "brick" power supply than before. It provides sufficient power to operate perfectly one LR-2000 reader. Ideal power supply specs are clearly listed in Section 2.4 of the LR-2000 Installation & Operation Manual that you can download. Because the power supply is a "switcher", it radiates RF noise. Hence the "brick" should be located at least 6 linear feet away from the reader's transmitter-receiver unit. However, the main enhancement has been made in the actual RFID credentials themselves.

4. Q: The LR-911 came also in a "Hi-Lo" version. Is the same true for the LR-2000?

A: Yes. The LR-2000 also can be ordered in a Hi-Lo configuration where the signal pattern needs to be enhanced either vertically (for different vehicle heights ... big trucks vs. cars) or horizontally (for vehicle approaches with tight corners). The configuration of the LR-2000HiLoMA is a remote antenna connected to the master reader's transmitter-receiver via a 6 foot coax cable. The two units have identical 8-inch-square enclosures. They are usually mounted 4 feet apart, on a pole or on an overhead structure.

5. Q: So the LR-911 reader system has been discontinued?

A: Only for all new applications. If there is an existing project where the LR-911 has been already deployed, then AWID will allow additional LR-911 readers to be deployed for that project only.

Take notice – LR-911 credentials are not compatible with LR-2000 credentials, and vice versa. AWID technical support continues to be available for the LR-911 at support@awid.com.

6. Q: Can the old style power supply that was used with the LR-911 also be used with the LR-2000?

A: Only for a brief interim time period. AWID strongly recommends that the new power supply that we sell optionally be installed ASAP. While the reader may draw peak loads of about 900 milliamps, one needs to have a DC power supply with about 50% more current rating (around 1.5 amps) to assure that the DC power remains quiet and smooth. If one uses an Altronix supply, it needs to be their LPS3 model rated at 2.5 amps.

7. Q: What is so special about the LR-2000's main enhancement … the credentials?

A: The new LR-2000 tags utilize a new chip and antenna design standard. This standard has been exclusively used by the technical community in supply chain and asset tracking RFID applications for several years. A large amount of R&D dollars has been spent in this arena resulting in better-performing RFID tags, while lowering costs at the same time due to high-volume production. AWID took this state-of-the-art standard and wrapped the chip and antenna designs (called inlays) inside new plastic form factors specifically aimed at vehicle-based AVI applications.

8. Q: Are the data that AWID programs into the LR-2000 tag identical to the supply chain format?

A: No. AWID still provides site code and serial number data just as before. But now we utilize the new tag designs created by the supply chain standard.

9. Q: Can you explain in detail the various LR-2000 RFID credentials introduced by AWID?

A: AWID has initially released 7 variations of RFID tags compatible with the LR-2000 reader. The tags come with various code formats. They can be programmed in formats from 26 through 50 bits. Encryption algorithms are also programmed into the reader and credentials, transparent to the user, so that the wireless long-range transmitted data between reader and tag cannot be decoded if captured. The 7 tags are as follows:

(1) Clamshell badge The credit-card-size portable clamshell (CS) design is identical in form to the standard low-frequency proximity reader CS design that we are all familiar with in building access control. Using this card type, the badge is "presented" to the reader by the user through the car's window.

(2) Graphics badge The graphics (GR) badge is ISO-compatible with the many badge printers on the market today. This allows graphics and text data to be printed right onto the badge. Like the CS badge, these thinner credit-card-size credentials are also presented to the reader by the user. Unlike the low-frequency (LF) graphics credentials that AWID offers, no magnetic stripe option is offered in this LR-2000 UHF card.

(3) Visor tag The white mobile visor tag (VT) comes with a white clip for easy mounting onto a car's sun visor. The visor tag is the same size as the familiar "hello - my name is …" party name tag. The driver flips the visor down and the tag is read through the windshield. Visor tag mounting can be on either the driver's visor or the passenger's visor, depending on what side the reader is located relative to the car's approach.

(4) Hang tag The white hang tag (HT) is a variation of the visor tag but is designed with an integral hook to be hung from the vehicle's rear-view mirror mounting post, just like a disabled handicap placard only shorter in length.

(5) Rear-View Mirror tag The permanently adhered rear-view mirror (RV) tag is black in color so it doesn't stand out when it is mounted to the back of the vehicle's rear-view mirror. Depending on reader location relative to the car's approach, this large-band-aid-size tag can be mounted on either side of the mirror's mounting post. This tag "self-destructs" into unusable pieces if someone tries to remove it after the adhesive solidifies.

(6) Windshield tag *Like the RV tag, the windshield (WS) tag also self-destructs when it is pulled from the windshield. This tag, longer than a regular band aid, is white in color. It was designed to be mounted on vehicle windshield glass for proper operation.*

(7) Metal-Mount tag *The metal-mount tag (MT) performs best if it is mounted on metal. It is designed for outside industrial applications. The ¼-inch-thick black tag looks like a tongue depressor with Mickey Mouse ears on the ends for secure mounting using conventional hardware. The tag comes also with a self-adhesive strip along its backside. The tag's mounting hole dimensions allow for attachment on the front license plate. But it can be adhered on a bumper or screwed to a door or fender. The MT credential is the most sensitive to parallel mounting of all the LR-2000 tags. That is, the MT's centerline axis needs to be more in parallel to the reader's front face than the other tags. This is especially crucial when license plate reading is required. Please refer to the application-specific Q&A in the next section regarding the metal-mount tag and attachment to a license plate.*

These credentials can generally be classified as badges (cards) that are portable, or tags that are fixed. The Clamshell and Graphics badges are hand-held; the others are attached permanently to vehicles.

It is important to note that typical applications may require more than one credential type to insure end-user satisfaction.

AWID is continually looking at new tag designs for continuous improvement and applications.

LR-2000 Application-Specific FAQ's:

1. Q: What are the main applications for the LR-2000 long-range UHF reader by AWID?

A: The LR-2000 has been used primarily in high-end gated communities for unattended vehicle access control. Secondary applications have been access control for both cars and trucks in industrial complexes, and access control of emergency carts in a hospital environment. Some Parking OEM's are evaluating the reader for incorporation into their respective product lines for vehicle lane access and traffic reporting.

2. Q: A new LR-2000 Installation Kit has been introduced. Can you describe the kit's contents?

A: AWID revamped the old LR-911 installation kit to be more user-friendly. The kit comes in a foam-lined travel case and has everything the dealer/integrator would need to perform a site survey or demonstration. The kit now includes a modified LR-2000 demo test reader, a small beeper module, AWID's standard power supply (a gel-cell portable battery or a car's 12 volt battery could be used if no AC power is available), a small lipstick-size RF signal detector, and one each of all the RFID tags described above.

3. Q: How would one use the kit?

A: The self-contained kit is designed for stand-alone operation wherein no connection to any control electronics is required. The primary purposes of the kit are for the dealer/integrator to set the correct expectation level with the end-user decision maker/influencer by demonstrating the reader's read range, and for subsequent selection of the various credentials, either in shop conditions or at the actual site location. The LR-2000EVAL reader's interface is disabled, so it cannot be offered as a salable unit. The RF signal detector is a battery-powered device that beeps when the reader is operating, and tells if there is any RF signal interference that may cause reduced read-range at the site. The signal detector should be used ASAP after the reader location is initially proposed. A secondary use of the kit is for trouble-shooting during the installation process and service calls. AWID technical support will always ask if a kit is available. Effective technical support may not be possible unless a kit is available at the site.

4. Q: AWID seems to be implying that the installation kit needs to be a one-time mandatory requirement. Is this assumption correct?

A. Yes! Based on tech support's negative experience resulting from the non-enforcement of earlier LR-911 installation kit procurement, AWID will not allow the shipment of any LR-2000 reader without an installation kit if it is a first-time buy. AWID will allow LR-2000-only shipments if an installation kit is confirmed to be in the installer's possession from a previous buy. The one-time cost can be amortized easily over the initial project's total expenditure and will pay for itself via honest expectation levels coupled with error-free installations.

***5.* Q: Can the LR-911 installation kit be upgraded to the LR-2000 installation kit?**

A. No. Although the beeper+LED test unit is common to both kits, the addition of the demo/test LR-2000, new power supply, RF signal detector, carrying case and new credentials do not make an upgrade feasible.

6. Q: Are there any major installation tips to assure a successful installation?

A: First, the installation kit should always be used at the site by sales or project personnel, not only to set the correct expectation level, but also to make sure that the production reader will operate in the same environment. Second, after the Installation Manual is reviewed, the production unit should be tested in a low-stress lab bench setting to make sure that the reader is correctly reading the tags chosen for the project. Then the reader should ideally be connected directly to the appropriate port on the access control panel before the reader is installed at the remote location.
Third, after reader wiring is connected to the remote cable, the voltage measured at the reader's installation location should be only a few tenths of a volt DC below the no-load voltage read at the power supply. The power supply is usually located near either the reader or the access control panel.

The reader's input DC power is never supplied by the access control panel because (a) there is usually not enough current available in the panel's DC power supply, and such a connection could possibly damage the panel's DC supply; (b) each reader must be connected to a dedicated power supply to which nothing else is connected; and (c) the reader's DC supply should be a linear, regulated supply except in California where state law requires a switching supply. At a nominal input voltage of 12 volts DC, current draw should be in the 450 milliamp range at standby and around 900 milliamps during tag data processing and transmission. Power wiring should be 18 AWG stranded cable, while data can be on 22 AWG stranded cable. All cables should be shielded.

7. Q: LR-2000 specs indicate the device is "splash proof", not "water resistant". What can be done to increase reader tolerance to the outside elements?

A: The LR-2000, like the LR-911, was designed to go outdoors but only in a covered environment (that is, recessed inside a parking garage). The unit was not designed to be exposed directly to the outside elements. AWID does not offer an enclosure that protects the reader from the environment. However, third-party suppliers (www.thehousingcompany.com) do offer a Lexan-built housing that can accommodate LR-2000 mounting within the enclosure. The model PCH196 enclosure has a hinged front panel with key-lock that protects the reader from vandalism, rain, snow, ice, high-temp sunlight, etc. with no read-range degradation.

8. Q: How important is site location layout and vehicle approach for a successful install?

A: As previously mentioned, the actual install site should be free of spurious RF signal interference, and good tag reads should have been observed previously using the LR-2000 installation kit. Depending on vehicle type, and using WS, RV, HT, VT or possibly MT tags, the reader may be mounted 7 feet high on a pole so that the reader's RF signal "rains down" onto the appropriate car tag location. If the CS or GR style card is selected, one might want to install the reader perpendicular to the vehicle's approach path so that the driver presents the credential to the low-mounted reader for access control. In either scenario the credential and the reader are parallel to each other for best reading. Ideally one car length should be allowed between the reader pole location and the access gate. Vehicle approach speed should not exceed 5 MPH. Vehicle approach should be in a straight path when coming into the reader's RF field. Sometimes the vehicle lane requires a tight turn just before reader engagement. In that case, the LR-2000HiLoMA configuration should be used.

9. Q: I understand that RFID-based credentials, including the LR-2000's tags, sometimes do not work on certain types of car windshields. Can you please elaborate?

A: Sometimes high-end luxury cars (typically top-of-the-line Mercedes, BMW, Bentley …) are ordered from the dealer with metallic-film coating on their windshields. In some cases the coating reflects sunlight, to keep the passenger compartment cooler and to reduce glare. In other cases the coating senses water outside the windshield to make automatic windshield wipers start to operate. Unfortunately this metallic coating blocks RF signal transmission regardless of what type of RFID devices (active or passive) are mounted on the windshields. To eliminate this problem some car manufacturers provide a cutout around the inside rear-view mirror, and sometimes also low on the windshield, just to the left of center (BMW). The cutout sometimes can be seen with the naked eye if closely observed. The metallic coating for cooling and windshield wipers may be a manufacturer's option; glare-reduction film is probably an aftermarket purchase. When these vehicles are encountered, the non-fixed clamshell (CS) or graphics (GR) card held by the fingertips outside the car's window may be the only alternative.

Another vehicle option that could interfere with tags inside vehicles is the RF transmitter for anti-collision warning and braking. Again the only alternative may be the MT tag on the front grill or bumper, or the CS or GR card held by the fingertips.

10. Q. Previous mention was made of the metal-mount tag (MT) used in a license plate reading application. Can you please elaborate?

A. As previously indicated the MT credential is optimized for metal mounting applications. If held by the fingertips, performance is degraded. Another characteristic is that the MT tag tends to be more sensitive to aiming compared to the other LR-2000 compatible credentials. Therefore in a license plate installation, the LR-2000 reader should be facing head-on to the license plate tag as much as possible relative to the vehicle's approach path from a height that allows all vehicles to pass underneath. Mounting a single reader on a high pole on either the driver's side or the passenger's side, looking down to read windshield tags as well as the occasional license plate tag, will give inconsistent reads from the license plate tag. Any non-MT credential scenario mixed in with a license-plate-mounted MT tag will require testing and an LR-2000HiLoMA configuration in most cases.

11. Q: In light of Answer #9, can AWID's LR-2000 guarantee 100% reliability of reading windshield tags regardless of vehicle model?

A: No. AWID cannot in good conscious make such a claim. Around 95% would be more realistic. The answer is to test the variety of tags in the LR-2000 installation kit, and find those that work better than WS tags in the problem vehicles The MT tag generally works well outside the vehicle when the inside tags don't read. In the worst case, the CS and GR cards, held up to the reader by the fingertips, do work.

12. Q: What is the main purpose in the introduction of the UA-612 UHF reader?

A: There are two main applications that we see for the UA-612 reader.

(1) In dealing with the gating and parking community, it became apparent that the ability to manage one set of credentials, one database for gate access and building access, could be a desirable benefit. The UA-612 satisfies this requirement by providing a short-range building access Ultra-High Frequency (UHF) reader that responds to the same credentials used for long-range vehicle access control.

(2) Additionally, the UA-612 reader, utilizing its standard Wiegand or RS-232 serial interface, can also double as a credential "enrollment reader" for the long-range tags and cards during system activation.

13. Q: What is an enrollment reader?

A: In a high-volume credential application, linking the site code and serial number programmed into each credential with individual user data can become a formidable task. Depending on the specific software attributes of the access panel used on the project, the reader may be connected directly to an "enrollment port" on the access panel or may be connected to the actual server PC maintaining the software. In either case, by manually presenting the credential to the UA-612 reader, the site code and sequential number data can be entered quickly into a user profile template, for example, bypassing tedious and inaccurate typing. This associates the entered credential data with the user. The enrollment process is typically done in real-time as the credentials are deployed, since user profile data have already been entered.

14. Q: What is AWID's warranty on the LR-2000 "system"?

A: The LR-2000 carries a two-year warranty on material and workmanship, just like the older LR-911 reader. All LR-2000 credentials carry a lifetime warranty, just like all LR-911 credentials. Specific details are noted in AWID's Warranty Policy, abbreviated version, dated January 2008. Copies are available upon request.

15. Q: Does AWID offer an Advance Replacement Policy for installed LR-2000's deemed to be defective?

A: AWID at its discretion may offer Advance Replacement if identical product (new or used) is available and approved for shipment. Details and procedures are noted in our official Product Return Policy, available upon request.

AWID is sensitive to non-billable manpower costs associated with the travel, uninstall and logistics of replacing defective readers. This is all the more critical when dealing with a system component like the LR-2000 unit, which typically becomes an immediate application choke point.

LR-2000 Advance Replacements can be virtually eliminated (1) if mandatory purchase of the LR-2000 installation kit is enforced, (2) if usage of the kit as outlined in FAQ #3 (on page 3) is performed before any production equipment is ordered, and (3) if one generally follows the steps outlined in FAQ #6 (on page 4) in conjunction with the LR-2000 Installation Manual to avoid costly out-of-carton problems or embarrassing installation blunders before the reader is pole-mounted.

v. 1.3, Jan. 2009

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Instructions

LR-911-HiLo Master-Antenna Reader Set

Testing Reader and Antenna

*These instructions apply to the LR-911-HiLo (MA) Long-Range Reader set, consisting of a **Master Reader** and a **Remote Antenna**, in identical housings. The Master Reader has special programming that alternates RF transmission from the Master Reader and the Remote Antenna. These two units may be mounted close to each other without interference between them. The standard test unit (a component of the LRIN Installation Kit) is used for these tests.*

CONTENTS

CONTENTS 1
A. MATERIAL FOR TESTS 1
B. PRE-INSTALLATION TESTING 2
C. INSTALLING AT THE SITE 3

A. MATERIAL FOR TESTS

Master Reader	LR-911-HiLo (MA) "M"	For WS and MT tags. (Reader does *not* contain an LED.)
Remote Antenna	LR-911-HiLo (MA) "A"	For WS and MT tags. (Antenna does *not* contain an LED.)
Coaxial Cable	SMA6	6 ft long; connecting Master Reader and Remote Antenna.
Mounting Brackets	LRMB	For Reader and Antenna housings (optional).
Installation Kit	LRIN	Contains the following components:
Test unit	SP-6820-LR	Has beeper and bi-color LED; cable with 3 spring clips.
Power module	PS12-1A	DC power supply, 12 volts, 1 ampere, linear, regulated.
Ferrite clamps	FC (quantity, 2)	To be assembled on cable of PS12-1A for LR-911 power.
Test tag	GMWS	WS tag on 3 inch by 4 inch piece of windshield glass.
Test tag	MT	Metal tag for RF field mapping, locating tag, and aiming.
Adapter cable	--	6 in long; 9-pin "D" female connector and 3 spring clips.
Document	--	Instructions - "LRIN Installation Kit" (contents).
Documents	--	"LR-911-HiLo MA Installation Sheet" "LR-911 Instructions Part 2" "LR-911 Surveillance Zone" "TR GMWS Holding Instructions" "TR Tags - Long-Range Readers - Location & Testing" "TR Tags - WS Mounting Recommendation" "TR Tags - MT Mounting Recommendation" "TR PS12-1A Power Module Installing Ferrite Clamps"

B. PRE-INSTALLATION TESTING

See LR-911 Instructions Part 2, Section C (page 3), for complete information about bench-testing. The only products required for this simple testing are the LR-911-HiLo reader set (both Master Reader and Remote Antenna, with coaxial cable), and the LRIN Installation Kit with the SP-6820-LR test unit.

Wiring for Quick Test

For ↓	**Wire on Master Reader**	**Connector on Remote Antenna**	**Clip on Test Unit SP-6820-LR**	**Clip on Power Module (12 VDC)**
Ground (power common)	Black wire …and…	(no connection)	Black wire … and …	Black wire (negative)
RF arming circuit	Yellow wire …and…	(no connection)	Black wire …and…	Black wire (negative)
RS-232 transmit data	Orange wire …to…	(no connection)	Orange wire	(no connection)
RF interconnection	RF coaxial cable …and…	RF coaxial cable	(no connection)	(no connection)
DC positive power	Red wire …and…	(no connection)	Red wire …and…	Red wire (positive)

Notes:
1. For bench-tests, there are *no* connections to the system's controller panel or reader-input module.
2. If the Remote Antenna is not connected, the Master Reader functions alone at a reduced duty cycle.
3. Unused wires on the LR-911 readers must be carefully separated and taped, so that they do not touch anything.

Procedure

Proper operation of each reader and tag is indicated by signals (beep, and LED color change) from the SP-6820-LR test unit.

The connections above allow the observer to see the performance of the reader and antenna as a set (two housings), or as individual units.

- To test as a combined set, locate and aim the two housings so that their effective RF fields overlap somewhat. When the test tag is held in the combined field, the reader set will transmit a code at the standard rate of about 3 reads per second (with occasional missed reads because of the frequency-hopping technology). The test unit will indicate each code transmission by LED and beeper.
- To test as individual units, use a piece of sheet metal or metal foil to block the RF transmission from one housing. Hold the test tag in the field of the other housing. The output will be half of the repetition rate for the combined units (above) – about 1-1/2 reads per second – from each unit separately.

For manual testing using hand-held test tags:
Typical maximum read range in front of the reader is 9-11 feet for GMWS test tags, and 10-12 feet for MT tags. Typical maximum diameter of the field's circular cross-section, when the test tag is held at about 6 feet in front of the reader, is 6 feet. Measure this diameter either up-and-down or side-to side in the field.

C. INSTALLING AT THE SITE

See LR-911 Instructions Part 2, Section D (pages 4 and 5), for complete information about site-testing. Follow all steps in the Installation Sheet for LR-911-HiLo (MA) Reader Set.

Wiring for Site Test

For ↓	**Wire on Master Reader**	**Connector on Remote Antenna**	**Independent Power Supply and Accessories**	**Clip on Test Unit SP-6820-LR**
Ground (power common)	Black wire … and …	(no connection)	Power: negative terminal … and … (No connection to controller panel)	Black wire (negative)
RF arming circuit	Yellow wire…and…	(no connection)	Ground loop sensor (if used) or Power: negative terminal … and …	Black wire (negative)
Wiegand Data-0	Green wire …to…	(no connection)	Panel's reader port: Data-0 terminal	(no connection)
Wiegand Data-1	White wire …to…	(no connection)	Panel's reader port: Data-1 terminal	(no connection)
Data common	Blue wire …to…	(no connection)	Panel's reader port: Data Common or Power Common or Ground terminal	(no connection)
RS-232 transmit data	Orange wire… and …	(no connection)	(no connection)	Orange wire
RF interconnection	Coax cable … and …	Coax. cable	(no connection)	(no connection)
DC positive power	Red wire …and…	(no connection)	Power: +12 volt terminal … and … (No connection to controller panel)	Red wire (positive)

Notes:

1. The reader's yellow wire must be grounded to read tags. When testing, either connect the yellow wire to the reader's black wire, or have a vehicle present over the ground loop sensor (if used).

Procedure

The procedure for site-testing is the same as in Section B for bench-testing. Use an independent power supply that meets AWID's specifications for the LR-911-HiLo (MA) reader set.

For manual testing using hand-held test tags:
Typical maximum read range in front of the reader is 9-11 feet for GMWS test tags, and 10-12 feet for MT tags. Typical maximum diameter of the field's circular cross-section, when the test tag is held at about 6 feet in front of the reader, is 6 feet. Measure this diameter either up-and-down or side-to side in the field.

For testing tags mounted inside or outside vehicles:
The "sweet spot" for WS and MT tags, when they are attached to a vehicle, is typically about 8 feet from the front surface of the LR-911 HiLo reader units. The "sweet spot" is the location of tags on the vehicles that is used for aiming the reader, for best overall performance. When the tag is at the "sweet spot", it should be about parallel to the reader's or antenna's front surface.

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Quick Installation Guide – LR-911 Long-Range Reader and Tags

If you are new to the LR-911 reader, or if this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100.

The LR-911 Reader is a long-range Radio Frequency Identification reader for AWID's UHF encoded vehicle-mounted tags. These instructions describe the Wiegand interface. For RS-232 serial interface, see AWID's Technical Reference.

Before you start the installation, download and study the complete LR-911 Installation & Operation Manual.

Preparation

- **Layout Plan**: Set up these ideal conditions for the installation site –
  - Locate reader 1 car length before the gate.
  - Restrict vehicles to a single lane, driving 5 miles per hour, moving in a straight line approaching the reader.
  - Mount reader on an adjustable bracket for aiming the reader.
  - Select reader location and height appropriate to the vehicle and tag types.
  - Have reader and tags facing each other at the reading distance, with their surfaces parallel to each other.
  - Decide on tag location in vehicles by testing before attaching. (See Installation Instructions for tags.)
  - Use LR-911HiLoMA reader set for turning lanes, or lanes with changing grade, or mixed small and large vehicles.
- **Installation Kit**: *Absolutely* required before starting installation. (See Instructions "LR-911KIT Installation Kit".)
- **Housing**: Mount the reader inside a plastic housing if the reader is mounted outdoors *and* is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example: The Housing Company, Model PCH196 (14 inches by 14 inches by 3 inches).
- **Power Supply**: A separate dedicated DC power supply for each LR-911 reader. Only the one reader connected to each reader. At 12-14 volt, current rating for a *linear* supply = 1.5 amperes or more; for a *switching* supply = 2.5 amperes or more. Keep a switching supply, including AWID's Part No. PS-12-3.3A, 8 feet or more from the reader.
- **Cable**: Overall-shielded, stranded wires, color-coded, *not* twisted-pair, high quality. For Wiegand interface, 500 feet long max. Power and data may be in 1 cable or separated. If combined in 1 cable, use 18 gauge, 5 conductors. If separated, use 18 gauge, 2 conductors for power, and 22 gauge, 3 conductors for data. All power, data and gate control cables at the site *must* be shielded.
- **Mounting**: An adjustable pan-and-tilt bracket (Pt.No. LR-MB-0-0) in most installations, to aim the reader at the tags for reading.

Pre-Installation Testing

1. Before installing at the site: These tests can be done on the bench at your shop, or in your van at the site – almost anywhere.
2. Part No. LR-911KIT: Use this Testing & Set-up Kit with the reader. No need to mount the reader or interface to the system.
3. Connections: Connect 3 negative (black) wires on reader, test unit and power supply, plus reader's yellow wire. Connect 2 orange wires on reader and test unit. Connect 3 power (red) wires on reader, test unit and power supply. See wiring, Figure 1.
4. Holding test tags: Press tag between fingertips as far from hand and body as possible. Have open space between tag and reader.
5. Procedure: When the test unit's LED is red, hold one of the Kit's test tags facing the reader by fingertips. Measure the maximum distance "R" where reads occur. At the tag's rated reading distance, measure the width "W" of the effective RF field.
6. Goal: At the reading distance, tags should read with default rate of about 3 reads per second. See Figure 2 for typical RF field.

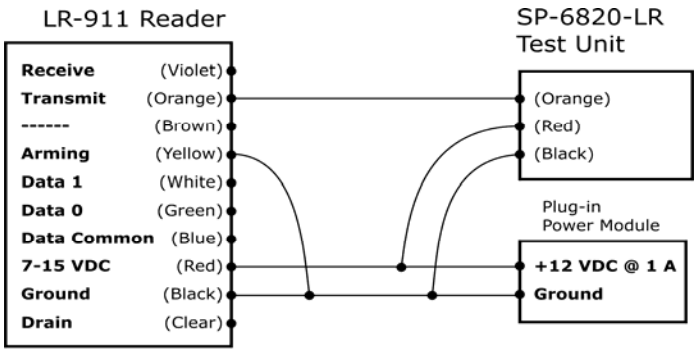


Figure 1. Connections for Pre-Installation Testing

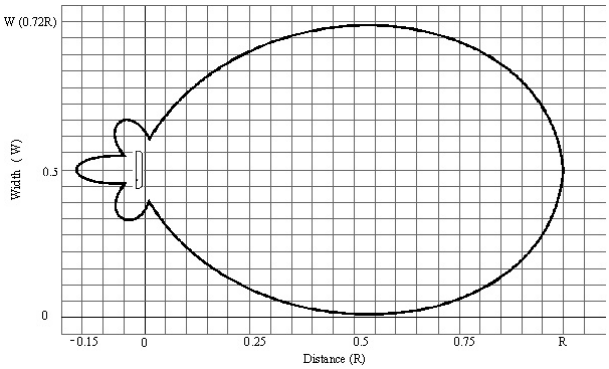


Figure 2. Effective RF Field for LR-911 Reader

Mounting the Reader

1. Fasten the mounting bracket to the pole, post, pedestal, wall or beam. Leave space for the reader's pan-and-tilt adjustment.
2. Install the plastic housing for protection of the LR-911 reader from rain, snow and sunlight, if required.
3. Fasten the LR-911 reader to the bracket or housing using two ¼"-20 screws. The LR-MB-0-0 bracket includes fasteners.
4. Clip off connectors from the reader's cable. Connect the wires to cable(s) that run to the panel and power supply. See Figure 3.
5. Aim the reader toward the location of tags on the vehicles, at their reading distance (typically 8 feet).

Wiring the Reader (for Wiegand Interface)

1. Check the power supply and cable(s) to be certain that they meet AWID's specifications (on page 1). Study Figure 3 carefully.
2. Connect the wires -- *yellow* to *black* at the reader; *black* and *red* to the power supply; *green* and *white* and *blue* to the panel.
3. Connect the reader's *drain* wire (bare silver) to the shields of **all** cables. **Do not ground** any of these wires – they all must float.
4. Keep the reader's *orange* wire available permanently for the LR-911KIT's test unit. Tape off *violet* and *brown* separately.
5. Do not seal or "wrap up" the junctions until the complete system has been tested thoroughly. Keep all junctions accessible.
6. Test the reader using the LR-911KIT Test & Set-up Kit. Be sure that hand-held test tags read on the test unit at rated distance.

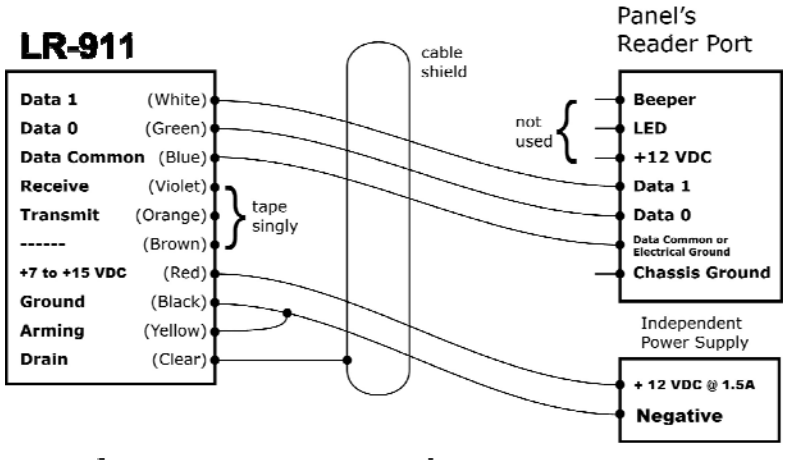


Figure 3. Wiring the Complete System

Attaching Tags

Select a location for the tags that has clear line-of-sight between the tags and the reader. Tags should be about parallel to the face of the reader at the reading distance (about 8 feet). Test tags in both "landscape" and "portrait" orientation for best performance.

WS-UHF Windshield Tag: Using the tag's adhesive, press the tag firmly inside the glass, at least 2 inches from edge of windshield.

MT-UHF Metal-Mount Tag: Fasten outside or inside the vehicle, using screws or rivets or the tag's adhesive. Tag must face reader.

See Installation Instructions, "Tags for LR-911 Long-Range Reader" and LR-911 Installation & Operation Manual, Section 6.

Programming the System

1. Complete the LR-911 reader's interface (Wiegand or RS-232) to the host access control or the vehicle identification system.
2. Program the applications system for the type of reader, and for the tags' code format, facility or site code, and tag ID numbers.
3. Assign suitable programming for the individual tags in the cardholders' database – gate groups, time zones, priority levels, etc.
4. Program the applications for the action to be taken for each valid read – gate motor operation, data recording, reports generation.

Testing the Completed System

1. Drive a vehicle with a mounted tag into the reading distance on the lane. Observe the code registered by the system for accuracy.
2. Test operation of all functions by driving a vehicle with an authorized tag code past the reader and through the gate repeatedly.
3. Study the PC monitor's data display for full and correct information about events on the system.
4. Enter command for a report on events in the system – for individual vehicles in a time period, and for history at a single gate.

If a Problem Occurs

1. Use the LR-911KIT Test & Set-up Kit to measure performance of the reader with hand-held test tags. Isolate the cause.
2. Study the LR-911 Manual, Part C – Trouble-Shooting. Interchange and substitute system components to identify the problem.
3. Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions visit … www.awid.com/support or call +**1-800-369-5533** (in the U.S.) or +**1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

Installation Sheet (Wiegand Interface)
LR-911-HiLo (MA) Reader Set (1-Reader, 1-Antenna)

Reader Description

The LR-911-HiLo (MA) Long-Range Reader Set contains one LR-911 "master reader" and one "remote antenna", in two identical ABS plastic housings. They connect to each other by an RF cable. The reader connects to the host system like a standard LR-911 reader. Special programming alternately arms the reader and the antenna so that they will not interfere with each other. Special instructions are included. The LRIN Installation Kit is required for installation and test. The LRMB mounting bracket is an available option.

Parts List

- LR-911 master reader, labeled "Master", with 30 inch cable and antenna cable port Qty=1
- LR-911 remote antenna, labeled "Antenna", with antenna cable port Qty=1
- Coaxial RF antenna cable, 6 feet long, with Type SMA-reversed connectors Qty=1

Installation Procedure

1. See AWID's complete LR-911 Instructions Part 1 for application planning, and LR-911 Instructions Part 2 for installation and test details.
2. Fasten the LR-911 "Master" reader to a mounting bracket or adjustable adapter. This may be at either the high reader position or the low position. Mount the reader housing *upside-down*, so that the coaxial connector is at the reader's bottom edge.
3. Fasten the LR-911 "Antenna" to a mounting bracket or adjustable adapter, typically about 4 feet from the "Master" reader. Mount the reader housing *upside-down*, so that the coaxial connector is at the reader's bottom edge.
4. Connect the RF cable between the reader and antenna, using the threaded Type SMA connectors.
5. After the Type SMA connectors on the coaxial cable are tightened at both housings, apply RTV sealant around the connectors as a weather seal.
6. Cut off all connectors from the master reader's cable. Keep the remaining pigtails as long as possible.
7. Use an independent DC power supply for the reader and antenna set. This power supply may be located at the panel or close to the reader set. At 12 volts, have current capacity of at least 1.5 ampere for the LR-911-HiLo set. See power supply specifications in Note 2, below.
8. Connect the master reader's **3** data wires to the controller panel of the host system. Connect the master reader's power and ground wires to the independent power supply. See Figure 1, Wiring Diagram, on page 2. See cable specifications in Note 4, on page 2.

Notes

1. ***Reader features:*** LR-911 readers contain no LED, Beeper, or Hold circuit. *Use the LRIN Kit* (Note 7).
2. ***Power:*** The LR-911 reader set requires an independent DC power supply.
   For a typical power supply → Nominal 12 volts (actual 12.0 to 13.8 volts) DC output; linear, regulated (*non-switching*); at least 1.5 amperes current capacity.
   If the power supply uses switching technology, current capacity must be at least 2.5 amperes. Do *not* power the LR-911-HiLo set by connecting the red and black wires to the panel's reader port.
3. ***Interface*** to host controller: The reader in the LR-911-HiLo (MA) reader set has both Wiegand-protocol and RS-232 interfaces. For Wiegand, the LR-911-HiLo reader set requires just *one* reader input port on the host panel. For RS-232, request information from AWID's Technical Support.

4. ***Housing****: Mount the reader and antenna inside a plastic housing if the reader is mounted outdoors* and *is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example: The Housing Company, Model PCH196 (14 inches by 14 inches by 3 inches).*

5. ***Cable:*** For all uses – Stranded wires, color-coded insulation, overall 100% shielded, high quality. For DC power to the reader set – 18 gauge wires, 2 conductors (black & red wires). For Wiegand data – Parallel wires (*not* twisted pairs), 22 gauge, 3 conductors (green, white & blue wires). For both power and data in the same cable – Use 18 gauge cable.

6. ***Wiring:*** The LR-911-HiLo reader set's Wiegand interface is compatible with every host system's Wiegand reader input port. *But the detailed wiring is different from a typical proximity reader.* Please follow the wiring in Figure 1 carefully.

7. ***Installation kit:*** Installers must use the LRIN Installation Kit for testing and aligning the reader set and for locating the tags. This kit includes a test unit, test tags, a 12 VDC power module, 2 test tags, etc.

8. Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions visit www.awid.com/support or call **1-800-369-5533** (in the U.S.) or +**1-408-825-1100** from 8:00 a.m. to 5:00 p.m. PST.

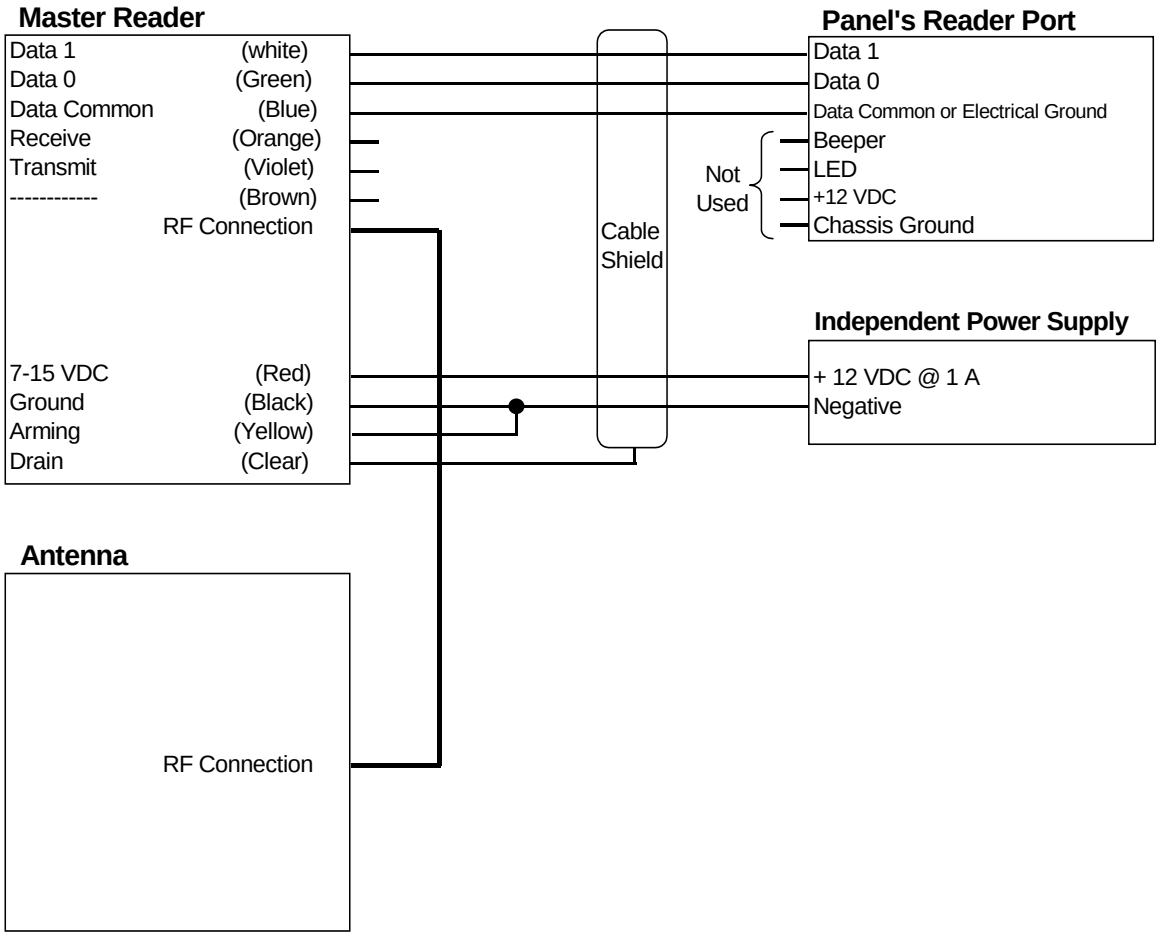


FIGURE 1. Wiring Diagram

Accessories

Vehicle sensor: If a ground loop is used to arm the reader set, the loop's relay must pull the reader's yellow wire to ground when the vehicle is present. The yellow wire must float when the vehicle has passed the ground loop. Omit the direct connection between the yellow wire and the black wire in Figure 1. Note: LR-911 readers transmit RF only when the yellow wire is grounded to the black wire.

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Quick Installation Guide – LR-911KIT Installation Kit

If you are new to the LR-911 reader, or this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100.

The LR-911KIT Installation Kit is **required** for planning, installing and testing the LR-911 reader and vehicle tags. Keep this Kit together, with this Guide, for quick access in your truck or at your shop. It is your prime tool for building confidence in performance of the LR-911 reader and its tags. The LR-911KIT is a first-time, one-time-only purchase.

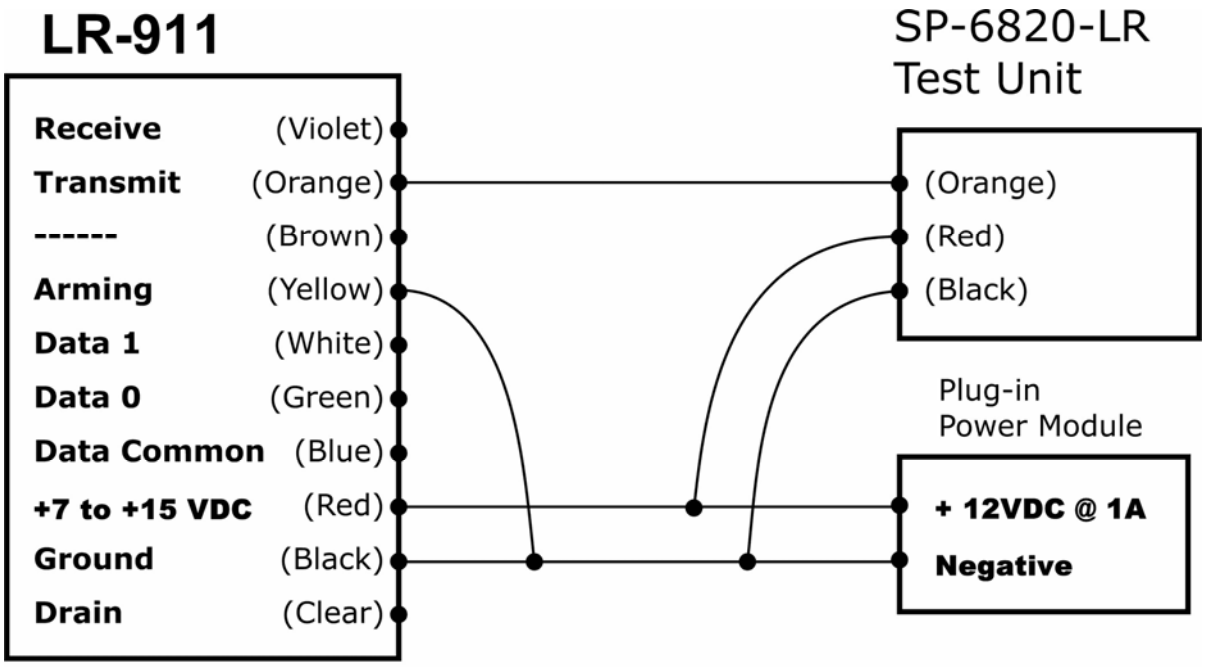
*Before you start the installation, download and study the complete **LR-911 Installation & Operation Manual**.*

Uses for the LR-911 Installation Kit

- Demonstrating the LR-911 to your sales prospects and customers.
- Testing the planned location, to assure uninterrupted operation of the long-range reader at the site.
- Observing the performance of an LR-911 reader, either in bench-testing or when installed at the site.
- Selecting the ideal location for mounting the vehicle tags inside the windshield or outside the vehicle.
- Proving that the vehicle tags operate well after they are mounted in or on the vehicle.
- Checking performance of an installed LR-911 reader in a service call, whether or not the reader is interfaced to the gate-control system.

Components of the Kit

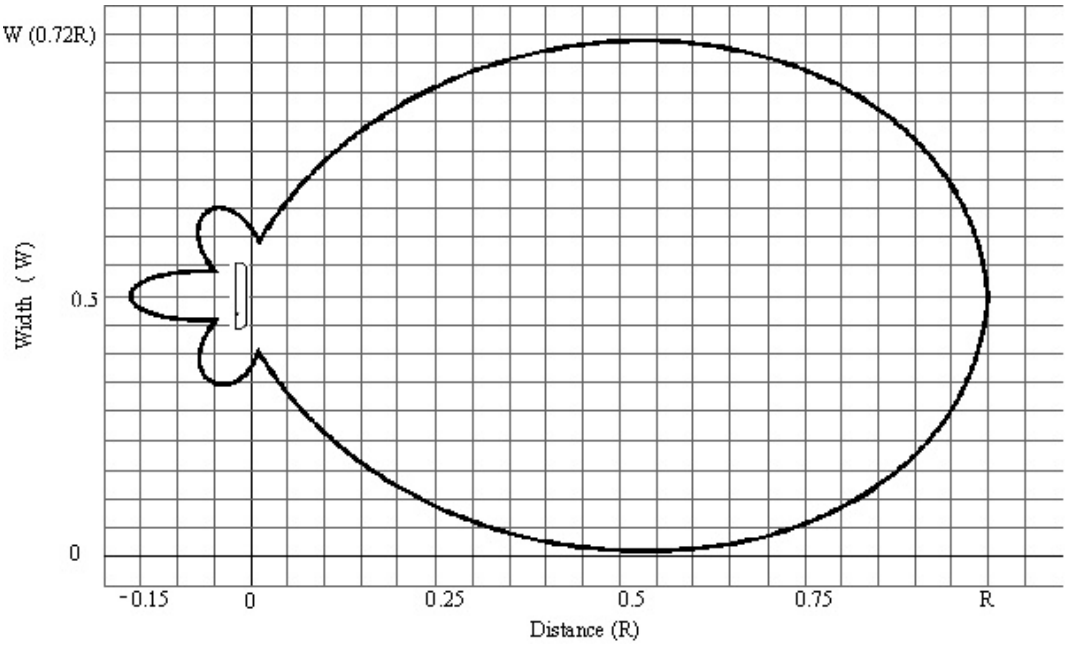
- **Test Unit** – This small unit (about 3 inches by 4-1/2 inches) alerts you to every read of the tag by the reader. It beeps and changes LED color with every read. It is your ears and eyes in demoing and testing an installation.
- **Adapter Cable** – It connects an LR-911 reader to a PC or controller, for output tests and software commands.
- **DC Power Supply** – It provides 12 volts DC for testing and demonstrating one LR-911 reader.
- **Credentials** – A set of tags for hand-testing – WS-1216 Windshield Tag mounted on a piece of windshield glass, and MT-1014 Metal-Mount Tag.



Connections to Test an LR-911 Reader

Use an LR-911 reader that is installed and interfaced to the access control system, or being tested before installation.

1. Clip the test unit's black lead, the power module's black clip, and the reader's black and yellow wires together.
2. Clip the test unit's orange lead to the LR-911 reader's orange wire.
3. Clip the test unit's red lead, the power module's red clip, and the LR-911 reader's red wire together.
4. Plug the power module into a 120 volts AC receptacle.



Measuring Performance

Test for these standard performance parameters:

(Note: Avoid holding the reader by hand. You will measure best read range when the reader and tags are away from your hands and body.)

- Hang the LR-911 reader so that it is in a clear area, at least 4 feet from the floor and walls.
- Starting close to the LR-911 reader, move the test tag back along an imaginary axis from the front of the reader. Search for the farthest point at which a read is indicated by the test unit – typically 10 feet to 12 feet for the hand-held tags. This determines the full range of the reader.
- Holding the tag at half of the maximum range, move the tag up and down, and side to side, to determine the height and width of the effective RF field. This is typically a 6 feet diameter of the field's circular cross-section.
- Hold the test tag at 8 feet in front of the reader. Move the tag around to measure the cross-section of the effective RF field. This is the "sweet spot" at which most vehicle tags will be read after the reader is installed.
- Attach a vehicle tag temporarily inside the vehicle at the proposed location. Hold the LR-911 reader in front of the tag, with the face of the reader parallel to the tag. Move the reader away from the tag to find the maximum reading distance. (When holding the reader for portable testing, keep your fingers far to the edge of the reader.)

To check the operation of the Kit's SP-6820-LR Test Unit:

1. Clip the Test Unit's 3 leads to the wires of any AWID proximity reader (except SR-2400). Connect black clip to black wire, orange clip to *violet* wire on the proximity reader, and red clip to red wire.
2. Present an AWID proximity card or tag to the proximity reader. Both the proximity reader and the test unit will beep simultaneously, and their LEDs will change color briefly. This indicates correct operation of both the reader and the test unit.

More Information

Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions, contact www.awid.com/support, or call +**1-800-369-5533** in the U.S. or +**1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

SENTINEL-PROX LR-911

LONG-RANGE TAG READER

Installation & Operation Manual



If you are new to the LR-911 reader, or if this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100

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COMPLIANCE

FCC: This equipment has been tested and found to be in compliance with the limits for FCC Part 15 digital device. 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 with radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's expense.

The users are prohibited from making any change or modification to this product. Any modification to this product shall void the user's authority to operate under FCC Part 15 regulations.

This device complies with Part 15 of the FCC Rules. 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 operation.

Industry Canada: Operation is subject to the following two conditions: (1) This device may not cause interference and (2) this device must accept any interference,
including interference that may cause undesired operation of the device.

CAUTION:

The reader should be positioned so that personnel in the area for prolonged periods may safely remain at least 20 cm (8 in) in an uncontrolled environment from the reader's surface. Observe FCC OET Bulletin 56, "Hazards of radio frequency and electromagnetic fields" and Bulletin 65, "Human exposure to radio frequency electromagnetic fields".

Table of Contents

1	INTRODUCTION	2
2	SPECIFICATIONS	3
PART A	**INSTALLATION**	**5**
3	PREPARING FOR INSTALLATION	5
4	TESTING READER AND TAGS BEFORE INSTALLATION	6
5	INSTALLING THE READER	7
6	INSTALLING THE TAGS	9
7	TESTING THE INSTALLED SYSTEM	10
8	INSTRUCTIONS FOR LR-911HILOMA READER SET	11
PART B	**PLANNING**	**12**
9	APPLICATIONS	12
10	PLANNING FACTORS	14
PART C	**REFERENCE**	**16**
11	TROUBLE-SHOOTING	16
12	GLOSSARY	20

NOTE: READ AND USE THIS MANUAL.

FAILURE TO FOLLOW THE PLANNING AND INSTALLATION GUIDE MAY RESULT IN POOR PERFORMANCE AND EVEN CAUSE PERMANENT DAMAGE TO THE READER. THIS WILL VOID THE PRODUCT WARRANTY.

REVISION HISTORY

Version No.	Revised By	Date	Sections Affected	Remarks
1	LHH	05 Sept. 2008	All	Initial version.
1.3	LHH	02 July 2009	All	General update. Added housing.

1 INTRODUCTION

1.1 GENERAL DESCRIPTION

AWID's Sentinel-Prox LR-911 Reader is a long-range (up to 11 feet) Radio Frequency Identification (RFID) reader that works with encoded credentials that may be adhered, fastened or held by hand inside or outside the vehicle. This reader comes with a unique combination of long read range, small size, and low power consumption. It has an internal power converter, allowing it to work with a wide range of supply inputs without affecting its performance. With a 12 volt DC supply, its current consumption is less than 1 ampere, making it suitable for a large selection of commercial power supplies. The LR-911 reader has simultaneous Wiegand and RS-232 outputs. Its primary applications are automated parking garage entrance control, hands-free access control, vehicle identification, asset tracking, and asset management applications.

1.2 SPECIAL FEATURES

- Single small housing for reader electronics, RF module and antenna – blends into the landscape.
- Easy to install using a pan-and-tilt adjustable mounting bracket – available from AWID.
- Compatible with all commercial access control systems.
- Can be interfaced to a PC or to a special application controller.
- Shares code formats with other encoded cards, badges and tags.
- Allows mixing RFID products for several applications into an integrated system.
- Operates at low power level.
- Uses frequency-hopping technology in the 902-928 MHz band (standard).
- Passive tags assure small size, unlimited life, and easy mounting out of the driver's vision.
- Users do not need an FCC license.

1.3 SUGGESTED APPLICATIONS

- Automated vehicle identification for passenger cars, small trucks, big trucks and trailers, and railcars.
- Operation of vehicle gates and garage doors for authorized vehicles.
- Tracking material assets in containers and on pallets.
- Hands-free operation of doors and elevator call buttons for handicapped users (wheelchairs, gurneys) in ADA situations.
- Data collection using encoded tags for input.

2 SPECIFICATIONS

2.1 LR-911 READER

Input voltage:	Between +7 volts DC and +15 volts DC	
Input current (peak):	At 7 volts DC	1.5 amperes
	At 12 volts	900 milliamperes
	At 15 volts	700 milliamperes
Read range (maximum):	With WS and MT tags	Entire distance between reader and 11-12 feet
Frequency:	Transmitter	902 MHz to 928 MHz
	Receiver	902 MHz to 928 MHz
Frequency-hopping channels:	Number of channels	50 channels (U.S.A. standard)
	Channel spacing	500 kHz
	Hopping sequence	Pseudo-random pattern of channels
Output data interfaces:	Wiegand electrical protocol, and RS-232 serial (simultaneous transmission)	
Reader housing:	Molded ABS plastic, on 1/8 inch aluminum back-plate; beige color	
Environment:	Temperature for 100% duty cycle	-31 to 113 F (-35 to 45 C)
	Temperature for 50% duty cycle	-31 to 150 F (-35 to 65 C)
	Operating humidity	0% to 95%, non-condensing
	Protection from weather	Gasket at edge of cover; grommet at cable entrance (Use shield or housing when required – Section 2.5.)

2.2 CABLE EXITING FROM LR-911 READER

The cable that is integrated into the LR-911 is 22 gauge, 10 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, 32 inches long. (The connectors on the reader's cable, when shipped, have no practical use. The installer removes these connectors and strips the insulation.)

Color assignment:

Red	DC power, positive	---
Orange	RS-232 interface, Transmit Data	Connect to controller's Receive Data.
Yellow	Enable RF transmission	Connect to reader's black wire for arming.
Green	Wiegand interface, Data-0	---
Blue	Data-Common	For either Wiegand or RS-232 interface. Do not tie to black wire.
Violet	RS-232 interface, Receive Data	Connect to controller's Transmit Data.
Brown	(not used)	---
Black	DC power, negative	Do not ground.
White	Wiegand interface, Data-1	---
(No insulation)	Drain wire	Connect to shields of extended cables. Do not ground.

2.3 EXTENDED CABLE FROM READER TO PANEL AND POWER SUPPLY

The LR-911 reader requires cables with particular specifications. If the installation will use separate cables from the reader to the power supply, and from the reader to the reader-input panel, use these specifications –

Power cable: 18 gauge, 2 conductors, stranded wire, color-coded insulation, overall 100% shielded, high quality.

Data cable: 22 gauge, 3 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

If power and data share the same cable, use these specifications –

Combined cable: 18 gauge, 5 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

The maximum allowable length of cable for **Wiegand** interface is 500 feet. The maximum specified length of the cable for **RS-232** interface at 9,600 bits per second is 75 ft; this may be stretched for certain equipment to 500 ft or more using Cat 5 cable. Length of a separate **power** cable should not exceed 500 ft.

Unlike proximity readers, the LR-911 reader uses 2 separate wires for Power Negative (black) and for Data-Common (blue). These wires must not be connected to ground, nor to each other, nor to any other circuit.

2.4 POWER SUPPLY

- The LR-911 reader requires a separate, dedicated DC power supply for each reader. Do *not* connect the reader's power wires (red and black) to the panel's + DC Power and Ground terminals. Connect only the reader to its power supply.
- For multiple readers, you may use a multi-section DC supply if the sections are isolated electrically from each other, if each section has its own positive and negative terminals, and if each section has sufficient current rating for the LR-911 reader.
- The ideal power supply has current rating of about 1.5 times the current drawn by the LR-911 reader. This helps to assure that the direct current remains quiet and steady. (See the table, below.)
- The most common DC power supply has a nominal output voltage range of 12.0 volts to 13.8 volts (including power supplies for charging a back-up battery). To power a single LR-911 reader, this power supply must have a current rating of 1.5 amperes or more.
- The PS-12-1A plug-in power module in AWID's LR-911KIT Test & Set-up Kit is suitable for temporary testing use only. Install AWID's PS-12-3.3A module or other switching-type power supply at least 8 feet away from the LR-911 reader.
- Certain commercial power supplies require excess current rating to assure quiet DC output, for example, 2.5 amperes at nominal 12 volts for a single reader. Contact AWID's Technical Support for discussion of acceptable power supplies.

Voltage Applied to Reader	Current Load of Reader (maximum)	Current Rating of Power Supply (minimum)
7 volts DC	1.5 amperes	2.25 amperes
12 volts DC	900 milliamperes	1.5 amperes
15 volts DC	700 milliamperes	1.2 amperes

2.5 PROTECTIVE HOUSING

The LR-911 reader should be mounted inside a protective, non-metal housing for certain characteristics of the installation site – if the reader is mounted outdoors, and if it is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example of a suitable housing: The Housing Company, Model PCH196 (Lexan, hinged and locked door, 14 inches by 14 inches by 3 inches).

2.6 READER'S EFFECTIVE RF FIELD

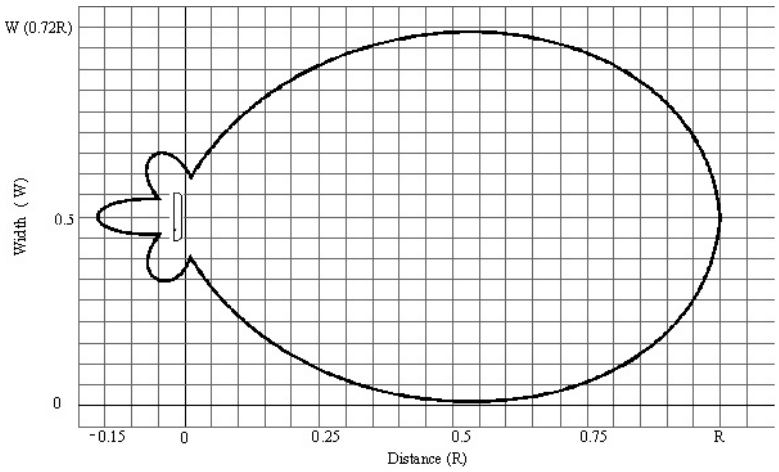


Figure 1. Effective RF field for tags with LR-911 reader.

- The effective RF field is a figure of rotation of this diagram about its horizontal axis. Polarity of transmitted RF is circular.
- "R" is the read range (maximum distance) for each AWID WS and MT tag. The typical reading distance of 8 feet is less than R. The field's diameter "W" is about 4 feet to 5 feet at the reading distance.

PART A INSTALLATION

3 PREPARING FOR INSTALLATION

3.1 STUDY THE APPLICATION

- Determine what your client wants. Discuss the requirements with AWID's Technical Support.
- Visit the site; take photographs; draw diagrams; compare with similar installations. Look for unusual features.
- Study the Planning sections in this Manual to be sure that all factors have been considered. (See Part B.)
- Prepare a list of products and materials. Ask AWID's Technical Support for ideas and review.

3.2 GUIDELINES FOR THE INSTALLATION

1. Plan about *one car length* between the reader and the gate, where possible. This allows the vehicle to continue moving slowly as the tag is read and as the gate opens.
2. Select a reader location where the vehicle can move in a *straight line* for about one vehicle length as the tag is read.
3. Use an *adjustable mount* or bracket for pan and tilt-down aiming of the reader at the "sweet spot" where most of the tags will be located in and on the vehicles.
4. Select a *reader height* that is appropriate for the location of tags in and on the vehicles. See Section 9 for the popular combinations of reader mounting and vehicle types.
5. Locate the reader and tags so that they are facing and *parallel* to each other when the tags are in the "sweet spot".
6. Experiment with *tag location* in the vehicles. Move a tag to different locations, and try both orientations ("portrait" and "landscape"). Press the WS windshield tag against the windshield using a block of plastic foam. Use tape to hold the MT tag
7. Restrict the vehicles to a lane that is a *single vehicle width*. Use painted lane markings, cones, bollards or barriers to assure that vehicles stay close to the reader.
8. Instruct drivers to move at about *5 miles per hour* as the tag is being read. Use signs and speed bumps at the "sweet spot".
9. Watch for applications that suggest use of the *LR-911HiLo* reader sets. See Sections 9.5 & 9.6 for discussion of these cases.

3.3 WIRING – GOOD PRACTICES

- Use only *shielded cable* for all readers, and for power, and for door locks or gate operator control. Unlike proximity readers, do *not* ground the LR-911 reader's cable shields.
- Use a *separate cable* for each reader. Do not share the reader's cable with wires that carry switched power, like door locks, or power to electrically noisy devices. (But data, TTL control, and dry-contact circuits may share the LR-911's cable.)
- Do not connect the wires for two LR-911 readers *in parallel*. Neither power nor data lines should be in parallel. (Parallel connection changes the pulse transmission characteristics, and prevents the host system from identifying the reader addresses individually.)
- Connect the reader's negative power wire (black) *first*, and positive power wire (red) *last*. Disconnect in the opposite order.
- *Remove power* from the reader before making any wiring changes.
- The Wiegand Data-0 and Data-1 lines should not share a *twisted pair* in the cable from the reader to the controller. If it is necessary to use twisted-pair cable, separate the data lines into two different pairs. For example, combine Negative Power (black) with Data-0 (green) in one twisted pair; and combine Positive Power (red) with Data-1 (white) in a second twisted pair. This minimizes cross-talk of Wiegand data pulses from one data line to the other.
- The LR-911 reader has *no LED*. The lens in the corner of the reader's cover is a dummy. Use the LR-911KIT instead.
- The LR-911 reader has 3 separate wires that serve as negative or common conductors – *black* for Power Negative, *blue* for Data-Common, and *bare silver* wire for cable shield Drain. These 3 wires must not be tied together anywhere in the system, and they must not be connected to ground anywhere.
- The LR-911 reader has wiring that is different from any proximity reader, or any other technology. You must follow the *wiring diagrams* and the *instructions* in this Manual to have the reader function correctly.
- Unused wires from the reader's cable must be taped or capped *separately*, so that they touch nothing.

4 TESTING READER AND TAGS BEFORE INSTALLATION

4.1 INTRODUCTION

Careful preparation is important for successful installation of AWID's long-range readers and tags. Simple bench-testing gives the installer confidence in the performance of the reader and the tags, before the products are taken to the site. This testing isolates the reader and tags from all other factors that contribute to performance of the final assembly.

4.2 ITEMS FOR BENCH TESTING

AWID's long-range reader and tags are tested easily using only the items listed below. It is not necessary to interface the reader to a controller panel or reader-input module while conducting this test.

- LR-911 reader (It does **not** contain an LED.)
- GMWS and MT tags (26-bit code) *
- SP-6820-LR test unit, cable with 3 clips *
- PS-12-1A power module, cable with 2 clips *
- Wiring diagram, Figure 2 (below)

* *A component of the LR-911KIT Test & Set-up Kit*

4.3 SUPPORTING THE READER

The reader's effective RF field, in which the long-range tags can be detected, is maximized when there is no material in front of the reader or immediately to the sides of the reader. See the LR-911 Effective RF Field diagram (Figure 1 on page 4).

- Cut off the connector from the LR-911 reader's cable. Prepare the pigtails for the planned installation. Keep the unused wires separated from each other.
- Hang the reader on a clear vertical surface in an open space, about 4 feet above the bench top, 4 feet from a side wall, and 4 feet below the ceiling.

4.4 WIRING FOR QUICK TEST

- Connect the wires as shown in the wiring diagram, Figure 2 (below).
- Be sure that unused wires are touching nothing. Do not cut off unused wires yet.
- The *first* connection made is the reader's black (negative power) wire. The *last* step is to plug in the DC power module.

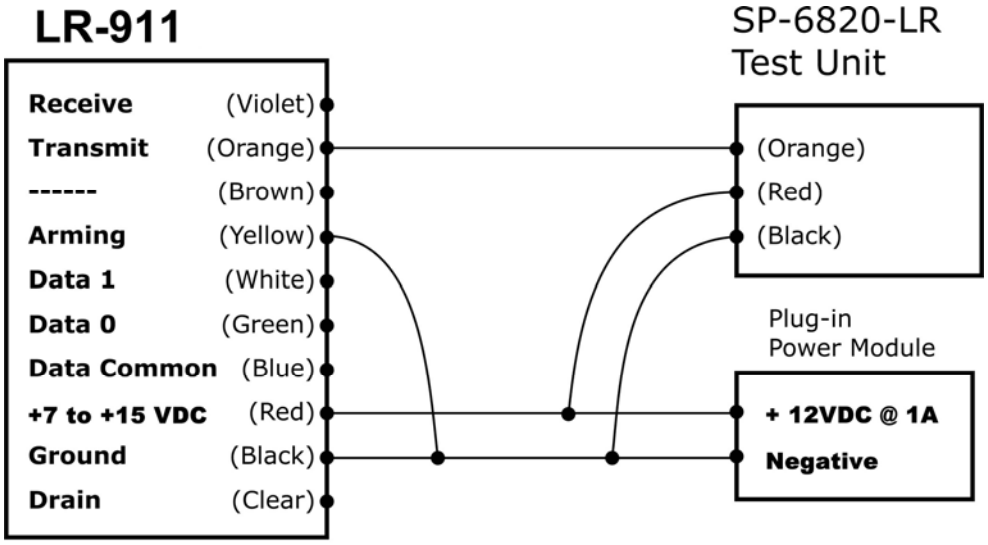


Figure 2. Wiring for quick test.

4.5 HOLDING THE TAG

- Hold the test tag by the fingertips, with the hand behind the tag. Hold the tag at arm's length, to the side of your body. Or …
- Attach the test tag to a non-metal stick. Stand to the side of the reader's RF field, and extend the tag into the reader's field.
- Hold the tag so that the face of the tag is approximately parallel with the reader's face. (The reader is circular-polarized, so the tags may be held at any angle – up-and-down, or side-to-side, or diagonal.)
- Move the tag slowly though the effective RF field in front of the reader. Observe the edges of the zone and the point of maximum read range. The widest part of the zone is at about half of the maximum range.

4.6 TEST RESULTS

- Proper operation of the reader and tag is indicated by a signal from the SP-6820-LR test unit each time that the tag is read. The LED changes briefly from Standby red to green, and a short beep (4 kHz tone) is heard. If the tag remains in the reader's effective RF field, reads repeat at about 3 per second (factory default rate).
- By moving the test tag in the space in front of the LR-911 reader, the tester can map the extent of the effective RF field that is plotted in Figure 1. The read range should extend from the reader's face to a maximum of about 11 feet with the test tags. The maximum diameter of the field's cross-section, at half of the maximum range, should be about 5 feet to 6 feet.

5 INSTALLING THE READER

5.1 INTRODUCTION

Before installing the long-range readers and tags, the rest of the application system is usually in place and tested. The system components for each entrance are commonly –

- Computer with the application program (may be shared)
- Controller panel and reader-input module
- Gate or door operator (control and motor)
- Status switch for gate or door
- Request-to-exit switch or sensor
- Safety loop detector beyond the gate or door
- Buried loop to detect approaching vehicles
- Independent power source (*not* from the panel)
- Cables in conduit

These installation instructions are for the LR-911 reader's Wiegand interface, using Data-0 and Data-1 wires (like most readers in access control). ***Note:*** *LR-911 wiring is not the same as a 125 kHz proximity reader. Follow the instructions in Section 5.3.* If a serial interface using RS-232 protocol will be used, please download AWID's Technical Reference on RS-232 Reader Interface.

Collect these items to install the readers and tags at the site –

- LR-911 readers
- Mounting brackets and housings for readers
- Power supplies, cables, and other material
- Long-range tags (WS and MT)
- LR-911KIT Test & Set-up Kit
- "LR-911 Installation & Operation Manual"

For additional information, please visit AWID's Web site www.awid.com. For technical support questions, visit www.awid.com/support, or call **1-800-369-5533** (in the U.S.) or **+1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

5.2 INSTALLING THE LR-911 READER

1. Before starting installation at the site, *plan* the project. Study Sections 9 and 10 of this Manual.
2. Keep the reader assembled. Do *not* remove the aluminum plate behind the reader. Do *not* remove the plastic cover of the reader. Do *not* tighten or loosen the screws through the cover. This preserves your Warranty.
3. Attach the LR-MB mounting bracket to the reader's metal plate using 2 screws (1/4"-20, supplied).
4. To use a different mounting device, make an adapter plate or bracket that lets you fasten your mounting device to the two capture nuts at the center of the reader's aluminum plate (1/4"-20 thread). Do *not* drill holes through the aluminum plate. In most applications the mounting device must allow pan-and-tilt adjustment for the reader.
5. Inspect the installation space. The reader may be mounted on any material including metal, but there must be open space in front of the reader and to its sides. There must be no material interfering with the reader's effective RF field between the reader and the tags' location.
6. Measure the mounting height. It must relate to the location of the tags when they are read at the "sweet spot". For passenger vehicles it is typically at a height of 7 feet, to the side of the vehicle lane.
7. Be aware of the environment. Stay away from UHF communications devices. Avoid fluorescent and other arc lighting fixtures by 3 or 4 feet. Aim neighboring readers so that their effective RF fields do not overlap. Mount readers for parallel lanes at least 12 feet apart, with their effective RF fields parallel to each other. Do not have LR-911 readers facing each other (but "back-to-back" is OK). If reader is outdoors, mount it inside a plastic housing to protect it from direct sunlight and rain.
8. Test the site for electronic devices that may interfere with the LR-911 reader. If interference is suspected, remove power from the other device while observing the LR-911 reader's performance.
9. Fasten the reader's adjustable bracket or housing to the pole, post, pedestal, wall, beam or ceiling.
10. Aim the reader at the location of the tags in the vehicle, when the tags are at their reading distance from the reader. This "sweet spot" distance is typically about 8 feet direct measurement between the tags and the reader. When the tags are at this "sweet spot", the reader and the tags should be facing each other, and about *parallel* to each other.

5.3 WIRING THE READER (FOR WIEGAND INTERFACE -- Figure 3)

1. The cable between the LR-911 reader and the controller panel should be (see complete specifications in Section 2.3) –
   - 5 conductors for data & power
   - 18 gauge for 2 power wires; 22 gauge for 3 Wiegand data wires
   - Stranded wire
   - "Bunched" (not twisted-pair) *
   - Color-coded insulation
   - Overall 100% shielded
   - High quality
   - Maximum length – 500 feet

   * *If the cable* is *twisted pair, combine negative (black wire) with one data line (green or white wire) in one twisted pair, and combine DC power (red wire) with the other data line in a second twisted pair. This reduces crosstalk on the data lines.*
2. From reader to power supply – **Black** wire for DC negative (first connection), and **red** wire for DC positive (last connection). Each reader's power supply must be a separate supply (see specifications in Section 2.4) that is connected to nothing else.
3. Arming circuit – For continuous RF from the reader, connect its **yellow** wire to the black wire at the reader permanently. For control of the reader's RF transmission by a vehicle sensor, connect the yellow wire to the relay contacts of the vehicle sensor. To disarm the reader (no RF transmission from the reader), let its yellow wire float.
4. From reader to panel's reader input port – **Green** wire to Data-0, **white** wire to Data-1, and **blue** wire to Data-Common. For Data-Common, use a terminal with this name if available. If not, use this reader port's "Common" or "Ground" terminal.
5. Drains for shields – Tie the reader's **uninsulated** wire to the shields of the power and data cables. **Do not ground the drain**.
6. Grounds – Connect the panel's ground to earth-ground only if instructed by the panel's manufacturer. The LR-911 reader and its power supply have **no ground connection**. Do not connect black, blue and drain wires together.
7. Unused wires – Keep the reader's **orange** wire available permanently to connect the LR-911KIT's test unit during set-up and tests. Wrap or cap the **violet** and **brown** wires separately.
8. Testing – While the cable terminations and junctions are still accessible, test the system for full function and performance. Then seal the terminations.

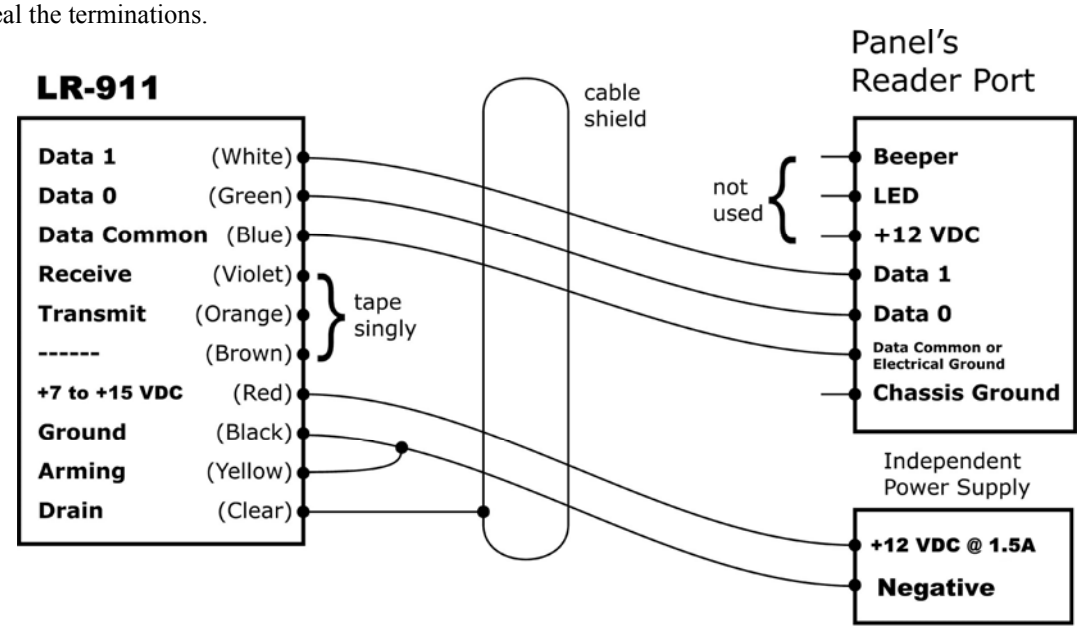


Figure 3. Wiring for LR-911 installation.

5.4 AIMING THE READER

This step should be taken before the tags are installed in or on the vehicles. From the LR-911KIT Test & Set-up Kit, use the test unit, and one of the hand-held test tags, and the wiring diagram in Figure 2 on page 6. The reader does not have to be interfaced with the host system (but they *may* be connected together). Use the DC power module from the LR-911KIT Test & Set-up Kit *only* if the independent DC power supply is not yet connected.

1. With no vehicle present, hold the hand-held test tag approximately where the vehicles' tags will be located when they are read. This is typically at about 8 feet from the reader.
2. With the test tag held at this "sweet spot", adjust the pan and tilt angles of the reader until the test unit indicates most robust reading. (Occasional reads will be missed normally because of the frequency-hopping feature of the LR-911 reader.)
3. Map the outer limits of the reader's effective RF field by moving the tag slowly up-and-down and side-to-side through the field, and along the axis from the reader's face to the point of maximum range.

6 INSTALLING THE TAGS

6.1 GENERAL RULES

1. The relationship between the *reader's* location and aiming, and the location of the *tags* inside or outside the vehicle, is important for good performance. Plan the installation considering these factors before installation starts.
2. Start by testing the LR-911 reader using the LR-911KIT's test unit and the hand-held test tags, with no vehicle present at the reader. When good read range has been proved, proceed to mounting the tags in or on the vehicles.
3. The "*sweet spot*" for reading a tag in or on the vehicle is typically 8 feet, measured between the face of the reader and the location of the tag. Note: The sweet spot is shorter than the tag's rated "*read range*", which is the total distance between the reader and the farthest point at which a hand-held tag can be detected.
4. At the sweet spot, the tag should *face the reader*, with clear *line of sight* (through the windshield is OK) to the reader, and with the tag and the reader about *parallel to each other*. Aim the reader at the sweet spot.
5. Orientation of a tag may be "portrait" or "landscape" or diagonal. Reading will be most active when the *long* edge of the tag is closest to the reader as the tag first enters the reader's effective RF field.
6. Keep your hand and your body away from the tags, to avoid blocking or reducing the tag's RF field.
7. Before attaching WS tags to the windshield, clean the windshield near the tag, inside and outside.
8. To attach tags to side windows, select a window that does not lower into the door frame. Align tags with a reader at the side.
9. If necessary, turn off RF sources on the vehicle, such as pre-collision warning sensors and UHF communications gear.
10. Prevent buildup of snow over the tags. Use windshield wipers to remove water from the windshield. Near the ocean, wash the windshield near the tag to remove salt coating.
11. Prepare instructions for the users' staff member who will oversee tag installation. Copy the suggestions in the sub-sections below for the appropriate tag, and copy the sub-section in Section 9 – Applications that matches this installation.

6.2 WS-1216-0-0 WINDSHIELD TAG

1. Mount the reader so that it faces the location of all windshield tags at the "sweet spot". For passenger cars the reader is typically at the side of the vehicle lane, close to the vehicles' path, 7 feet above ground level.
2. Leave the large paper label in place on the tag, to protect the tag's adhesive.
3. Use a hand-sized block of plastic foam (flexible but firm), about 2 inches thick. Press the large paper label of the WS tag flat against the inside of the windshield. Keep your hand away from the tag.
4. Move the tag to different locations inside the windshield, where the tag faces the reader. Test the reader's performance with the tag high and low on the windshield, several inches from the vehicle's door pillar, in "portrait" and "landscape" orientation.
5. Avoid items that may block the tags' transmission – embedded wires, metal coating, dark tinting, RF emitting devices.
6. When you identify a good tag location, peel the large paper label off the tag. Press the tag's adhesive flat against the inside of the windshield. This is a one-time application. The tag will not work after it is pulled from its original position.
7. *Do not* carry the WS tag in a pouch or wallet, or attach it using tape, or hold it by hand, or place it on the dashboard. *Do not* adhere the tag to anything except windshield glass. *Do not* attempt to move the tag from one vehicle to another.
8. In a small percentage of cars, metal in or on the windshield reduces the read range. If so, use the MT-1014 metal-mount tag.

6.3 MT-1014-0-0 METAL-MOUNT TAG

1. Inside the vehicle –

   Locate the MT tag, at the sweet spot, on a flat surface where it is in line of sight through the windshield with the reader. The "AWID" logo must face the reader. Suitable locations are the dashboard (away from the windshield), or the sun visor facing the reader when the visor is turned down, or the inside rearview mirror's frame facing the windshield, or inside the windshield if the tag is spaced away from the glass by ½ inch or more.

   Attach the MT tag to the surface temporarily using a Velcro dot behind the tag, or tape over the screw holes. The MT tag may be hand-held by squeezing it between the thumb and forefinger, like a baton, at the end of the tag (over the screw hole). Keep your hand behind the tag. Hold the tag away from the body. The tag may be attached to any material or held in air.

   The MT tag may be moved between different vehicles if the attachment is temporary, like Velcro or tape. The MT tag may be stored in the glove compartment when not being used.

2. Outside the vehicle –

   Locate the MT tag, at the sweet spot, on a flat surface where it is in line of sight with the reader. The "AWID" logo must face the reader. Suitable locations are the top of the front bumper, the radiator grill, the edge of the hood, the edge of the windshield, the front door pillar, the roof rack, and others. On trucks and buses, the MT tag may be on a fender or side door, facing a side-mounted reader. Mounting a tag on the front license plate *may not* work; test first for suitable read range.

   Attach the tag using the tag's own adhesive under its peelable label, or by sealant around the edges, or by wire ties, or by non-metal screws or pop-rivets through the tag's screw holes.

3. Finishing the installation –

   Test the MT tag's performance before attaching it permanently. Protect the adhesive (if used) by running a small bead of sealant around the edge of the tag. Insert the screw-hole plugs over screw heads for good appearance and security.

7 TESTING THE INSTALLED SYSTEM

7.1 INTRODUCTION

Install the system's components, and apply power to all components. The LR-911 reader and the tags may be tested in several ways that look at isolated parts of the system, and at the integrated system. This helps to assure that the complete system is functioning normally, and to identify a problem area, if any. (See Section 11 – Trouble-Shooting for solutions to particular problems.)

7.2 TESTING AWID'S PRODUCTS (ISOLATED)

At any time the LR-911 reader may be disconnected from the other components of the system, and the performance of the reader and the tags tested by themselves.

1. Disconnect the power supply cable and the data cable from the reader. Break these circuits at the reader, not at the power supply or at the controller panel, so that problems with the cables and junctions can be detected also.
2. Use the LR-911KIT Test & Set-up Kit at the LR-911 reader. Follow the instructions in Section 4, but keep the reader installed and the tags mounted normally.
3. If the test unit indicates normal reader performance using the hand-held test tag, continue testing using the tags that are mounted in the vehicles.
4. If the reader is not operating, contact your source of the AWID products for a Return Material Authorization (RMA).
5. When the LR-911KIT indicates normal operation of the reader and tags, connect other components of the application system one-by-one, watching for recurrence of the problem. Continue to use the LR-911KIT as an indicator for the LR-911 reader while the system is reconnected.

7.3 TESTING OUTPUT OF THE LR-911 READER

The LR-911 reader has two data outputs – Wiegand and RS-232. Wiegand is commonly used for access control systems including automated vehicle identification. RS-232 is suited for commercial systems like truck scales and supply chain management. There are simple techniques that show the condition of the reader's data interfaces

1. To test the reader's **Wiegand** output:
   - Interface the reader's 3 Wiegand data lines to this system's controller, *or*
   - Interface the reader's 3 Wiegand data lines to a different access control system that works normally with other readers and tags, *or*
   - Connect a test, display or enrollment device, such as Cypress Computer Systems' WDG-5912 Keyboard Data Wedge, *or*
   - Use a dual-trace oscilloscope suitable for AWID's data output (100 microseconds pulse width, 2,000 microseconds interpulse spacing). Connect the oscilloscope's leads for Data-0 (green and black wires), and for Data-1 (white and black wires).

2. To test the reader's **RS-232** output:

   - Interface the reader's 3 RS-232 data lines to the system's controller, *or*
   - Interface the reader's 3 RS-232 data lines to a different commercial system that works normally with other readers and tags, or with other RS-232 output devices, *or*
   - Clip the test unit from AWID's LR-911KIT Test & Set-up Kit to the LR-911 reader, *or*
   - Interface the reader's 3 RS-232 data lines to the serial port of a PC, and run the Windows HyperTerminal program *, *or*
   - Connect the leads for a single-trace oscilloscope suitable for AWID's data output (9,600 bits per second) between the reader's Transmit Data and Data Common (Ground) wires.

     * In Microsoft Windows, the path is: Start → Programs → Accessories → Communications → HyperTerminal → Hypertrm.exe. Configuration is 9,600 bits per second, 1 start bit, 8 data bits, 1 stop bit, no parity, ANSI emulation, flow control = any. To open the port and start HyperTerminal, click on the Call tab at the top of the window, and select the option "Start Call".

7.4 TESTING AN APPLICATION SYSTEM

When the LR-911 reader is interfaced to the reader input port of the application system, the format of displayed data depends upon the programming of the system. In a typical access control or automated vehicle identification system, the program allows selection of a code format that replicates the Wiegand-style encoding that AWID has programmed into the tags. Therefore the system's monitor may display the code data in the same data fields, and the same number system (decimal), that AWID uses for its encoding. Testing may be as simple as reading the decimal values of the tag's data fields on the monitor.

If the system's monitor indicates that data are received from the reader but not recognized by the host ("Code format error", "Facility code error", "Parity error", etc.) –

- Check the host's programming.
- Check the reader's output.
- Check the wiring between the reader and the controller.
- Check the tag's code on a different reader or on a different system.

If the system's monitor indicates no data input from the reader –

- Test the LR-911 reader and the tag by interfacing to a different controller that is known to work normally.
- Test the system by connecting the LR-911 reader directly to the controller's reader port, bypassing the cable and junctions.
- Test the system's input by substituting a different reader and a compatible card or tag.

8 INSTRUCTIONS FOR LR-911HiLoMA READER SET

AWID's **LR-911HiLoMA** is a set of two units that work together at a reader location. One unit is a Master Reader that controls the alternation of RF transmission between the two units. The second unit is a Remote Antenna, in an identical housing. The two units are interconnected by a coaxial cable. Instructions for installing the LR-911HiLoMA reader set can be downloaded from the public documents in AWID's Web site, www.awid.com/support.

- Position: The master reader and the remote antenna may be in either position at the site. The deciding factor may be the position of the master reader that results in the easiest or shortest cabling.
- Protection: If you mount the reader units upside-down, the coaxial connectors will have added protection from rain and snow.
- Separation: AWID supplies a 6 foot long coaxial cable to connect the remote antenna to the master reader. When installed on brackets, the practical maximum separation between the master reader and the remote antenna is about 4 feet. Do not attempt to substitute a longer cable, because electrical loss in the cable will reduce the remote reader's read range.
- Accessories: All accessories for the LR-911 reader apply also to the LR-911HiLoMA reader set. Use the same LR-911KIT.
- Reference Documents: o LR-911HiLoMA Installation Sheet. o Technical Reference issues for description, applications, etc.

PART B PLANNING

9 APPLICATIONS

9.1 INTRODUCTION

The **LR-911** reader is especially designed for Automated Vehicle Identification (AVI). The common variables that must be considered in planning the readers and tags for the system are –

- Lane characteristics
- Vehicle types
- Reader location
- Tag characteristics
- Environmental conditions

The most important factors in planning a system are listed in Section 3.2. These must be considered carefully when laying out the plan for the installation.

The following paragraphs describe particular applications and recommend reader location and tag type for each application.

9.2 SMALL VEHICLES ONLY

If the reader is *beside the lane*, mount the reader as close to the edge of the lane as possible without risking damage to the reader. Choose the left side of the lane when possible, because this side is easier for the driver (in right-lane-driving countries) to judge the vehicle's location relative to the left edge of the lane. Mount the reader on an adjustable bracket at a height of about 7 feet (for small cars, 6 feet may suffice). Attach a tag on the same side of the vehicle as the reader. Aim the reader at the tags when they are at the "sweet spot" – about 8 feet direct measurement from reader to tag as the vehicle approaches the reader. See Figure 4.

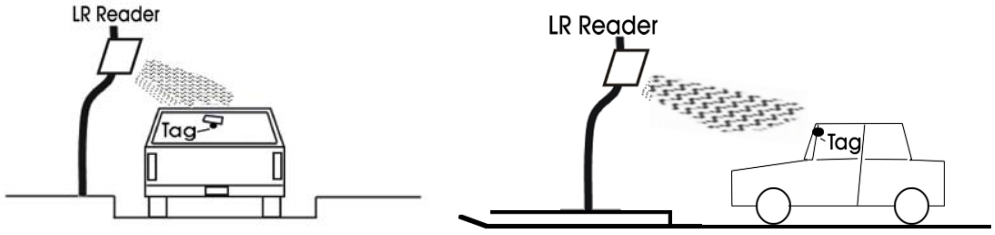


Figure 4. Passenger vehicles -- reader beside lane.

If the reader is *centered above the lane*, as inside a parking structure, mount the reader on an adjustable bracket at the lowest height that assures safe clearance between the reader and the highest vehicle. Attach the WS tag at the upper center of the windshield, behind the inside rearview mirror, several inches below the top of the windshield. Or locate the MT tag at the center of the vehicle facing the reader. Aim the reader at the tags when they are at the "sweet spot". See Figure 5.

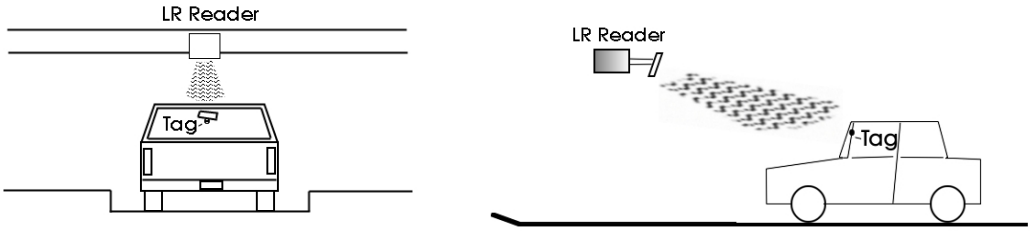


Figure 5. Passenger vehicles -- reader above lane.

9.3 MIXED PASSENGER CARS, PICKUPS, VANS AND SUVs

This application is a variation of Section 9.2. The reader *beside* the lane should be at about 7 feet height; the reader *above* the lane must be raised to clear the higher vehicles. Mount the tags in small vehicles (sports cars) higher than in larger vehicles (SUVs). This places the tags for all vehicles at about the same position relative to the reader. See Figure 4 and Figure 5.

9.4 LARGE TRUCKS AND BUSES

Follow the general suggestions for vehicles in Sections 9.2 and 9.3, regarding the location of the reader mounting (beside the vehicle lane or over the center of the lane). Select the tag that performs best in the combination of vehicle lanes, vehicle types, reader locations, and tags characteristics. See Figure 4 and Figure 5.

9.5 MIXED VEHICLES OF ALL SIZES

Use the **LR-911HiLoMA** reader set, consisting of a Master Reader and a Remote Antenna. Mount the Master and Remote units on adjustable brackets at locations that are suitable for the type of tags that will be used in the different vehicles. Both reader brackets are usually supported by a single pole or pedestal, at heights that assure clear line of sight between the readers and the tags in all vehicles. (To reduce cable length, it is often best to mount the Master Reader lower than the Remote Antenna. Invert the units so that the coaxial connectors are at the *bottom* edge.)

Aim the readers individually at the locations of tags when they are at the sweet spots for the two vehicle types or sizes.

9.6 SPECIAL CONDITIONS

The LR-911HiLoMA reader set may be used also to spread out the effective RF field so that it covers a larger continuous area. (The read range does not become longer, but the cross-section size of the field may become larger.)

Spreading the field *horizontally* is helpful when –

- the vehicle lane turns – for example, the lane to the gate carries vehicles that turn off a through street, *or*
- the vehicle lane is wider than a single lane, and some vehicles may be farther from the edge of the lane where the reader is located.

Spreading the field *vertically* is helpful when –

- tags are on a mix of small and large vehicles, requiring the readers to be aimed at different heights to read all tags, *or*
- the reader is on a hill, or at the crest or dip in a hill, causing the tags to be at variable heights when they are read, *or*
- the reader is near a change in the elevation of the lane surface, as at a curb or gutter or drain.

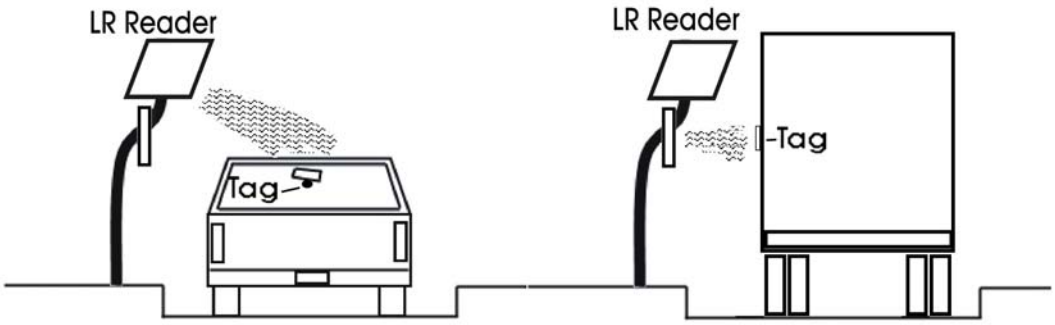


Figure 6. Mixed passenger vehicles and large trucks -- using LR-911HiLoMA.

The LR-911HiLoMA reader set has a single data interface to a single reader port on the host panel. The reader set uses a single reader address in the host system.

10 PLANNING FACTORS

10.1 INTRODUCTION

Preparation for the LR-911 installation pays dividends for the installer. The following topics cover the common questions. These topics apply generally to all forms of the LR-911 reader. The environmental, electrical, interference and temperature range characteristics likewise apply to all forms of the LR-911 reader. These characteristics are optimized if a buried-loop vehicle sensor arms the reader for RF transmission only when a vehicle is present at the reader.

10.2 ENVIRONMENT

- Physical obstructions: The space where the reader will be mounted and aimed must be clear.
- Weather: If the reader is installed outdoors, mount it inside a non-metal housing to protect the reader from direct rainfall and snow, and to shade the reader from bright sunlight. If ambient temperature is very high, use a vehicle sensor to arm the reader.
- RFI: Avoid sources of radio frequency emission that might interfere with the reader. Stay several feet from fluorescent lights.

10.3 LANE LAYOUT

- Lane geometry: The lane should be straight for about a vehicle length where the reader reads the tag. Avoid sharp turns from through streets into short driveways.
- Multiple lanes: Locate and aim readers so that they do not interfere with each other. For readers in parallel lanes, pointed in the same direction, minimum centerline distance between the lanes is 12 feet.
- Reader location: If readers are above the lanes, aim neighboring readers parallel to each other. If readers are on posts beside the lanes, aim the readers so that one reader is not aimed at the back of the neighboring reader.
- Eliminating cross-reader interference: If readers must be close to each other so that their effective RF fields overlap, use either of the LR-911HiLo reader set. This set of 2 units transmits RF alternatively, so that only one unit is active at any time.

10.4 VEHICLE TYPES

- All passenger car types: A single LR-911 reader usually works for sport cars, sedans, SUVs, vans and pickups, unless tags are in diverse locations on the vehicles.
- Mixed small and large vehicles: The LR-911HiLo reader set is available in two forms, depending on the required distance between the two units of the LR-911HiLo set.
- See Section 9 for details on reader selection for mixtures of vehicle types and sizes, and on reader location.

10.5 VEHICLE MOTION – IDEAL CONDITIONS

- Vehicle in motion while the tag is read at the “sweet spot”.
- Vehicle moving in a straight line while the tag is read.
- Vehicle close to the reader location.
- Vehicle’s tag facing the reader’s front face, and about parallel to it, when the tag is at the sweet spot.
- Vehicle speed around 5 miles per hour for safety. (OK to experiment with higher speed.)

10.6 VEHICLE MOTION -- CONTROLS

- To enforce the vehicle speed – use signs, speed bumps, traffic signals (red/green lights), gates, instructions for drivers, .
- To enforce the vehicle path – use signs, painted stripes, cones, bollards, barriers, instructions for drivers.

10.7 READER TYPE

- Typical case: Most applications are served well by a single LR-911 for each vehicle lane.
- Diverse vehicle sizes: For a combination of large and small vehicles in a lane, use LR-911HiLoMA mounted *over-under* on the same post, for example. The “over” position may be for tags in passenger cars. The “under” position may be for tags on the side of buses and large trucks.
- Turning lanes: To increase the horizontal spread in a tight turn, use LR-911HiLoMA mounted *side-by-side*. Aim the reader and remote antenna somewhat apart. Test for continuity of field using the LR-911KIT Test & Set-up Kit.

10.8 READER POSITION

- Above the lane or beside it? – Either position works. If the reader is above the lane, the reader must be no higher than is required for vehicle clearance – typically less than 10 feet above the lane, unless the tags are all high on the vehicles. If the reader is beside the lane, the height and aiming depend on the type and location of tags on the vehicles.
- Which side? – Either right or left side works. Left side (driver's side) is better, because it is easier for the driver to align the vehicle with the left side of the lane, and with the reader if it is on the driver's side. (This applies to right-lane-driving countries.)

10.9 READER MOUNTING

- Adjustable bracket: The reader (and remote antenna) must be adjustable for both "pan and tilt" (in camera parlance – that is, horizontal and vertical panning) for proper aiming. See AWID's LR-MB (11 inch long arm, with a two-axis adjustable head). The installer may use a standard camera bracket effectively.
- Fixed reader: The reader may be fastened directly to a wall, flat against the wall, in applications where the tags are on the side of vehicles facing the reader, as on buses, large trucks and trailers, and on wheelchairs, gurneys, containers, etc. Distance between reader and tags should be about 4 feet to 8 feet.
- Distance from lane: For a reader on a side post, locate the reader close to the edge of the lane, but safe from side-mirrors and errant drivers. For a reader above the lane, locate the reader as low as possible while leaving clearance for roof-racks, etc.
- Reader aiming: The "sweet spot" for reading tags is when the tag is typically about 8 feet from the reader. The goal is to have the tag about parallel to the reader's face when the tags are read.

10.10 ELECTRIC POWER

- Isolation: For each LR-911 reader, or for each LR-911HiLo set, provide an independent DC power supply that is not used to power any other equipment. Use a separate DC power supply for each LR-911 reader. A single power supply is used for LR-911HiLoMA.
- Quality: The power supply should be regulated, linear-rated (where allowed). Use a switching power supply if required, 8 feet or more from the LR-911 reader.
- Voltage: Voltage at the reader must be between 7 volts and 15 volts DC. Prevent voltage drop of more than several tenths of 1 volt between power supply and reader.
- Current: For a typical 12 volts to 13.8 volts supply, the current rating must be 1.5 amperes or more with a linear power supply, and 2.5 amperes or more with a switching power supply.

10.11 CABLE

- Number of conductors: Depends on whether DC power for the reader is combined with data transmission in the same cable. Cables are usually specified in multiples of 2 conductors.
- Power: 2 conductors in shielded cable. Use 18 gauge wires between the reader and the power supply.
- Data: 3 conductors for either Wiegand interface or RS-232 interface. Use 22 gauge (18 gauge is OK).
  For Wiegand, use parallel wires – not twisted pairs. For RS-232, Cat 5, twisted or untwisted, is good.
- Other specifications: Overall 100% shielded. Stranded wire. Color-coded insulation. Maximum length – 500 feet for Wiegand data and power; 75 feet for RS-232 data at 9,600 bits per second (up to 500 feet with certain terminal equipment). High quality.

10.12 MOUNTING THE TAGS

- See the complete instructions for installing all tags in Section 6.
- Attachment: The different tags have different requirements for mounting in or on the vehicles, or for holding by hand. Windshield Tags adhere inside the windshield glass by their adhesive. Metal-mount tags use adhesive or mechanical fasteners.
- Orientation: The flat surface of the tag should be about parallel to the face of the reader. The hand should be behind the tag when the tag is held by the fingers. The tag may be held "portrait" or "landscape" relative to the reader; the angle does not matter.
- Pre-installation testing: Hold the tag as intended in normal operation, or attach it temporarily (using masking tape, for example) in the planned location. Drive the vehicle slowly through the sweet spot. Observe the LR-911KIT's test unit for consistent reading. Adjust the reader's position and aiming, and the tags' location, and the vehicle's path and speed, as required.

10.13 ACCESSORIES

- LR-911KIT Test & Set-up Kit: *Absolutely required*. AWID may not be able to support the installer if the Kit is not at the site.
- Documents: The complete "LR-911 Installation & Operation Manual" must be at the site with the installer.

10.14 AVOID …

- "Toll-tag attitude": If the drivers are used to high-speed tollgates with active tags, they may feel restricted by a long-range reader using passive vehicle tags. If so, emphasize the desired goal of having the gate at the LR-911 installation open, by driving at safe speed in a reasonable fashion near the reader. Point out the unlimited life and the low cost of passive tags.
- Metal in or on vehicle's windows: Anti-glare tinting … reflective coating … metallic coating for automatic windshield wipers … embedded wires for defrost or antenna. These metal materials can reduce or block transmission from tags to reader. ("Lead glass" does *not* reduce performance.)
- Electronics in the vehicle: Pre-collision warning sensors and certain communications gear, while they are active, may interfere with other RF transmission, including LR-911's tags. However, most communications devices (cell phones, portable radios) and GPS have no effect on the tags.

PART C REFERENCE

11 TROUBLE-SHOOTING

11.1 PRODUCTS AND TOOLS

AWID Products:

LR-911 long-range reader
PS-12-1A DC power module *
SP-6820-LR test unit *
GMWS and MT Test tags for LR-911 *
Adapter cable, 3 clips to 9-pin "D" *

RF-SD Detector for RF fields *
"LR-911 Installation Manual"

Required Tools:

Digital multimeter (20 VDC, 5 ADC)
Common hand tools
Back-up battery – 12 V, 7.5 A-hr

Desirable Tools:

Proximity reader (small) and card
Oscilloscope, dual-trace, 915 MHz
RF spectrum analyzer

* Component of the LR-911KIT

11.2 SUMMARY

The following 4 steps summarize the trouble-shooting procedure for the LR-911 reader, from the simplest combination of products and test tools, to the complete access control system. The detailed trouble-shooting subjects start at Section 11.3.

1. Bench-testing at your shop: Test the reader using the instructions in Section 4 with Figure 2. Follow all steps. Goal: To be confident that the LR-911 works by itself stand-alone, communicating only with the test tags and the test unit.
2. Interfacing to a PC: Connect the reader's RS-232 output to the serial input port of a PC. Run the Microsoft Windows HyperTerminal program. Watch for a column of data in rows of 18 hexadecimal characters. Do not mount the reader yet. Goal: To see consistent data from the test tag's programmed code, at the programmed repetition rate.
3. Interfacing to the system: Connect the reader *directly* to the reader input port on the host system's controller panel. This bypasses the cable and junctions between the reader and the panel.
   Goal: To see the reader transmit the tag's code to the host system, with correct code consistently, and with access granted.
4. Connecting the complete system: Test the system as described in Section 7, using all components of the system. Goal: To confirm proper operation of the system in its final form.

11.3 GOOD IDEAS

- Do not "button up" the system mechanically or electrically until you have tested it thoroughly, and until you are confident that all components and the complete system are working as specified.
  - Do not make final adjustments on the reader's mounting yet. Keep the fasteners accessible.
  - Do not cut and trim cables and wires yet. Keep all terminations available for measurements and for changes.
- Identify what the system is doing wrong, or what it isn't doing right.
  - Isolate the system's components. How does each component work alone? Decide which component is at fault.
- Keep the LR-911KIT with you. It is absolutely necessary, and it may pay for itself in the first installation.
  - The Kit tells you when the reader reads a tag. It helps also in locating tags in the vehicle, and in aiming the reader.

11.4 POWER SUPPLY

- Use an independent power supply, not connected in any way to the controller panel or other system components.
- Do not connect other readers and other devices to the LR-911 reader's power supply.
  - Connect only a single LR-911 reader to a power supply, and no other electrical load – not even a small proximity reader.
  - Have a different power supply for each LR-911 reader.
  - Multiple readers may connect to a single power source if the DC outputs are isolated electrically from each other.
- Check the power supply's specifications.
  - A separate DC power supply for every reader. Black and red wires connected only to this one power supply.
  - Voltage = between 7 volts and 15 volts DC (commonly 12.0 to 13.8 volts).
  - Current rating for a nominal 12 volt power supply: Using a linear supply, at least 1.5 amperes for each LR-911 reader. Using a switching supply, at least 2.5 amperes; locate the supply at least 8 feet from the reader.
  - Linear rating (that is, not a switching-type power supply). Regulated DC output.
  - For Altronix power supplies, select "Linear" rating and minimum current rating of **2.5** amperes. Model LPS3 is good.
- Calculate voltage drop between the power supply and the reader. The 4-point test is --
  1. Measure voltage at the power supply with nothing connected to the supply (no-load test).
  2. Connect the cable to the power supply (but with the reader not connected). Measure voltage at the power supply.
  3. Measure voltage at the reader-end of the power cable before the reader is connected.
  4. Measure voltage at the reader when it is connected to the power supply (black and red wires).
  - Voltage drop is a combination of power supply regulation, and voltage drop in the cable. This should not exceed a few tenths of a volt. Check the reader's current draw, and the cable's wire gauge, and the power supply's current rating.
- Measure DC current in the reader's red wire.
  - Set the multimeter's function to DC Amperes, and the range to 2 A or 5 A or 10 A.
  - Disconnect the reader's red wire from the power cable.
  - Insert the multimeter's leads in series – positive lead toward the power supply, and negative lead toward the reader.
  - With voltage restored to the reader, its current is typically about 450 milliamperes in standby (no tag present), and about 900 milliamperes momentarily when the reader is processing and transmitting a tag's code.
- To evaluate the reader's DC power supply and the power cable, substitute a back-up battery in place of the power supply.
  - Disconnect the reader from the independent DC power supply and the power cable.
  - Replace the power supply temporarily with a back-up battery (typically 12 volts, 7.5 ampere-hours, fully charged). This will power the LR-911 reader for a working day. Alternative: Connect long clip leads to your truck's battery.
  - A charged battery has perfect DC voltage quality and plenty of current rating.

11.5 CABLE

- Check the specifications of the cable between reader and panel, and between reader and power supply. They should be –
  - Stranded wires, color-coded insulation, overall 100% shielded, outside plastic sheath, high quality.
  - For *power*: 18 gauge wires, 2 conductors, twisted-pair is OK.
  - or *data*: 22 gauge wires, 3 conductors, not twisted-pair.
  - For *power and data* in same cable: 18 gauge, 5 conductors, not twisted-pair.
  - Maximum length for *Wiegand* interface (using the reader's Data-0 and Data-1 lines) is 500 feet. For longer cable runs, use a Wiegand extender or a wireless transmitter. See Cypress Computer Systems' Web site, www.cypressworld.com.
  - Maximum length for *RS-232* serial interface is 75 feet at 9,600 bits per second. 500 feet is possible in special cases.
- If existing cable is twisted-pair (rather than "bunched" wires), run Data-0 and Data-1 through different twisted pairs.
  - Example: Run Data-0 and DC power positive in one twisted pair, and run Data-1 and DC power negative in another pair.
- Check the cable's junctions and splices.
  - Be certain that they are solid, clean, dry, insulated, shielded and *tested*.
  - Do not let the cable shield touch metal conduit. Check metal conduit's ground. Check for water inside conduit.
- If a cable problem is suspected, disconnect that cable, and run a temporary cable on the surface.
  - If the reader now works normally, pull new cable through the conduit, with no splices or junctions.
- If existing power cable has 22 gauge wires, connect spare wires in parallel for both DC positive and DC negative.

11.6 WIRING

- **Wiring an LR-911 reader is *not* the same as wiring other reader types.** For the Wiegand interface, Data-0 and Data-1 lines are the same, but all other wires are *different*. 8 of the reader's 10 wires must be used or reserved; 2 wires are not used.
- Study the wiring diagram in Figure 3. Compare the actual wiring with this wiring diagram.
- The reader must be armed to transmit its RF field. To arm the reader, its *yellow* wire must be connected to its *black* wire.
  - To transmit RF only when a vehicle is present at the reader, use a buried loop or other vehicle sensor with relay contacts that connect the yellow and black wires temporarily.
- There must be no connection between the reader's power supply and the host system's panel – not even a ground connection. The power supply must be floating.
- The reader's drain wire and the cables' shields must be connected together, but they must not be grounded. These shields must be floating. (Induced noise is drained inside the LR-911 reader.)
- *Never* connect 2 readers' data lines in parallel on one reader input port. Always use a separate port for every reader. This preserves the data pulse shape, and allows each reader to have its own address in the host system.
- To bypass a problem in the cable, wire the LR-911 reader directly to the panel's reader input port.
  - Connect the reader's **3** data wires directly to the panel's reader input port – green to Data-0, white to Data-1, and **blue** to Data-Common on the *same reader port*. If there is no terminal labeled "Data-Common" on that reader port, connect the blue wire to the Ground, Negative or Common terminal on that reader port, which serves as data-common also.
  - Use an independent DC power supply that meets AWID's specifications fully (Section 11.4). Do not connect the reader's black and red wires to the panel.
  - If the reader now operates normally, there may be a problem in the cable or its junctions, or in the conduit.
- Check the unused wires on the reader.
  - The unused wires must not touch each other or anything else. Tape them off singly.
  - The violet and brown wires are never used in the Wiegand interface. They should be separately taped or capped.
  - The orange wire is used by the SP-6820-LR test unit (part of the LR-911KIT Test & Set-up Kit). Keep this wire continually accessible for testing.
- For RS-232 serial interface, see AWID's Technical Reference "RS-232 Interface". Download it from www.awid.com/support

11.7 GROUNDING

- **The LR-911 reader has no grounded wires.** Three wires are used as common or negative wires – *black* wire for power supply negative, *blue* wire for data-common, and *drain* (bare silver) wire for shield draining.
  - These 3 wires *must* be wired correctly as shown in Figure 3. These 3 wires must *not* be connected to each other.
  - The reader's *yellow* wire must be connected to the *black* wire to arm the reader for RF transmission. (See Section 11.6.)
- The reader's power supply DC negative and the panel's electrical ground must be kept separate.
  - Do not wire these two negatives together. Let the power supply's secondary (DC output) side float.
  - The panel and readers must be powered by different DC power supplies (or isolated outputs in a multi-channel supply).
- Check the reader's drain wire (silver stranded wire without insulation).
  - The drain must be tied to the shields of the cables between the reader and the panel, and between the reader and the power supply – **but** the shields must not be grounded anywhere. The shields must float. (Noise is drained inside the reader.)
- Measure voltage between earth-ground and the system's electrical ground.
  - Voltage must not exceed a few tenths of a volt in AC or DC. If it does, have a qualified electrical contractor check the 3-wire 120 VAC grounded power line and receptacle that feeds the DC power supply for both the panel and the reader.
  - Check that the 120 VAC green wire is at earth-ground. Check that the black and white AC wires are not reversed at a receptacle or junction.

11.8 ISOLATION

- “Green field test” = Disconnect everything from the reader. Move the reader to a remote location that has no electrical or RF noise. Use a backup battery (12 volts, 7.5 ampere-hours, fully charged) instead of the DC power supply. Test using the test unit and test tags from AWID’s LR-911KIT Test & Set-up Kit.
  - Observe the reader’s performance by itself. Map the reader’s effective RF field by moving the tag slowly, side to side, gradually farther from the reader. Measure the maximum width of the field, and the farthest point where the tag reads. (This is the reader’s read range for that tag.)
  - Reconnect the rest of the system, one component at a time. Observe the reader’s performance at each step. What is it that makes the problem re-appear?
- Disconnect other devices near the problem reader. Observe performance of the LR-911 reader by itself.
  - Remove power temporarily from proximity card readers, communications gear, intercoms, telephone-access controllers, fluorescent and other arc-type lamps, PCs and monitors, transformers, motors, etc., that are near the LR-911.
  - When the LR-911 is connected directly to the system’s panel, disconnect other readers that are connected to that panel.

11.9 REPLACEMENTS AND SUBSTITUTIONS

- Try a different reader in place of the problem reader:
  - Is there a spare LR-911 reader in your truck or at your shop? If so, use it in place of the original reader.
  - Is there another LR-911 reader, installed at this site, operating correctly? If so, interchange the two readers, and observe if the malfunction moves with the reader or stays at the original location?
  - Do you have a different kind of reader, like a proximity reader and a compatible card or tag? If so, wire it into the panel in place of the LR-911 reader. This may indicate a panel or system programming problem.
- Do all tags give the same results? Try other tags and compare results.
- Interface the LR-911 reader to an access control system that has tested good previously with a different reader.

11.10 ENVIRONMENT

- Remove power temporarily from all other equipment near the reader that generates magnetic fields or electric fields.
  - Look for communications antennas, PC monitors, arc-type lighting (including fluorescent), heavy electrical equipment (elevator motors, air conditioners, etc.), RF-type telephone access panels, other RF-type readers (even 125 kHz proximity readers), high-voltage 60 Hz power lines, etc.
- If the reader’s cable to the system has a junction inside the gate-motor housing, try removing power from the gate motor for the reader performance tests.
- Shield the reader from possible RF noise sources:
  - Form a large sheet of aluminum foil into a hemisphere around the reader’s rear and edges, to block environmental RF interference. Leave the aluminum foil open in front of the reader so that the reader can communicate with the test tags.
- Remove power from other LR-911 readers that are less than 12 feet from the tested reader if they are aimed parallel (as in neighboring lanes at the gates), or less than 30 feet from the tested reader if they are aimed head-on toward the tested reader.
  - Does the problem go away? Does the reader operate normally?
- To see how the reader performs when it is removed from possible RF interference, do a “green field” test.
  - Collect the LR-911 reader, a back-up battery (or use your truck’s battery), a tag, and the test unit from the Test & Set-up Kit. Carry them to a remote site away from interfering devices. Test the reader’s performance under these conditions.

11.11 HOST SYSTEM

- Observe messages on the PC monitor while the access control program is running.
  - If no message – there may be no data input from the reader to the panel, or from the reader input module to the controller.
  - If no message – there may be input data but not with the number of bits for which the system is programmed. For example, induced noise or data collision may add bits to the normal bit stream from the reader (commonly 26 bits).
  - If the message indicates bit-count error, or format error, or parity error, or facility code error, or non-valid identification number – find the source of the error. It may be incorrect programming of the host system, or of AWID’s cards or tags.
  - Watch the “Access denied: …” message. The listed reason for denying access may point to the cause of failure.

- Program the host system to configure the data input from the readers.
  - Enter the code format of the tags (usually "26-bit Wiegand standard"), and the tags' facility code or site code, and (in the cardholders' database) the ID number for the individual tag.
  - Program your own test tag as an administrator, with top-priority level, access to all doors or gates, for all days and times.
- If the tag's code data shown on the PC monitor are different from the code that is printed on the tag's label –
  - *Consistently wrong* code for every read indicates that the tag is programmed wrong. Test the code from a different tag.
  - *Randomly different* code for every tag read indicates induced noise, intermittent wiring connection, or incorrect system grounding. Check for cable and wiring problems.
- If the problem is data collision in the host system because it can not process repeated code inputs quickly enough –
  - Use the reader's arming circuit to transmit a single code read to the system. Touch the yellow wire to the black wire for only about one-half second. Does the system process the single code transmission correctly, every time?
  - Contact AWID about slowing the LR-911 reader's repetition read rate to prevent data collision in the host system.

11.12 POINTERS

- Keep the screws that fasten the aluminum plate to the reader's plastic housing in place. Do not drill holes in the plate.
- Shield the LR-911 from direct rain, and from bright sunshine in hot weather. Mount the reader inside a plastic housing.
- Remove heavy snow from the face of the LR-911 reader, and from the windshield over windshield-type tags.
- Wipe rain from the windshield. Wash salt coating from the windshield. Avoid metal films and embedded wires.

11.13 TESTING TOOLS AND TECHNIQUES

- Digital multimeter (DMM): Absolutely necessary for voltage checks, and for current measurements at the reader.
- Oscilloscope: Useful for observing digital data output at the reader and input at the panel, and for analyzing the pulse shape.
- Test tags: Test the tags on a reader that is known to work well, to be sure that the tags work at their full rating.
- Reader substitution: Indicates whether the problem is in the reader or in the other components at the "bad" location.

12 GLOSSARY

Controller panel ..... The electronic device that contains the input data port for the LR-911 reader. For the Wiegand interface, this may be the access control system's panel or board near the reader or gate operator, or the reader input module (RIM). For the RS-232 interface, this may be the system controller or a PC's serial input port.

Credential ..... A token, such as a card or tag or wafer, that carries data to identify the individual token, and therefore to identify the person or vehicle by which the token is carried.

Effective RF field ..... The three-dimensional space in front of the LR-911 reader in which the vehicle tag can be read by the reader. The field is circularly polarized. It has a circular cross-section at every distance from the reader.

Isolation ..... A trouble-shooting technique that separates the components of the system temporarily so that performance of the components can be observed and measured individually.

Lane..... The roadway that leads the vehicle past the reader and toward the gate. The ideal lane is a single vehicle width, or is marked by signs, painted stripes, cones, posts, bollards or barriers that remind the drivers to stay close to the reader.

Power supply ..... Linear = A supply with DC output generated by a circuit that produces continuous, uninterrupted power. Regulated = A supply whose output is maintained at or near the rated voltage regardless of the current (load) on the supply. Switching = A supply whose DC output is generated by a circuit that produces interrupted current flow, at a rate of around 25 kilohertz.

Read range..... The space along the axis of the reader's effective RF field in which the tag can be read in hand-held testing – from the LR-911 reader's face to the maximum distance – typically between 9 feet and 12 feet.

Substitution ..... A trouble-shooting technique that replaces a component of uncertain performance with a similar component that you know works well.

Sweet spot ..... The space in front of the LR-911 reader where most credentials in a given installation are read. This is typically about 8 feet direct measurement from the face of the reader. At the sweet spot, the reader's effective RF field has a cross-section with a diameter of about 4 feet or more.

Tag orientation..... Direction ("landscape" or "portrait") that tags are mounted in or on vehicles. If the reader looks down on a tag, landscape may give best reading. If the reader is at the side of the vehicle, portrait may be best.

Installation Sheet (Wiegand Interface)
MM-6800 Low-Frequency Card Reader

These instructions are for AWID's MM-6800 Reader, using compatible proximity credentials from AWID.

Parts List

(a) 1 Installation Sheet for MM-6800
(b) 1 Model MM-6800 Reader
(c) 2 #6-32 × 1" thread-cutting screw
(d) 3 Screw-hole plug (1 spare)

Preparation

Reader Location: Select the reader's mounting location. The MM-6800 Reader may be screwed to a 1-3/4 inch door frame, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The MM-6800 may be installed indoors or outdoors. The diagram for screw and cable holes is on page 2.

DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use a separate power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be close to +12 volts DC (as low as +5 volts is OK), 1 ampere capacity, linear-rated, regulated DC output.

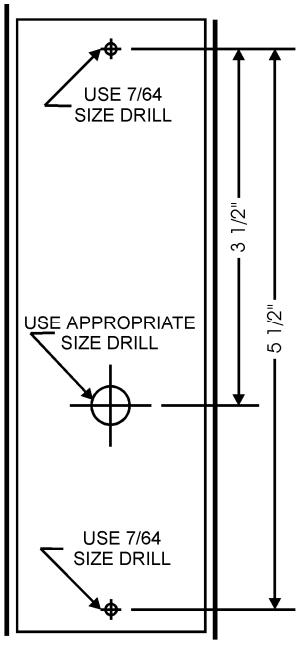
Cable to Controller and Power Supply: 4 to 7 conductors from the reader to the system (2 wires for DC power, 2 wires for Wiegand data, and 1 to 3 wires for external LED, Beeper/Alarm, and Hold control, if used). 22-gauge stranded wires. Overall 100% *shield for both power and data*. 500 feet maximum length.

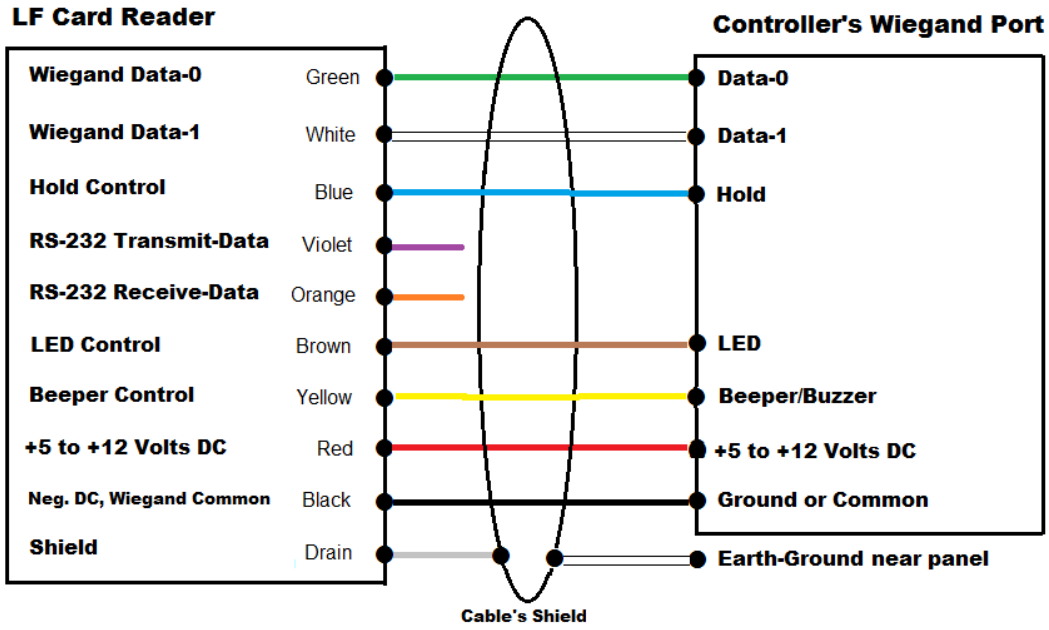
- If the DC power supply is separated from the panel's reader port, the reader's **black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel reader port's Ground terminal.
- If the separate DC power supply is close to the reader, run two 22-gauge cables – 2 wires for DC power, and 3 to 6 wires for Wiegand data (including Ground) and for the external control lines, if used. *Both* cables must be overall-shielded and earth-grounded (at the end far from the reader).
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Installation

1. **Connector** – Cut off the 10-pin in-line connector from the end of the reader's cable. Discard the connector.
2. **Wire Connections** – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable. If power and data are in separate cables, connect all three drains/shields together near the reader.
   d. If the LED, Beeper/Alarm and/or Hold features are used, connect the **brown**, **yellow** and/or **blue** wires.
   e. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   f. Last, connect **red** to the DC Positive terminal.

(continued)





3. **Reader Mounting** – Feed the reader's cable through the cable opening in the door frame or wall. Fasten the reader to the frame or wall, with screws through the holes from the front of the reader. Use the supplied screws or other fasteners for mounting. After final testing, push the screw-hole plugs over the screw heads.
4. **Reader Test** – When power is applied to the MM-6800, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID LF card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 8 inches.
5. **System Test** – Wire the reader to the system's controller. Program the code for the AWID proximity card or tag into the host system, with full priority, all doors groups, and all time zones. Present the card or tag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support ● Call 408-825-1100, option 1. E-mail Support@awid.com.

MM-6800 has been evaluated to the following Access Control Performance Levels for UL standard 294:

1. Destructive Attack – Level I (No Attack).
2. Line Security – Level I (No Line Security).
3. Endurance – Level IV (100,000 cycles).
4. Standby Power – Level I (No Standby Power).

Installation Sheet (Wiegand Interface)
MR-1824 and MR-1824MC LF Card Readers

These instructions are for AWID's Model MR-1824 and MR-1824MC readers, using compatible proximity credentials from AWID. The "**MC**" model is compensated to mount the reader directly on a large metal surface.

Parts List

(a)	1	Installation Sheet for MR-1824/MC	(d)	4	Plastic screw anchor
(b)	1	MR-1824 or MR-1824MC Reader	(e)	5	Screw-hole plug for reader's cover (1 spare)
(c)	4	#6-20 × 1.375" self-tapping screw	(f)	2	Cable slot plug (pre-installed in MR-1824MC)

Preparation

Reader Location: Select the reader's mounting location. Mount the **MR-1824** reader 4 inches away from metal. Mount the **MR-1824MC** on a flat metal surface at least 8 inches square. Observe ADA height requirements. This reader may be installed outdoors, but needs protection (non-metal housing) from direct rain, or sunlight when hot.

DC Power Supply: Use a separate power supply – 12 volts DC, current rating 1 ampere or more, linear-rated, regulated DC output. Do ***not*** connect the reader's red wire to the panel's +DC terminal.
When the reader is connected to its power supply, voltage on the reader's red and black wires should be **12.0** volts. Power may be shared with other proximity readers if the power supply has sufficient current capacity.

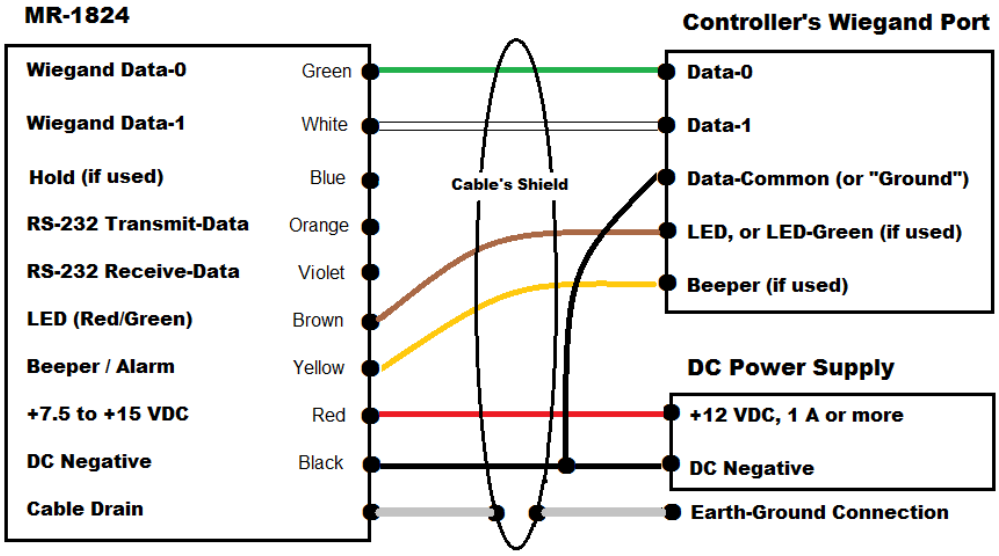
Cable to Controller and Power Supply: 4 to 7 conductors from the reader to the system (2 wires for DC power, 2 wires for Wiegand data, and 1, 2 or 3 wires for external LED, Beeper/Alarm, and Hold control, if used).
18 gauge. Overall 100% *shield for both power and data*. 500 feet maximum length.

- The reader's **black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel reader port's Ground or Negative or Common terminal (for Wiegand Data Common)..
- If the DC power supply is close to the reader, run two cables – 2 wires, 18 gauge for DC power, and 3 to 6 wires, 22 gauge for Wiegand data, and for the external control lines, if used.
  Both cables must be overall-shielded and earth-grounded at the end far from the reader.
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Installation

1. **Connector** – Cut off the 10-pin in-line connector from the end of the reader's cable. Discard the connector.
2. **Open the Reader** – Remove the 4 screws in the cover's beveled edges. Lift the cover off the base. Pull the cable behind the cover gently and remove the LED assembly. Save the 4 screws for final assembly in step 5.e.
3. **Mark the Mounting Holes** – Use the reader base as a template. Level the base. Mark the 4 mounting holes on the wall or surface. Mark and drill the cable's clearance hole (if needed). Pull the cable through the hole.
4. **Wire Connections** – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground or Negative terminal, *and* to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable.
      If power and data are in separate cables, connect all three drains/shields together near the reader.
   d. If the LED, Beeper/Alarm and/or Hold features are used, connect the **brown**, **yellow** and/or **blue** wires.
   e. At the end of the cable(s) near the panel and near the power supply, connect the cables' **shield** to a verified earth-ground.
   f. Last, connect **red** to the DC Positive terminal.

(continued)



5. **Mounting the MR-1824 or MR-1824MC** -- Note: Be careful not to touch the copper antenna or the electronic components. In the **MR-1824MC**, do *not* remove the 4 ferrite plates from the back of the reader.
   a. Drill lead holes in the wall, if needed. Insert the 4 screw anchors (supplied), if needed.
   b. For **MR-1824** (not MC): If the reader's cable is to exit either right or left edge of the reader base, lay the cable in the serpentine slot. Insert one of the cable slot plugs in the other edge of the reader base.
   c. Fasten the reader base to the wall using the 4 supplied screws, or other fasteners that you select.
   d. Re-insert the LED assembly into the lens recess on the cover. Position the cover on the reader base.
   e. Using the 4 screws that you removed in step 2, fasten the cover securely to the reader base on the wall.
   f. *After* you test the reader, insert the 4 screw-hole plugs in the cover over the fasteners.
6. **Reader Test** – When power is applied to the MR-1824, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID proximity card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 24 inches for the MR-1824, and up to 16 inches for the MR-1824MC. (See "Suggestions" (a), below.)
7. **System Test** – Wire the reader to the system's controller. Program the code for the AWID proximity card or tag into the host system, with full priority, all doors groups, and all time zones. Present the card or tag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Suggestions

(a) For best performance, please read Technical Reference "MR-1824 – Assuring Maximum Read Range". Download this memo from www.awid.com > "Access Control" tab > "Readers".

(b) When the **brown** (LED) and **yellow** (Beeper/Alarm) wires are not connected, these features are active under reader control. When these wires are connected to the panel, the host system adds control of these features.

(c) The **blue** wire should be connected only for Hold control by the host system (if the customer needs Hold).

(d) For information on the RS-232 interface, download Technical Reference "Readers – RS-232 Interface", or call Technical Support.

Technical Support • Call 408-825-1100, option 1. E-mail Support@awid.com.

The UL 294 performance levels to comply with are as follow:

Destructive Attack	Line Security	Endurance	Standby Power
I	I	I	I

Installation Sheet (Wiegand Interface)
MR-1824HiLo and MR-1824HiLoMC LF Reader Sets

These instructions are for Model MR-1824HiLo and MR-1824HiLoMC readers, using compatible proximity credentials from AWID. The "**MC**" model is compensated to mount the readers directly on large metal surfaces.

Parts List

(a)	1	Installation sheet for MR-1824HiLo and MR-1824HiLoMC Reader Sets	(d)	8	Plastic screw anchor
(b)	2	MR-1824HiLo or MR-1824HiLoMC Reader	(e)	10	Screw-hole plug for reader's cover (2 spares)
(c)	8	#6-20 × 1.375" self-tapping screw	(f)	4	Cable slot plug (pre-installed in MR-1824HiLoMC readers)

Preparation

Reader Location: Select the readers' mounting locations. Mount **MR-1824HiLo** reader units 4 inches away from metal. Mount **MR-1824HiLoMC** reader units on flat metal surfaces at least 8 inches square. Observe ADA height requirements. The units may be installed outdoors, but they need protection (a non-metal housing) if they are exposed directly to rain or snow, or to bright sunlight in a hot environment.

The two "HiLo" units may be up to 30 feet apart. (In practice, the units may work well up to 75 feet apart. *Test this* before making the final decision on extended distance between the two units.)

DC Power Supply: Use a separate power supply – 12 volts DC, current rating **2** amperes or more, linear-rated, regulated DC output. Do ***not*** connect the reader units' red wires to the panel's +DC terminal. When the 2 "HiLo" units are connected to the separate power supply, voltage on the units' red and black wires should be **12.0** volts. The two units may share a single 2 ampere power supply, or they may have separate 1 ampere power supplies.

Cable to Controller and Power Supply: 5 to 7 conductors from the "HiLo" set to the system (2 wires for DC power, 3 wires for Wiegand data, and 1 or 2 wires for external LED and Beeper/Alarm, if used). 18 gauge. Overall 100% *shield for both power and data*. 500 feet maximum length. Both "HiLo" units share this cable.

- The "HiLo" units' black wire *must* be connected to *both* (a) the DC power supply's Negative terminal *and* (b) the panel reader port's Ground or Negative or Common terminal (for Wiegand Data Common).
- If the DC power supply is close to the "HiLo" units, you may run two cables – (a) 2 wires, 18 gauge for DC power, and (b) 3 to 5 wires, 22 gauge for Wiegand data, and for the external control lines, if used.
- Additional wires connect the units' orange and violet wires (crossed over) – 2 wires, 22 gauge, unshielded.
- *All* cables must be overall-shielded and earth-grounded at the ends far from the reader.
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Installation

1. **Connector** – Cut off the 10-pin female connectors from the end of the reader units' cables. Discard the connectors. All further wiring junctions will use the reader cables' individual wires.
2. **Open the Units** – Remove the 4 screws in the cover's beveled edges. Lift the cover off the base. Pull the cable behind the cover gently and remove the LED assembly. Save the 4 screws for final assembly in step 5.e.
3. **Mark the Mounting Holes** – Use the reader unit's base as a template. Level the base. Mark the 4 mounting holes on the wall or surface. Mark and drill the cable's clearance hole (if used). Pull the cable through the clearance hole.

(continued)

4. **Wire Connections** – Connect the "HiLo" units' wires to the cables for power, data, and controls.

   a. Start the wiring by connecting together these corresponding wires (same insulation color) on the two reader units:
      - 3 Wiegand data lines – **green**, **white** and **black**.
      - 1 or 2 external control lines – **brown** for LED, **yellow** for beeper/alarm, if they are used. (Do *not* use **blue**.)
      - 2 DC power lines – **black** and **red**. (If each "HiLo" unit has its own DC power supply, omit this step.)

   b. Next, connect the reader's **black** wire to the panel port's Ground or Negative or Data Common terminal, *and also* to the power supply's Negative terminal.

   c. Connect the reader's **green** wire to the Data-0 terminal. Connect the **white** wire to the Data-1 terminal.

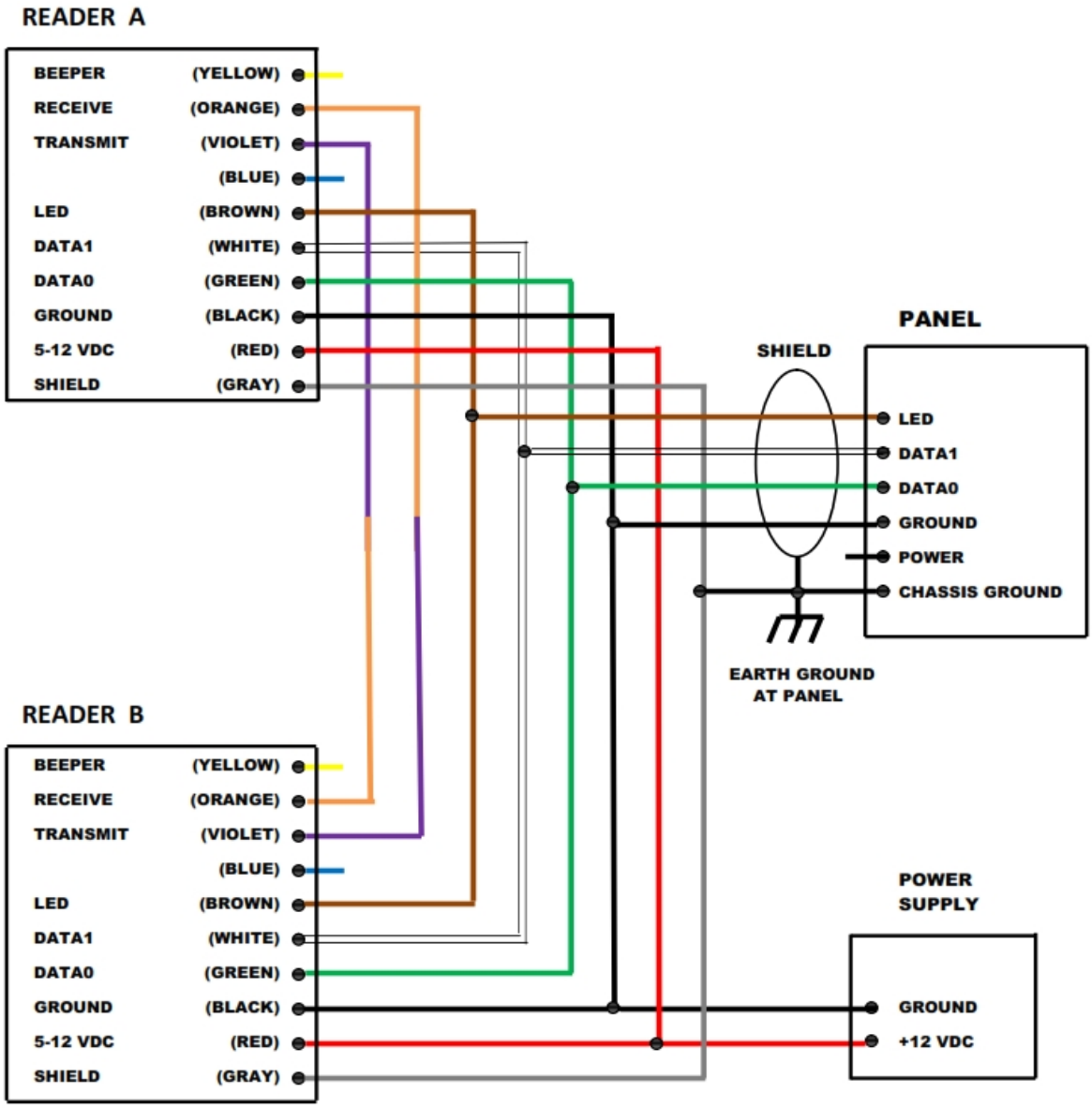
   d. For alternating control of the two units, connect one unit's **orange** wire to the **violet** wire of the other unit; also, connect the first unit's **violet** wire to the other unit's **orange** wire.

   e. Connect the **gray** drain wire to the shield of the connecting cable.
   If power and data are in separate cables, connect all three drains/shields together near the reader.

   f. If the LED and/or Beeper/Alarm features are used, connect the **brown** and/or **yellow** wires.

   g. At the end of the cable(s) near the panel and near the power supply, connect the cables' **shield** to a verified earth-ground.

   h. Last, connect **red** to the DC power supply's Positive terminal.



5. **Mounting the MR-1824HiLo or MR-1824HiLoMC**
   Note: Be careful not to touch the copper antenna or the electronic components.
   In the **MR-1824MC** units, do *not* remove the 4 ferrite plates from the back of the reader.
   a. Drill lead holes in the wall, if needed. Insert the 4 screw anchors (supplied), if needed.
   b. For **MR-1824** (not MC): If the reader's cable is to exit either right or left edge of the reader base, lay the cable in the serpentine slot. Insert one of the cable slot plugs in the other edge of the reader base.
   c. Fasten the reader base to the wall using the 4 supplied screws, or other fasteners that you select.
   d. Re-insert the LED assembly into the lens recess on the cover. Position the cover on the reader base.
   e. Using the 4 screws that you removed in step 2, fasten the cover securely to the reader base on the wall.
   f. After you test the reader, insert the 4 screw-hole plugs in the cover over the fasteners.
6. **Reader Test** – When power is applied to the MR-1824HiLo, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID proximity card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 24 inches for the MR-1824HiLo units, and up to 16 inches for the MR-1824HiLoMC units.
7. **System Test** – Wire the reader to the system's controller. Program the code for the AWID proximity card or tag into the host system, with full priority, all doors groups, and all time zones. Present the card or tag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Suggestions

- For best performance, please read Technical Reference "MR-1824 – Assuring Maximum Read Range". Download this memo from www.awid.com > "Access Control" tab > "Readers".
- When the brown (LED) and yellow (Beeper/Alarm) wires are not connected, these features are active under reader control. When these wires are connected to the panel, the host system adds control of these features.
- The blue wire for Hold control does not function in the MR-1824HiLo and MR-1824HiLoMC reader sets.
- These MR-1824HiLo/MC reader sets have Wiegand data interface only. There is no RS-232 interface.

Technical Support ● Call 408-825-1100, option 1. E-mail Support@awid.com.

MR-1824HiLo has been evaluated to the following Access Control Performance Levels for UL standard 294:

1. Destructive Attack – Level I (No Attack).
2. Line Security – Level I (No Line Security).
3. Endurance – Level IV (100,000 cycles).
4. Standby Power – Level I (No Standby Power).

Installation Sheet (Wiegand Interface)
Sentinel-Prox PCB-125 Reader Module

Reader Description

The Sentinel-Prox PCB-125 Reader Module is a radio-frequency proximity reader for Access Control Systems. The RF Module consists of reader electronics on a printed wiring board. The PCB-125 RF Reader Module may be mounted inside a protective housing, and may be integrated with other electronic devices that do not use 125 kHz. Electrical connections are made at six plated-through holes at one edge of the printed wiring board.

Parts List

(a)	Installation sheet	Qty=1
(b)	Sentinel-Prox PCB-125RM	Qty=1

Wiring List

Note: Pin #1 is identified as the one *square* hole in the row of 6 plated holes for electrical connections. The other pins (#2 through #6) are round holes. Use *only* +5 VDC power supply for Pin #1.

Pin #1 .....+5 VDC

Pin #2 .....(no connection)

Pin #3 .....Data-0

Pin #4 .....Data-1

Pin #5 .....(no connection)

Pin #6 .....Ground

Product Specifications

Cable to Controller

- *n* conductors (not twisted pairs), stranded, 22 AWG, color-coded insulation, overall 100% shielded (Number of conductors *n* depends upon other local uses of the interface cable.)
- Length for Wiegand interface.....Up to 500 feet

Maximum Read Distance with AWID Card

- Read distance is a function of the antenna characteristics, and of the properties of the circuits that match the antenna to the PCB-125RM.

Characteristics

- Operating Temperature Range .....-35° C to 65° C (-31° F to 150° F)
- Operating Humidity.....0 to 95% non-condensing

Operating Parameters

- Excitation Frequency.....125 kHz
- Wiegand Output .....26 bits to 50 bits (determined by code in credentials)

Notes

1. For additional information, please visit AWID's Web site www.awid.com. For technical support questions visit www.awid.com/support or call **1-800-369-5533** (in the U.S.) or +**1-408-825-1100** from 8:00 a.m. to 5:00 p.m. PST.

Installation Sheet (Wiegand Interface)
Sentinel-Prox SC-2300 Reader

Reader Description

The Sentinel-Prox SC-2300 Reader is a radio-frequency reader for Smart Cards and Smart Tags. The Reader consists of a transmit/receive antenna and reader electronics in a polycarbonate housing. The reader electronics are potted with epoxy resin to protect against the environment. The SC-2300 Reader may be mounted like a cover plate on a single-gang electrical utility box, or on any surface (wall, cabinet, etc.).

Parts List

(a)	Installation sheet	Qty=1
(b)	Sentinel-Prox SC-2300 Reader	Qty=1
(c)	#6-32 x 1" machine screw	Qty=2

Installation Procedure

1. Install a single-gang utility box, or drill two no. 27 (0.144 inch) clearance holes for the reader screws and one hole for the cable, at the desired location. Observe ADA height requirements.
2. Snap open the reader's front cover by inserting a wide screwdriver blade into the slot at the bottom edge of the cover, then twisting the blade gently (see Figure 1).
3. Clip off the white inline connector from the end of the reader's cable. Keep the wires as long as possible.
4. Connect the reader's cable to the controller panel as shown in Figure 2.
   Connect the ***yellow*** wire only if used for Beeper control by the panel.
   Do not connect the *orange, blue* and *violet* wires to anything. **Tape or cap all unused wires singly.**
5. Use a linear regulated DC power supply, between 7 volts and 12 volts (90 mA peak load).
6. Install the reader on the single-gang utility box or other surface. Fasten the reader to the utility box using supplied screws (item c in the Parts List).
7. Re-attach the reader's front cover -- hook the cover over the top edge of the base, then snap the bottom closed by pressing it firmly.
8. Power up the reader. The LED should be steady RED. This indicates that the reader is prepared to read smart cards.

Product Specifications

Cable to Controller

- 5 or 6 conductors (not twisted pairs), stranded, 22 AWG, color-coded insulation, overall 100% shielded (Number of conductors depends upon use of optional features – Beeper and LED. See Figure 2.)
- Length for Wiegand interface.....Up to 500 feet

Read Range (Metal Compensated)

- At 7 volts to 12 volts DC.....2 to 3 inches (5 to 7.5 cm) typically, depending on type of card or tag

Characteristics

- Indoor and Outdoor .....UL Listed
- Operating Temperature Range .....-35° C to 65° C (-31° F to 150° F)
- Operating Humidity.....0 to 95%, non-condensing

Operating Parameters

- Excitation Frequency.....13.56 MHz
- Smart-card/smart-label protocols .....Depends on the "Revision" for the SC-2300

- Wiegand-formated Data Output .....40 bits
  (continued)

Notes

1. When **wiring** the reader, connect the black wire (ground) *first*, and the red wire (positive power) *last*.
2. When the **yellow wire** is not used, the beeper remains active and under the reader's internal control.
3. The Beeper and LED lines are **TTL logic levels**. *Never* apply power to them. They may be pulled to a low level (0 to 1.2 VDC) to enable their function. They must float at a high level when not used.
4. SC-2300 readers have both Wiegand-protocol and RS-232 serial **interface**. For information on RS-232, contact AWID's Technical Support.
5. For additional information, please visit AWID's Web site www.awid.com. For technical support questions visit www.awid.com/support or call **1-800-369-5533** (in the U.S.) or +**1-408-825-1100** from 8:00am to 5:00pm Pacific Time.

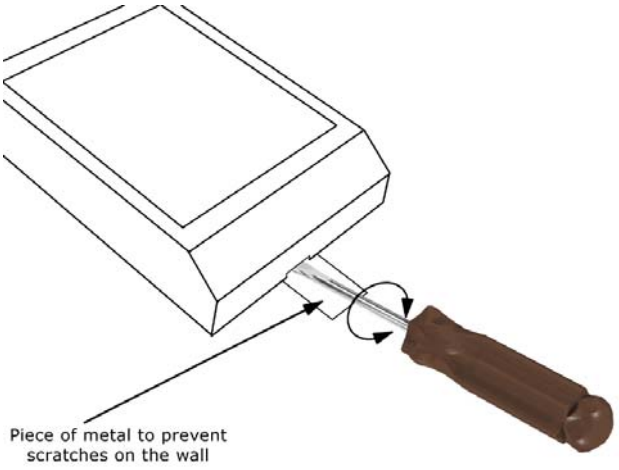


FIGURE 1: SNAPPING OPEN THE COVER

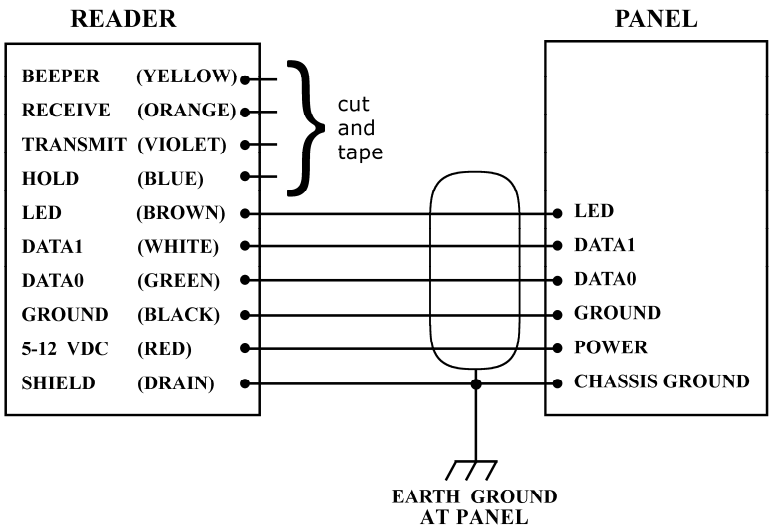


FIGURE 1: WIRING DIAGRAM – WIEGAND

Installation Sheet (Wiegand Interface)
SP-6820 Low-Frequency Card Reader

These instructions are for AWID's Model SP-6820 reader, using compatible proximity credentials from AWID.

Parts List

(a) 1 Installation Sheet for SP-6820
(b) 1 Model SP-6820 Reader
(c) 2 #6-32 × 1" machine screw (for single-gang utility box)

Preparation

Reader Location: Select the reader's mounting location. The SP-6820 Reader may be screwed to a single-gang utility box like a cover plate, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The SP-6820 may be installed indoors or outdoors, but it needs protection from direct rain or snow.

DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use an independent power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be close to +12 volts DC (as low as +5 volts is OK), 1 ampere capacity, linear-rated, regulated DC output.

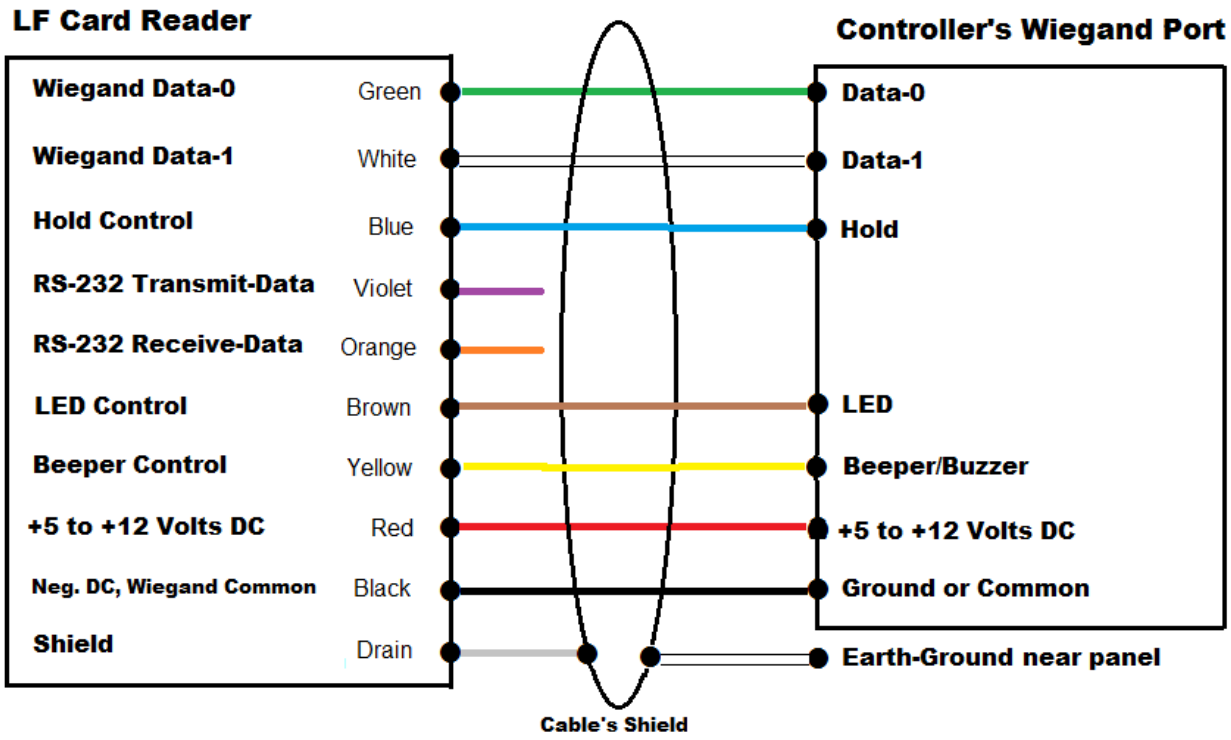
Cable to Controller and Power Supply: 4 to 7 conductors from the reader to the system (2 wires for DC power, 2 wires for Wiegand data, and 1 to 3 wires for external LED, Beeper/Alarm, and Hold control, if used). 22-gauge stranded wires. Overall 100% *shield for both power and data*. 500 feet maximum length.

- If the DC power supply is separated from the panel's reader port, the reader's **black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel reader port's Ground terminal.
- If the separate DC power supply is close to the reader, run two 22-gauge cables – 2 wires for DC power, and 3 to 6 wires for Wiegand data (including Ground) and for the external control lines, if used. *Both* cables must be overall-shielded and earth-grounded (at the end far from the reader).
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Installation

1. **Connector** – Cut off the 10-pin in-line connector from the end of the reader's cable. Discard the connector.
2. **Open the Reader** – Snap open the reader's front cover by inserting a wide screwdriver blade in the slot at the bottom edge of the cover. Twist the blade gently.
3. **Wire Connections** – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable. If power and data are in separate cables, connect all three drains/shields together near the reader.
   d. If the LED, Beeper/Alarm and/or Hold features are used, connect the **brown**, **yellow** and/or **blue** wires.
   e. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   f. Last, connect **red** to the DC Positive terminal.

(continued)



4. **Reader Mounting** – Feed the reader's cable through the utility box or the wall's cable opening. Fasten the reader to the utility box or the wall, with screws through the holes inside the open reader. Use the supplied screws for mounting on a utility box. When mounting is finished, snap the cover on the reader.
5. **Reader Test** – When power is applied to the SP-6820, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID LF card or tag to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 8 inches.
6. **System Test** – Wire the reader to the system's controller. Program the code for the AWID proximity card or tag into the host system, with full priority, all doors groups, and all time zones. Present the card or tag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support ● Call 408-825-1100, option 1. E-mail Support@awid.com.

SP-6820 has been evaluated to the following Access Control Performance Levels for UL standard 294:

1. Destructive Attack – Level I (No Attack).
2. Line Security – Level I (No Line Security).
3. Endurance – Level IV (100,000 cycles).
4. Standby Power – Level I (No Standby Power).

Installation Sheet (Wiegand Interface)
SR-2400 Low-Frequency Card Reader

These instructions are for AWID's SR-2400 Reader, using compatible proximity credentials from AWID.

Parts List

(a) 1 Installation Sheet for SR-2400
(b) 1 Model SR-2400 Reader
(c) 2 #6-32 × 1" thread-cutting screw, type 23
(d) 3 Screw-hole plug (1 spare)

Preparation

Reader Location: Select the reader's mounting location. The SR-2400 Reader may be screwed to a 1-3/4 inch door frame, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The SR-2400 may be installed indoors or outdoors. The diagram for screw and cable holes is on page 2.

DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use a separate power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be close to +12 volts DC (as low as +5 volts is OK), 750 milliamperes capacity, linear-rated, regulated DC output.

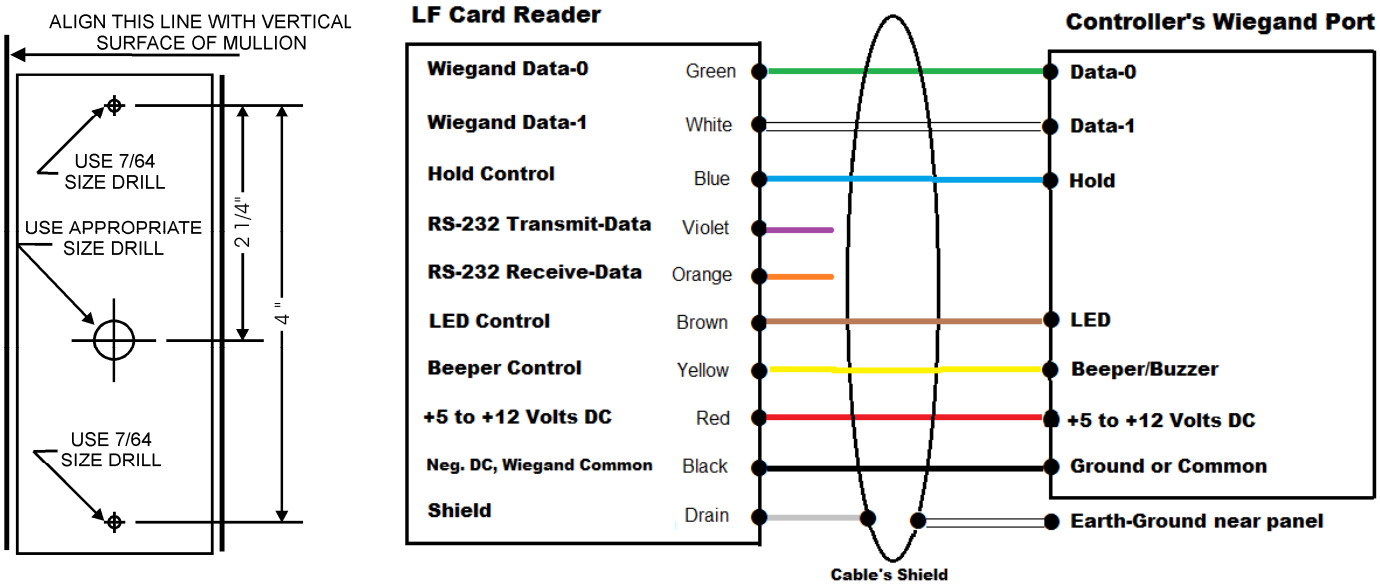
Cable to Controller and Power Supply: 4 to 6 conductors from the reader to the system (2 wires for DC power, 2 wires for Wiegand data, and 1 or 2 wires for external LED and Beeper/Alarm, if used). 22-gauge stranded wires. Overall 100% *shield for both power and data*. 500 feet maximum length.

- If the DC power supply is separated from the panel's reader port, the reader's **black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel reader port's Ground terminal.
- If the separate DC power supply is close to the reader, run two 22-gauge cables – 2 wires for DC power, and 3 to 5 wires for Wiegand data (including Ground) and for the external control lines, if used. *Both* cables must be overall-shielded and earth-grounded (at the end far from the reader).
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Installation

1. **Connector** – Cut off the 10-pin in-line connector from the end of the reader's cable. Discard the connector.
2. **Wire Connections** – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable. If power and data are in separate cables, connect all three drains/shields together near the reader.
   d. If the LED and/or Beeper/Alarm features are used, connect the **brown** and/or **yellow** wires.
   e. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   f. Last, connect **red** to the DC Positive terminal.

(continued)



Note: The SR-2400 reader has no Hold control or RS-2232 interface. Do not use the **blue**, **violet** and **orange** wires.

3. **Reader Mounting** – Feed the reader's cable through the cable opening in the door frame or wall. Fasten the reader to the frame or wall, with screws through the holes from the front of the reader. Use the supplied screws or other fasteners for mounting. After final testing, push the screw-hole plugs over the screw heads.
4. **Reader Test** – When power is applied to the SR-2400, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID LF proximity card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible card is up to 5-1/2 inches.
5. **System Test** – Wire the reader to the system's controller. Program the code for the AWID proximity card or tag into the host system, with full priority, all doors groups, and all time zones. Present the card or tag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support ● Call 408-825-1100, option 1. E-mail Support@awid.com.

SR-2400 has been evaluated to the following Access Control Performance Levels for UL standard 294:

1. Destructive Attack – Level I (No Attack).
2. Line Security – Level I (No Line Security).
3. Endurance – Level IV (100,000 cycles).
4. Standby Power – Level I (No Standby Power).

Installation Sheet (Wiegand Interface)
UA-612 UHF Reader

Reader Description

The UA-612 Reader combines the technology of a UHF long-range reader for vehicle identification with small size and easy mounting for access control. It reads the same UHF tags and cards that AWID's LR-2000 reader reads for automated vehicle identification. The polycarbonate enclosure contains both antenna and RF module. The UA-612 Reader is mounted like a cover plate on a single-gang electrical utility box, or on any surface.

Parts List

(a)	Installation Sheet	Quantity 1
(b)	UA-612 Reader	Quantity 1
(c)	#6-32 x 1" machine screw (for single-gang utility box)	Quantity 2

Installation Procedure

1. Install a single-gang utility box, or drill two no. 27 (0.144-inch) clearance holes for the reader screws and one hole for the cable, at the desired location. Observe ADA height requirements.
2. Snap open the reader's front cover by inserting a wide screwdriver blade into the slot at the bottom edge of the cover, then twisting the blade gently (see Figure 1). Note: Do not remove screws inside the cover.
3. Clip off the white 10-pin in-line connector from the end of the reader's cable. Keep the wires as long as possible.
4. Install the reader on the electrical box or other surface. Fasten the reader to the electrical box with supplied screws (Parts Lists, item c). Hang the reader's cover over the base reader, and snap the cover closed securely.
5. Prepare the cable to the system's panel and power (see Figure 2). (See "Product Specifications", below, for the number of cable conductors.) Power and data may share the same shielded cable, or use separate shielded cables. Use the *black* and *red* wires for the power supply. Use the *black* wire also for the panel's common or negative or ground terminal. For Wiegand data, use the *green* wire for Data-0, and the *white* wire for Data-1. Connect the reader's bare *drain* wire to the cable's shield or drain wire; do not ground the shield anywhere – let it float. Connect the reader's *brown* wire if used for LED control, and the *yellow* wire if used for beeper control. Do not connect the *orange*, *blue* and *violet* wires; tape or cap them separate.
6. Use an independent regulated DC power supply, 12 volts ± 10% (a battery-charging power supply is OK). The current rating must be 1.0 ampere or more. **Do not use** the panel's DC voltage terminals for reader power.
7. Apply power to the UA-612 reader. The beeper sounds, and the LED is steady red indicating standby.
8. Present an AWID UHF card or tag (same as used with the LR-2000 reader) to the UA-612 reader. The reader's beeper sounds with every tag read, and the LED changes to amber briefly, and then red. If the LED control wire (*brown*) is connected to the panel's terminal, the reader's LED is green when the system authorizes door-unlock.

Product Specifications

Cable to Controller and Power Supply

- 4 to 6 conductors (not twisted pairs), stranded, 22 gauge, color-coded insulation, overall 100% shielded
  - ⇨ Cables may be separated – 2 conductors to power, and 3 to 5 conductors to the panel. Cables must be shielded. The number of conductors to the panel depends upon the number of control lines used – none / LED / beeper.
- Length for Wiegand interface.....Up to 500 feet

Reading Distance

- With all tags for LR-2000 long-range reader .....6 to 12 inches (15 to 30 cm)

Characteristics

- Indoor and outdoor .....Rated for outdoor installations if mounted in IP64-rated housing
- Operating temperature.....-31° F to 150° F (-35 C° to 65° C)
- Operating humidity.....0 to 95% non-condensing

Operating Parameters

- Transmitting frequency range.....902.6 to 927.4 MHz, frequency-hopping
- Frequency channels .....125 channels; each channel spaced by 200 kHz
- Data format for Wiegand output.....26 bits to 50 bits (as programmed in UHF cards or tags)

Certifications .....FCC Part 15; Industry Canada; UL listed; RoHS compliant

Notes

1. Connect the black wire (negative) first, and the red wire (positive) last. Disconnect power before any wiring changes.
2. The LED and Beeper lines are logic levels. *Never* apply power to them. They may be pulled to a low level (0 to 1.2 VDC) to enable their functions, and left floating or pulled to a high level (3.6 to 5.0 VDC) when not used.
3. UA-612 readers have both Wiegand-protocol and RS-232 serial interfaces. For information on RS-232, contact AWID's technical support.
4. For additional information, please visit AWID's Web site www.awid.com. For technical support questions visit www.awid.com/support or call **1-800-369-5533** (in the U.S.) or **1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.
5. 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

   According to "Administrative Regulations on Low Power Radio Waves Radiated Devices" Without permission granted by the DGT, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power or alter original characteristic as well as performance to a approved low power radio-frequency devices. The low power radio-frequency devices shall not influence aircraft security and interfere legal communications; If found, the user shall cease operating immediately until no interference is achieved. The said legal communications means radio communications is operated in compliance with the Telecommunications Act. The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices

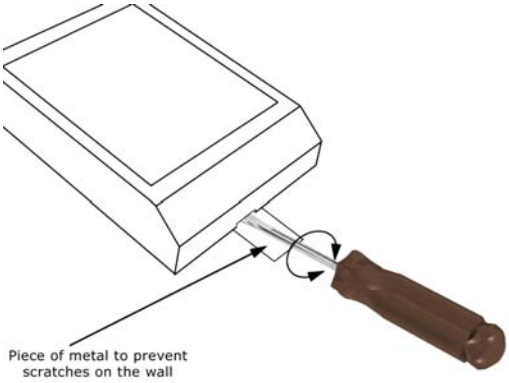


FIGURE 1: SNAPPING OPEN THE COVER

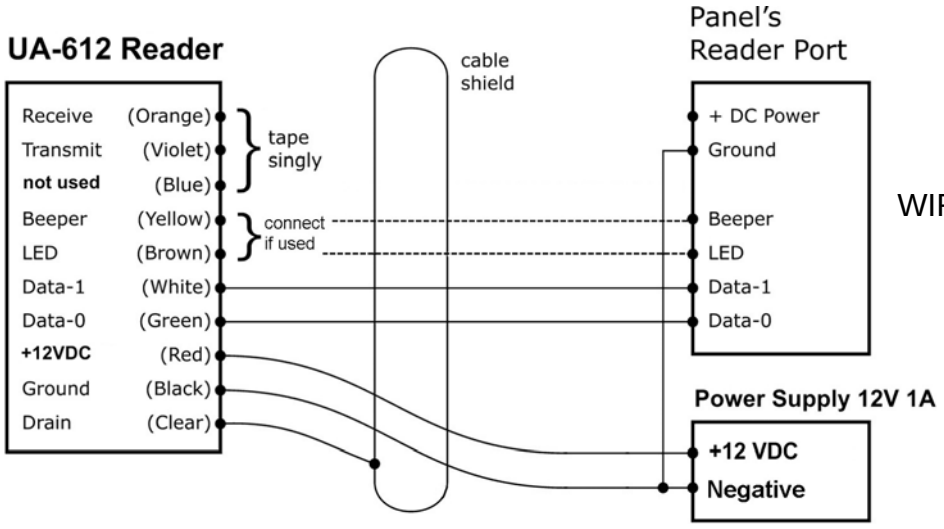


FIGURE 2:
WIRING DIAGRAM (WIEGAND)

Installation Sheet (Wiegand Interface)
UA-612 UHF Card Reader

These Instructions are for AWID's Model UA-612 reader, using compatible UHF cards supplied by AWID.

Parts List

(a)	1	Installation Sheet UA-612
(b)	1	UA-612 Reader
(c)	2	#6-32 X 1" machine screw (for single-gang utility box)

Preparation

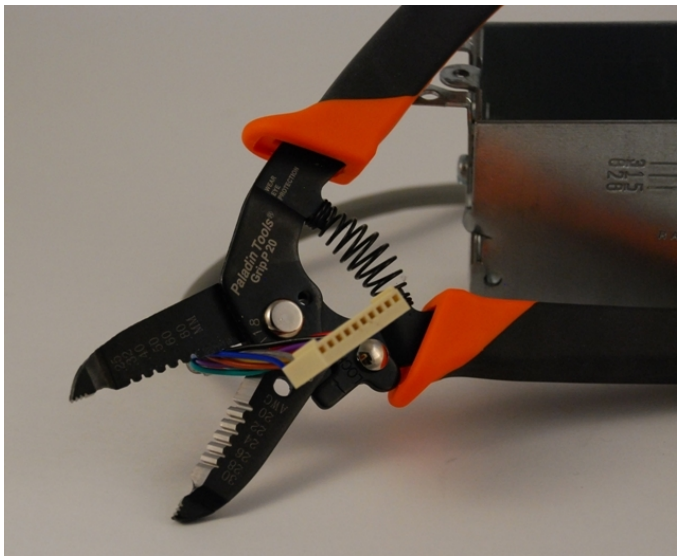
Reader Location: Select the reader's mounting location. The UA-612 Reader may be screwed to a single-gang utility box like a cover plate, or to a wall or other surface. On a metal surface, read range is reduced about 20%. If the reader is exposed directly to rain or snow, use a polycarbonate housing for protection.

DC Power Supply: Separate – independent from any other device. Dedicated – only this reader connected to the power supply. Do *not* draw the reader's power from the system's controller. Nominal 12 volts DC (supply between 7.5 V and 15 V to the reader). Current capacity, 1 ampere or more. Linear-rated. Regulated DC out.

Cable to Controller and Power Supply: 5 to 7 conductors from reader to the system (2 for DC power, 3 for Wiegand data, and 2 for control lines if used). 18 gauge (22 gauge for data and control lines if they are in separate cable from power). Overall 100% shield for *both power and data*. 500 feet maximum length. If cable is pulled through metal conduit, the conduit must be earth-grounded.

Procedure

1. Connector – Cut off the white 10-pin connector from the end of the reader's cable. Discard the connector.

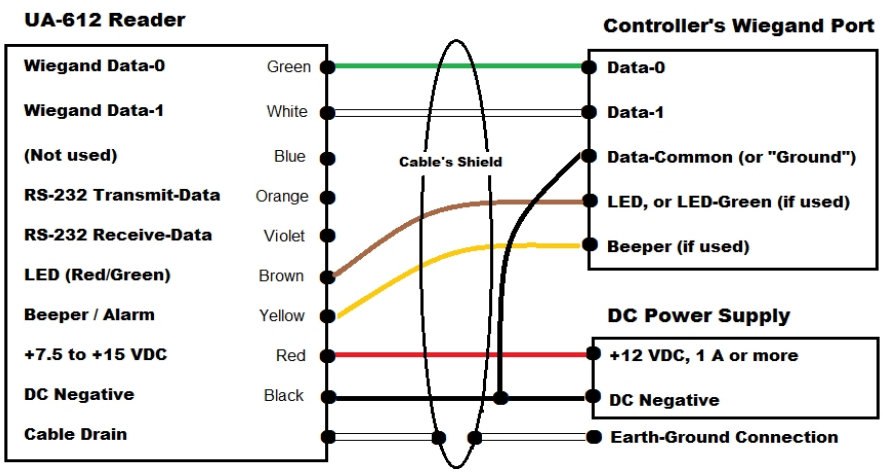


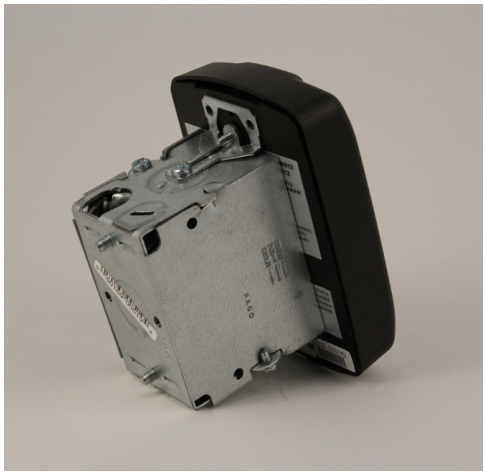


2. Open the Reader – Snap open the reader's front cover by inserting a wide screwdriver blade in the slot at the bottom edge of the cover. Twist the blade gently. Do not remove screws inside the cover.

(continued)

3. Wire Connections – Connect the reader's wires to the cable(s) for power and data and control.
   a. First, connect **black** to DC negative on the power supply. Then …
   b. Connect **black** also to Data-Common on the panel. If there is no Data-Common terminal, use Ground.
   c. Connect **green** to Data-0 and **white** to Data-1.
   d. If control lines are used, connect **brown** to LED (or LED-Green) and **yellow** to Buzzer.
   e. Connect the **drain** wire to the shields of power and data cables.
   f. At the end of the cables near the panel and power supply, connect the cables' **shields** to earth-ground.
   g. Last, connect **red** to DC positive on the power supply.





4. Physical Mounting – Feed the reader's cable through the utility box or the wall's cable opening. Fasten the reader to the utility box or the wall, with screws through the holes inside the open reader. Use the supplied screws for mounting on a utility box. A tamper alarm NC pushbutton switch may be inserted in the 0.110 inch hole through the base of the reader. Tamper alarm occurs when the UA-612 reader's cover is removed.
5. Reader Test – When power is applied to the UA-612, the LED is lighted steady-red for standby, and the beeper sounds. With every presentation of an AWID UHF card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range is up to 6 inches.
6. System Test – Wire the reader to the system's controller. Program the code for the AWID UHF card into the host system, with full priority, all doors groups, and all time zones. Present the card to the reader. The LED changes to green for a few seconds, indicating Access Granted.

Interface

- Wiegand Interface Wires – **Green** for Data-0, **white** for Data-1, and **black** for Data-Common.
- Codes in Cards – UA-612 reads AWID's UHF cards, programmed with codes of 26 bits to 50 bits.
- RS-232 Serial Interface – Contact AWID's Technical Support for the RS-232 Technical Reference.

Operating Conditions

- Indoor and Outdoor – If exposed to rain or snow, install UA-612 in an IP64-rated polycarbonate housing.
- Temperature & Humidity – -31 F to 150 F degrees (-35 C to 65 C). 0% to 95% R.H. non-condensing.
- Transmitting Frequency – 902.6 to 927.4 MHz, frequency-hopping. Channels separated by 200 kHz.
- Voltage Connections – Apply power only to UA-612's black and red wires – never to the other wires.
- Output Testing – To test UA-612 operation, clip the LR-KIT's Test Unit to black, orange and red wires.

Support

- Technical Support – Call 408-825-1100, option 1. E-mail Support@awid.com.

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Quick Installation Guide – LR-2200 and LR-2200HiLoMA Readers and Tags

If you are new to the LR-2200 readers, or if this is your first long-range installation, and you have any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100.

The LR-2200-series Readers are long-range Radio Frequency Identification readers that use AWID's encoded vehicle-mounted tags and hand-held cards. This Guide describes the Wiegand interface. For RS-232 interface, see AWID's Technical Reference.

Before you start the installation, download and study the LR-2200 Installation & Operation Manual.

Preparation

- **Layout Plan**: Ideal conditions for the reader installation site are –
  - ► 1 car length or more between reader and gate;
  - ► Vehicles driving in the lane close to the reader, in a straight line, at up to 15 miles per hour;
  - ► Reader mounted on a bracket with adjustable head (pan and tilt) for aiming the reader;
  - ► Reader location and height to match vehicle and tag types;
  - ► Reader and tags aimed toward each other, and parallel, when tags are 15 foot from the reader (the "sweet spot");
  - ► Good tag location in vehicles determined by tests before attaching the tags; and
  - ► Using LR-2200HiLoMA to spread the effective RF field where the lane turns, or for mixed small and large vehicles.
- **Power Supply**: A separate dedicated DC power supply for each LR-2200 reader or "HiLo" reader set, connected to nothing else. For a 12-14 volt DC supply, rating = 1.5 amperes or more, linear, regulated supply. Locate 12 feet or more from the reader.
- **Housing:** Mount the reader inside a Lexan housing if the reader is mounted outdoors *and* is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example: The Housing Company, Model PCH196 (14 inches by 14 inches by 3 inches).
- **Cable**: May be separate cables for data and for power, or may be combined for data and power together. Max. length = 500 feet.
  For *power* alone – 18 gauge, 2 conductors, stranded wires, color-coded, overall 100% shielded, high quality.
  For *data* alone – 22 gauge, 3 conductors, stranded wires, color-coded, not twisted pairs, overall 100% shielded, high quality.
  For *combined* cable – 18 gauge, 5 conductors, stranded wires, color-coded, not twisted pairs, overall 100% shielded, high quality.
- **Mounting**: Adjustable pan-and-tilt brackets (Pt.No. LR-MB-0-0) in most installations, to aim the readers at the tags for reading.

Pre-Installation Testing *(See Quick Installation Guide for LR-2200KIT Installation Kit)*

- *Before* installing at the site, run these tests on the bench at your shop, or in your van at the site – almost anywhere.

1. Installation Kit (Pt.No. LR-2200KIT-0-0): Provides beep and LED color. No need to mount the reader or interface to the system.
2. Connections: Connect together the 3 negatives (black wires) on the reader, test unit, and power supply, plus reader's yellow wire. Connect together the reader's orange wire to the test unit's orange wire.
   Connect together the 3 positive power lines (red wires) on the reader, test unit, and power supply. See Figure 1 for test wiring.
3. Holding test tags: Squeeze in fingertips at edge of tag. Hold tag at arm's length to your side. Tag and reader facing each other.
4. Procedure: When the test unit's LED shows red, present one of the test tags from the Kit to the reader. Measure (a) the maximum distance "R" where reads occur, and (b) the width "W" of the effective RF field at half of the maximum reading distance.
5. Results: Tags should read about 3 reads per second, inside the "balloon" (Figure 2). All tags should read to 15 feet or more.

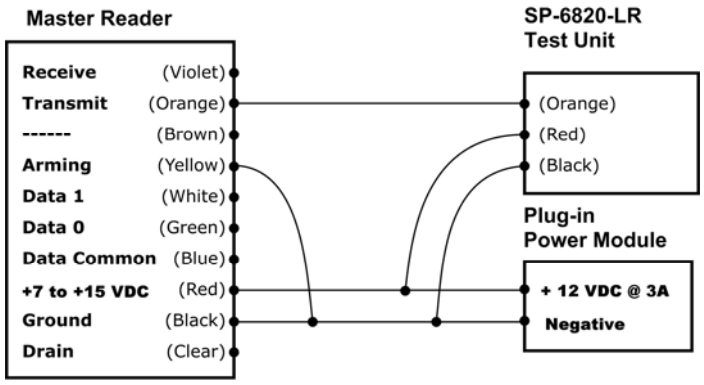


Figure 1. Connections for Pre-Installation Testing

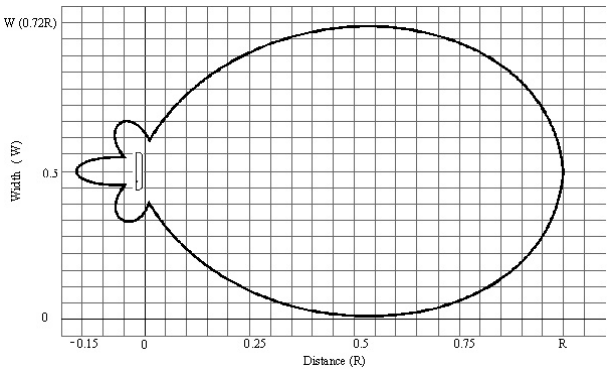


Figure 2. Effective RF Field for LR-2200 Reader

Mounting the Reader and the Remote Antenna *(See LR-2200 Installation & Operation Manual, Sections 5, 8 and 9)*

1. Fasten the mounting bracket to the pole, post, pedestal, wall or beam. Leave space for the reader unit's pan-and-tilt adjustment.
2. Fasten the reader to the bracket with 2 ¼"-20 screws. The LR-MB bracket includes fasteners. With a housing, use longer screws.
3. Cut off the connector from the reader's cable. For LR-2200HiLoMA, locate the 6 foot coaxial cable that will connect the 2 units.
4. Aim the reader (and "HiLo" antenna) toward the location of tags when they are mounted on vehicles, at the "sweet spot" distance.

Wiring the Reader (for Wiegand Interface) *(Study Figure 3 carefully)*

1. Check the power supply and cable(s) for power and data to be certain that they meet AWID's specifications ("Preparation", p. 1).
2. Connect the wires -- *yellow* to *black* at the reader; *black* and *red* to the power supply; *green* and *white* and *blue* to the controller.
3. Connect the reader's *drain* (bare silver) wire to the shields of all cables. **Do not ground** drain and shield wires – they must float.
4. Keep the reader's *orange* wire available for connecting the LR-2200KIT's test unit. Tape off *violet* and *brown* wires separately.
5. For LR-2200HiLoMA, screw the coaxial cable's rings to the brass connectors on the reader and the antenna. Seal the connectors.
6. Do not tape or seal the wire junctions until the complete system has been tested thoroughly. Keep all junctions accessible for test.
7. Test the reader (and antenna) using the LR-2000KIT Installation Kit. The hand-held test tags should read on the test unit at 15 ft.

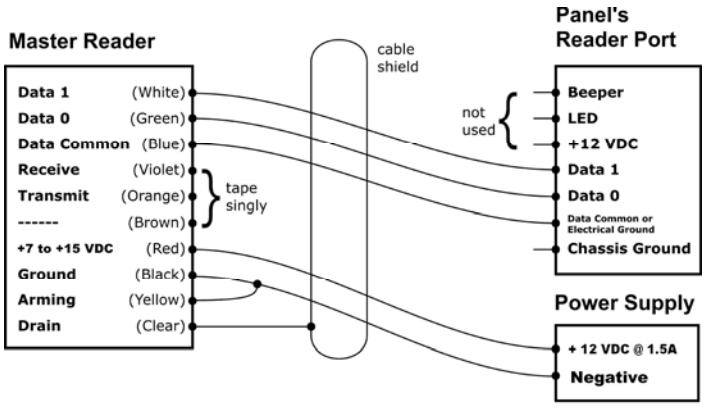


Figure 3. Wiring the Complete System for Wiegand Interface

Using Tags and Cards

- Select a location for the tags that has clear line-of-sight between the tags and the reader. Tags should be about parallel to the face of the reader at the reading distance (the "sweet spot" - 15 feet). Test the tags with both "landscape" and "portrait" orientation.

VT-UHF Visor Tag: Clip the tag on the sun visor. At about 15 feet, the driver lowers the visor so the tag faces the reader.

HT-UHF Hangtag: Hang the tag on the inside rearview mirror's post. Or hold the tag, by fingertips at its hook, inside the vehicle.

RV-UHF Mirror Tag: Using the tag's adhesive, press the tag smoothly on the frame of the inside mirror, facing the reader.

WS-UHF Windshield Tag: Using the tag's adhesive, press the tag firmly inside the glass, at least 2 inches from edge of windshield.

MT-UHF Metal-Mount Tag: Fasten tag outside or inside the vehicle, using screws, pop-rivets, Velcro dots, or the tag's adhesive.

CS-UHF Clamshell Card and **GR-UHF Graphics Card**: Hold facing reader with fingers at edges of card. (Read on UA-612 also.)

Programming the System

1. Complete the LR-2200 reader's (or "HiLo" master reader's) interface to the host access control or vehicle identification system.
2. Program the applications system for the type of reader, and for the tags' code format, facility (or site) code, and card numbers.
3. Assign suitable programming for the individual tags in the cardholders' database – gate groups, time zones, priority levels, etc.
4. Program the applications for the action to be taken for each valid read – gate motor operation, data recording, reports generation.

Testing the Completed System

1. Drive a vehicle with a mounted tag into the read range on the lane. Observe the code registered by the system for accuracy.
2. Test operation of all functions by driving a vehicle with an authorized tag code past the reader and through the gate repeatedly.
3. Study the PC monitor's data display for full and correct information about events on the system. Watch for "Access granted".
4. Enter the command for a report of events in the system – for individual vehicles in a time period and for history at a single gate.

If a Problem Occurs

1. Use the LR-2000KIT Installation Kit to measure performance of the reader with hand-held test tags. Isolate the problem.
2. Study the LR-2200 Installation Manual, Part C – Trouble-Shooting, for an organized way to identify a problem source.
3. Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions visit … www.awid.com/support or call +**1-800-369-5533** (in the U.S.) or +**1-408-825-1100** from 8:00 a.m. to 5:00 p.m. Pacific Time.

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LR-3000 Reader and Tags – Quick Installation Guide

If you are new to the LR-3000 Reader, or if this is your first long-range reader installation, we suggest that you call AWID Technical Support at 408-825-1100.

The LR-3000 Reader is a long-range Radio Frequency Identification reader that uses AWID's UHF vehicle tags and hand-held cards. This Guide describes installation using the *Wiegand* interface. For *RS-232* interface, download AWID's Technical Reference.

➔ ***Before you start the installation, download and study the LR-3000 Installation & Operation Manual.***

Preparation

- **Layout Plan**: Ideal conditions for the installation site are –
  - ► 1 vehicle length or more between the reader and the gate.
  - ► Vehicles driving in the lane that is nearest the reader, in a straight line, at up to 15 miles per hour.
  - ► Reader mounted on a bracket with pan-and-tilt adjustable head for aiming the reader.
  - ► Reader location and height to match vehicle type and tag type.
  - ► Reader and tags aligned, facing each other head-on (parallel to each other) at the reading distance – up to 25 feet.
  - ► Good tag location in vehicles determined by tests *before* attaching the tags.
- **Power Supply**: A separate dedicated DC power supply for each LR-3000 reader, connected to nothing else. For a 12-14 volt DC supply, current rating = 2 amperes or more, linear rated, regulated DC out. Install power supply 12 feet *or more* from the reader.
- **Cable**: May be separate cables for data and for power, or may be combined for data and power together. Max. length = 500 feet.
  For *power* alone – 18 gauge, 2 conductors, stranded wires, color-coded, overall 100% shielded, high quality.
  For *data* alone – 22 gauge, 3 conductors, stranded wires, color-coded, not twisted pairs, overall 100% shielded, high quality.
  For *combined* cable – 18 gauge, 5 conductors, stranded wires, color-coded, not twisted pairs, overall 100% shielded, high quality.
- **Mounting**: Adjustable pan-and-tilt bracket (Part No. LR-MB-0-0), required in most installations.

Pre-Installation Testing *(See Quick Installation Guide for LR-KIT Installation Kit)*

- *Before* installing at the site, run these tests at your shop. ➔ Cut off and discard the connector on the reader's cable.

1. Installation Kit (Pt.No. LR-KIT-0-0): Provides beep and LED color. No need to mount the reader or interface to the system.
2. Connections: Connect the 3 negative wires (**black** wires) on the reader, test unit, and power supply, plus the reader's **yellow** wire.
   Connect the reader's **orange** wire to the test unit's **orange** wire.
   Connect the 3 positive power wires (**red** wires) on the reader, test unit, and power supply. See Figure 1 for test wiring.
3. Holding test tags: Squeeze in fingertips at edge of tag. Hold tag at arm's length to your side. Tag and reader facing each other.
4. Procedure: When the test unit's LED is lighted **red**, present one of the test tags from the Kit to the reader. Measure (a) the maximum distance "R" where reads occur, and (b) the width "W" of the effective RF field at half of maximum reading distance.
5. Results: Tags should read at about 3 reads per second, inside the "balloon" (Figure 2). Maximum range "R" may be 35-40 feet.

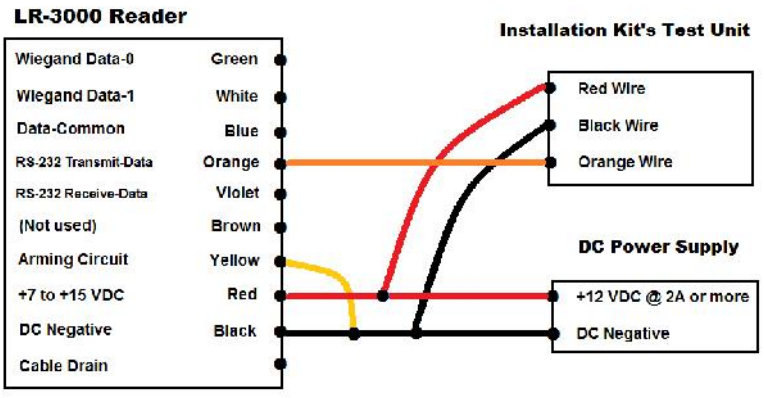


Figure 1. Connections for Pre-Installation Testing

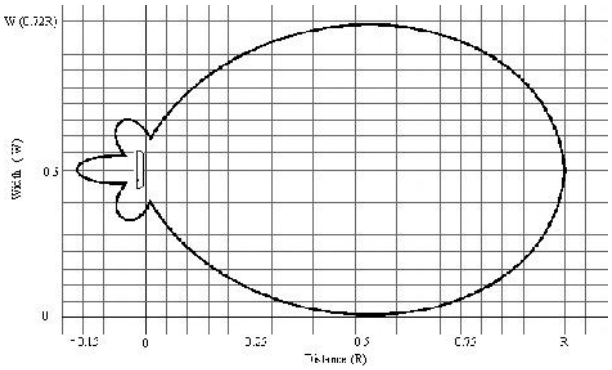


Figure 2. Effective RF Field for LR-3000 Reader

Mounting the Reader and the Remote Antenna *(See LR-3000 Installation & Operation Manual, Sections 5, 8 and 9)*

1. Fasten the mounting bracket to the pole, post, pedestal, wall or beam. Leave space for the reader unit's pan-and-tilt adjustment.
2. Fasten the reader to the bracket with 2 ¼"-20 screws. The LR-MB bracket includes fasteners.
3. Aim the reader toward the location of tags when they are mounted on vehicles, for the reading distance (up to 25 feet).

Wiring the Reader (for Wiegand Interface) *(Study Figure 3 carefully. There is no wiring for the reader's LEDs.)*

1. Check the power supply and cable(s) for power and data to be certain that they meet AWID's specifications ("Preparation", p. 1).
2. Connect the wires -- **yellow** to **black** at the reader; **black** and **red** to the power supply; **green** and **white** and **blue** to the controller.
3. Connect the reader's **drain** (shield) wire to the shields of all cables. **Do not ground** drain and shields – they must float.
4. Keep the reader's **orange** wire available for connecting the LR-KIT's test unit. Insulate **violet** and **brown** wires separately.
5. Do not tape or bead the wire junctions until the complete system has been tested thoroughly. Keep all junctions accessible.
6. Test the reader using the LR-KIT Installation Kit. A tag, held in fingertips, will be indicated by beeper and LED on the test unit.

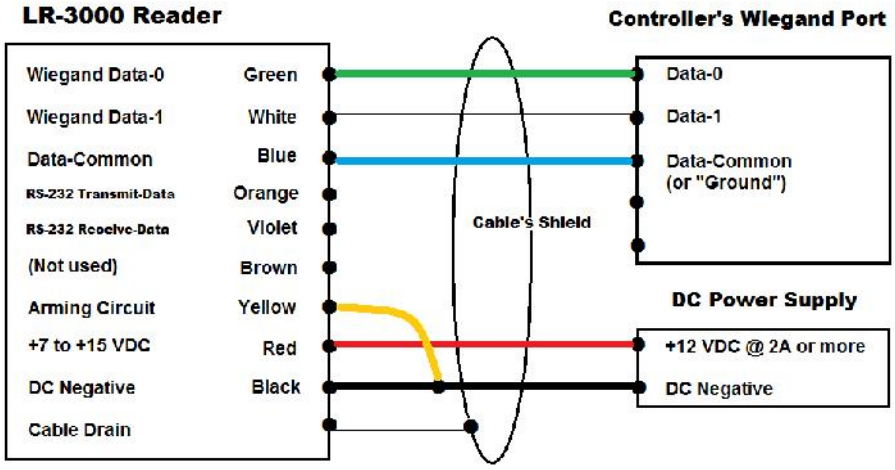


Figure 3. Wiring the Complete System for Wiegand Interface

The blue wire must connect to the panel's terminal that serves as Data Common. Look for a "Common" terminal. If none, use the "Ground" terminal.

Using Tags and Cards

- Select a location for the tags that has clear line-of-sight to the reader. Tags should be aligned with the reader, facing it head-on, about parallel to the reader at the reading distance. Test the tags using both "landscape" and "portrait" orientation.

VT-UHF Visor Tag: Clip the tag on the sun visor. At the reading distance, the driver lowers the visor so the tag faces the reader.

HT-UHF Hangtag: Hang the tag on the inside rearview mirror's post. Or hold the tag, by fingertips at its hook, inside the vehicle.

RV-UHF Mirror Tag: Using the tag's adhesive, press the tag smoothly on the frame of the inside rearview mirror, facing the reader.

WS-UHF Windshield Tag: Using the tag's adhesive, press the tag firmly inside the glass, 2 inches or more from edge of windshield.

MT-UHF Metal-Mount Tag: Fasten outside or inside the vehicle, by its adhesive, screws, rivets, wire ties, or hook & loop tape.

CS-UHF Clamshell Card and **GR-UHF Graphics Card**: Hold facing reader with fingers at edge of card. (Use with UA-612 also.)

Programming the System

1. Complete the LR-3000 reader's interface to the host access control or vehicle identification system.
2. Program the applications system for the type of reader, and for the tags' code format, facility (or site) code, and card numbers.
3. Assign suitable programming for the individual tags in the cardholders' database – gate groups, time zones, priority levels, etc.
4. Program the applications for the action to be taken for each valid read – gate motor operation, data recording, reports generation.

Testing the Completed System

1. Drive a vehicle with a mounted tag into the read range on the lane. Observe the code registered by the system for accuracy.
2. Test operation of all functions by driving a vehicle with an authorized tag code past the reader and through the gate repeatedly.
3. Study the PC monitor's data display for full and correct information about events on the system. Watch for "Access granted".
4. Enter the command for a report of events in the system – for individual vehicles in a time period and for history at a single gate.

If a Problem Occurs

1. Use the LR-KIT Installation Kit to measure performance of the reader with hand-held test tags. *Isolate* the problem.
2. On AWID's Web site, get the Technical Support memo "Support 4 – Trouble-Shooting". It will identify and cure problems.
3. Visit AWID's web site (www.awid.com) for product data and downloads. For technical support questions visit … www.awid.com/support or call **1-800-369-5533** (in the U.S.) or **1-408-825-1100** from 8:00 a.m. to 7:00 p.m. Eastern Time.

SENTINEL-PROX LR-3000

LONG-RANGE TAG AND CARD READER

Installation & Operation Manual



If you are new to the LR-3000 reader, or this is your first long-range installation, and you are having any concerns, we suggest that you call AWID Technical Support at +1-408-825-1100

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COMPLIANCE

FCC: This equipment has been tested and found to be in compliance with the limits for FCC Part 15 digital device. 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 with radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's expense.

The users are prohibited from making any change or modification to this product. Any modification to this product shall void the user's authority to operate under FCC Part 15 regulations.

This device complies with Part 15 of the FCC Rules. 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 operation.

Industry Canada: Operation is subject to the following two conditions: (1) This device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

CAUTION:

The reader should be positioned so that personnel in the area for prolonged periods may safely remain at least 20 cm (8 in) in an uncontrolled environment from the reader's surface. Observe FCC OET Bulletin 56, "Hazards of radio frequency and electromagnetic fields" and Bulletin 65, "Human exposure to radio frequency electromagnetic fields".

Table of Contents

1	INTRODUCTION	2
2	SPECIFICATIONS	3
PART A	INSTALLATION	5
3	PREPARING FOR INSTALLATION	5
4	TESTING READER AND TAGS BEFORE INSTALLATION	7
5	INSTALLING THE READER	8
6	INSTALLING THE CREDENTIALS	10
7	TESTING THE INSTALLED SYSTEM	11
8	INSTRUCTIONS FOR LR-3000HILOMA READER SET	12
PART B	PLANNING	13
9	APPLICATIONS	13
10	PLANNING FACTORS	14
PART C	REFERENCE	17
11	TROUBLE-SHOOTING	17
12	GLOSSARY	21

NOTE: READ AND USE THIS MANUAL.

FAILURE TO FOLLOW THE PLANNING AND INSTALLATION GUIDE MAY RESULT IN POOR PERFORMANCE AND EVEN CAUSE PERMANENT DAMAGE TO THE READER. THIS WILL VOID THE PRODUCT WARRANTY.

REVISION HISTORY

Version No.	Revised By	Date	Sections Affected	Remarks
1.0		05 June 2012	All	Initial version

1 INTRODUCTION

1.1 GENERAL DESCRIPTION

AWID's Sentinel-Prox LR-3000 Reader is an extra-long-range Radio Frequency Identification (RFID) reader that works with a selection of encoded credentials that may be clipped, hung, taped, adhered, fastened or held by hand inside or outside the vehicle. This reader comes with a unique combination of long read range, small size, and low power consumption. It has an internal power converter, allowing it to work with a wide range of supply inputs without affecting its performance. With a 12 volt DC supply, its current consumption is less than 1 ampere, making it suitable for a large selection of commercial power supplies. The LR-3000 reader has simultaneous Wiegand and RS-232 outputs. Its primary applications are automated parking garage entrance control, hands-free access control, vehicle identification, asset tracking, and asset management applications.

1.2 SPECIAL FEATURES

- Single small housing for reader electronics, RF module and antenna – blends into the landscape.
- Easy to install using a pan-and-tilt adjustable mounting bracket – available from AWID.
- Compatible with all commercial access control systems.
- Can be interfaced to a PC or to a special application controller.
- Shares code formats with other encoded cards, badges and tags.
- Allows mixing RFID products for several applications into an integrated system.
- Operates at low power level.
- Uses frequency-hopping technology in the 902-928 MHz band (standard).
- Passive tags assure small size, unlimited life, and easy mounting out of the driver's vision.
- Users do not need an FCC license.

1.3 SUGGESTED APPLICATIONS

- Automated vehicle identification for passenger cars, small trucks, big trucks and trailers, and railcars.
- Operation of vehicle gates and garage doors for authorized vehicles.
- Tracking material assets in containers and on pallets.
- Hands-free operation of doors and elevator call buttons for handicapped users (wheelchairs, gurneys) in ADA situations.
- Data collection using encoded cards and tags for input.

2 SPECIFICATIONS

2.1 LR-3000 READER

Input voltage:	Between +7 volts DC and +15 volts DC	
Input current (peak load):	At 7 volts DC	1.5 amperes
	At 12 volts	900 milliamperes
	At 15 volts	700 milliamperes
Read distance (guaranteed):	With UHF tags and cards	From reader to 15 feet or more, depending upon tag
Frequency:	Transmitter	902 MHz to 928 MHz
	Receiver	902 MHz to 928 MHz
Frequency-hopping channels:	Number of channels	125 channels (U.S.A. standard)
	Channel spacing	200 kHz
	Hopping sequence	Pseudo-random pattern of channels
Output data interfaces:	Wiegand electrical protocol, and RS-232 serial (simultaneous transmission)	
Reader housing:	Molded ABS plastic, on 1/8 inch aluminum back-plate; beige color	
Environment:	Temperature for 100% duty cycle	-31 to 113 °F (-35 to 45 °C)
	Temperature for 50% duty cycle	-31 to 150 °F (-35 to 65 °C)
	Operating humidity	0% to 95%, non-condensing
	Protection from weather	Gasket at edge of cover, grommet at cable entrance (Use shield or housing when required – Section 2.5.)

2.2 CABLE EXITING FROM LR-3000 READER

The cable that is integrated into the LR-3000 is 22 gauge, 10 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, 32 inches long. (The connectors on the reader's cable, when shipped, have no practical use. The installer removes these connectors and strips the insulation.)

Color assignment:

Red	DC power, positive	---
Orange	RS-232 interface, Transmit Data	Connect to controller's Receive Data.
Yellow	Enable RF transmission	Connect to reader's black wire for arming the RF generator.
Green	Wiegand interface, Data-0	---
Blue	Data-Common	For either Wiegand or RS-232 interface. Do not tie to black wire.
Violet	RS-232 interface, Receive Data	Connect to controller's Transmit Data.
Brown	(not used)	---
Black	DC power, negative	Do not ground.
White	Wiegand interface, Data-1	---
(No insulation)	Drain wire	Connect to shields of extended cables. Do not ground.

2.3 EXTENDED CABLE FROM READER TO PANEL AND POWER SUPPLY

The LR-3000 reader requires cables with particular specifications. If the installation will use separate cables from the reader to the power supply, and from the reader to the reader input panel, use these specifications –

Power cable: 18 gauge, 2 conductors, stranded wire, color-coded insulation, overall 100% shielded, high quality.

Data cable: 22 gauge, 3 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

If power and data share the same cable, use these specifications –

Combined cable: 18 gauge, 5 conductors, stranded wire, color-coded insulation, not twisted pairs, overall 100% shielded, high quality.

The maximum allowable length of cable for **Wiegand** interface is 500 feet. The maximum specified length of the cable for **RS-232** interface at 9,600 bits per second is 75 ft; this may be stretched for certain equipment to 500 ft or more using Cat 5 cable. Length of a separate **power** cable should not exceed 500 ft.

Unlike proximity readers, the LR-3000 reader uses 2 separate wires for Power Negative (black) and for Data-Common (blue). These wires must not be connected to ground, nor to each other, nor to any other circuit.

2.4 POWER SUPPLY

- The LR-3000 reader requires a separate, dedicated DC power supply for each reader. Do *not* connect the reader's power wires (red and black) to the panel's + DC Power and Ground terminals. Connect only the reader to its power supply.
- For multiple readers, you may use a multi-section DC supply if the sections are isolated electrically from each other, if each section has its own positive and negative terminals, and if each section has sufficient current rating for the LR-3000 reader.
- The ideal power supply has current rating of about 1.5 times the current drawn by the LR-3000 reader. This helps to assure that the direct current remains quiet and steady. (See the table, below.)
- The most common DC power supply has a nominal output voltage range of 12.0 volts to 13.8 volts (including power supplies for charging a back-up battery). To power a single LR-3000 reader, this power supply must have a current rating of 1.5 amperes or more.
- The PS-12-3.3A plug-in power module in AWID's LR-3000KIT Test & Set-up Kit is suitable for a single LR-3000 reader.
- Certain commercial power supplies require excess current rating to assure quiet DC output, for example, 2.5 amperes at nominal 12 volts for a single reader. Contact AWID's Technical Support for discussion of acceptable power supplies.

Voltage Applied to Reader	Current Load of Reader (maximum)	Current Rating of Power Supply (minimum)
7 volts DC	1.5 amperes	2.25 amperes
12 volts DC	900 milliamperes	1.5 amperes
15 volts DC	700 milliamperes	1.2 amperes

2.5 PROTECTIVE HOUSING

The LR-3000 reader should be mounted inside a protective, non-metal housing for certain characteristics of the installation site – if the reader is mounted outdoors, and if it is exposed directly to rain or snow, or to bright sunlight in a hot environment. Example of a suitable housing: The Housing Company, Model PCH196 (Lexan, hinged and locked door, 14 inches by 14 inches by 3 inches).

2.6 READER'S EFFECTIVE RF FIELD

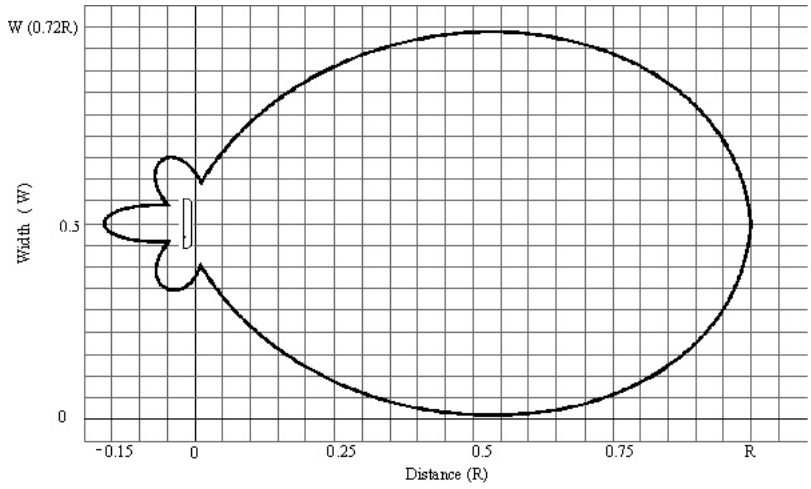


Figure 1. Effective RF field for tags with LR-3000 reader.

- The effective RF field is a figure of rotation of this diagram about its horizontal axis. Polarity of transmitted RF is circular.
- "R" is the read range (maximum distance) for each AWID UHF tag or card. The typical reading distance is 10 feet to 15 feet, depending upon the tag or card type and the reader mounting. The field's diameter "W" is about 6 feet at the reading distance.

PART A INSTALLATION

3 PREPARING FOR INSTALLATION

3.1 STUDY THE APPLICATION

- Determine what your client wants. Discuss the requirements with AWID's Technical Support.
- Visit the site; take photographs; draw diagrams; compare with similar installations. Look for unusual features.
- Study the Planning sections in this Manual to be sure that all factors have been considered. (See Part B.)
- Prepare a list of products and materials. Ask AWID's Technical Support for ideas and review.

3.2 GUIDELINES FOR THE INSTALLATION

1. Plan about *one car length* between the reader and the gate, where possible. This allows the vehicle to continue moving slowly as the tag is read and as the gate opens.
2. Select a reader location where the vehicle can move in a *straight line* for about one vehicle length as the tag is read.
3. Use an *adjustable mount* or bracket for pan and tilt-down aiming of the reader at the "sweet spot" where most of the credentials will be located in and on the vehicles.
4. Select a *reader height* that matches the location of credentials in and on the vehicles. See Section 9 for the popular combinations of reader mounting and vehicle types.
5. Locate the reader and credentials so that they are facing and *parallel* to each other when credentials are in the "sweet spot".
6. Experiment with *tag location* in the vehicles. Move a tag to different locations, and try both orientations ("portrait" and landscape"). Hook the HT-UHF Hangtag behind the inside rearview mirror. Hold the RV-UHF Rearview Mirror Tag against the mirror's frame. Clip the VT-UHF Visor Tag to the sun visor. Press the WS-UHF Windshield Tag against the windshield using a block of plastic foam. Hold the MT Metal-Mount Tag in place by tape over the screw-holes, or by a Velcro dot.
7. Restrict the vehicles to a lane that is a *single vehicle width*. Use lane markings, cones, bollards or barriers to assure that vehicles stay close to the reader.
8. Instruct drivers to move at about *5 miles per hour* as the tag is being read. Use signs and speed bumps at the "sweet spot".
9. Watch for applications that suggest use of the *LR-3000HiLoMA* set. See Sections 9.5 & 9.6 for discussion of these cases.
10. Listed outdoor enclosure should be used when installing outdoors.

3.3 WIRING – GOOD PRACTICES

- Use only *shielded cable* for all readers, and for power, and for door locks or gate operator control. Unlike proximity readers, do *not* ground the LR-3000 reader's cable shields.
- Use a *separate cable* for each reader. Do not share the reader's cable with wires that carry switched power, like door locks, or power to electrically noisy devices. (But data, TTL control, and dry-contact circuits may share the LR-3000's cable.)
- Do not connect the wires for two LR-3000 readers *in parallel*. Neither power nor data lines should be in parallel. (Parallel connection changes the pulse transmission characteristics, and prevents the host system from identifying the reader addresses individually.)
- Connect the reader's negative power wire (black) *first*, and positive power wire (red) *last*. Disconnect in the opposite order.
- *Remove power* from the reader before making any wiring changes.
- The Wiegand Data-0 and Data-1 lines should not share a *twisted pair* in the cable from the reader to the controller. If it is necessary to use twisted-pair cable, separate the data lines into two different pairs. For example, combine Negative Power (black) with Data-0 (green) in one twisted pair; and combine Positive Power (red) with Data-1 (white) in a second twisted pair. This minimizes cross-talk of Wiegand data pulses from one data line to the other.
- The LR-3000 reader has *no LED*. The lens in the corner of the reader's cover is a dummy. Use the LR-3000KIT instead.
- The LR-3000 reader has 3 separate wires that serve as negative or common conductors – *black* for Power Negative, *blue* for Data-Common, and *bare silver* wire for cable shield Drain. These 3 wires must not be tied together anywhere in the system, and they must not be connected to ground anywhere.
- The LR-3000 reader has wiring that is different from any proximity reader, or any other technology. You must follow the *wiring diagrams* and the *instructions* in this Manual to have the reader function correctly.

- Unused wires from the reader's cable must be taped or capped *separately*, so that they touch nothing.

4 TESTING READER AND TAGS BEFORE INSTALLATION

4.1 INTRODUCTION

Careful preparation is important for successful installation of AWID's long-range readers and credentials. Simple bench-testing gives the installer confidence in the performance of the reader and the credentials, before the products are taken to the site. This testing isolates the reader and credentials from all other factors that contribute to performance of the final assembly.

4.2 ITEMS FOR BENCH TESTING

AWID's long-range reader and credentials are tested easily using only the items listed below. It is not necessary to interface the reader to a controller panel or reader-input module while conducting this test.

- LR-3000 reader (It does **not** contain an LED.)
- HT-UHF hangtag (26-bit code), or other tag *
- SP-6820-LR test unit, cable with 3 clips *
- PS-12-3.3A power module, cable with 2 clips *
- Wiring diagram, Figure 2 (below)

* *A component of the LR-3000KIT Test & Set-up Kit*

4.3 SUPPORTING THE READER

The reader's effective RF field, in which the long-range credentials can be detected, is maximized when there is no material in front of the reader or immediately to the sides of the reader. See the LR-3000 Effective RF Field diagram (Figure 1 on page 4).

- Cut off the connector from the LR-3000 reader's cable. Prepare the pigtails for the planned installation. Keep the unused wires separated from each other.
- Hang the reader on a clear vertical surface in an open space, about 4 feet above the bench top, 4 feet from a side wall, and 4 feet below the ceiling.

4.4 WIRING FOR QUICK TEST

- Connect the wires as shown in the wiring diagram, Figure 2 (below).
- Be sure that unused wires are touching nothing. Do not cut off unused wires yet.
- The *first* connection made is the reader's black (negative power) wire. The *last* step is to plug in the DC power module.

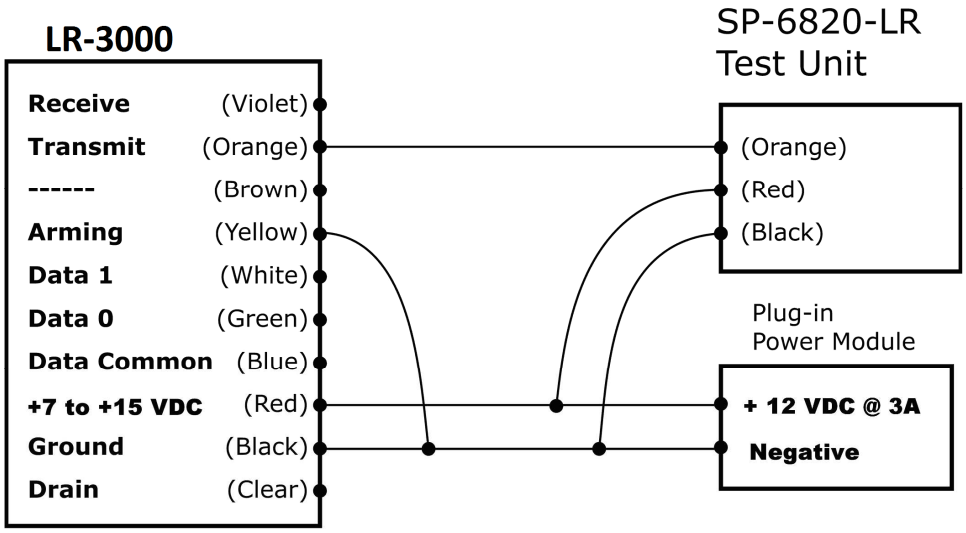


Figure 2. Wiring for quick test.

4.5 HOLDING THE TAG

- Hold the test tag by the fingertips, with the hand behind the tag. Hold the tag at arm's length, to the side of your body. Or …
- Attach the test tag to a non-metal stick. Stand to the side of the reader's RF field, and extend the tag into the reader's field.
- Hold the tag so that the face of the tag is approximately parallel with the reader's face. (The reader is circular-polarized, so the credentials may be held at any angle – up-and-down, or side-to-side, or diagonal.)
- Move the tag slowly though the effective RF field in front of the reader. Observe the edges of the zone and the point of maximum read range. The widest part of the zone is at about half of the maximum range.

4.6 TEST RESULTS

- Proper operation of the reader and credential is indicated by a signal from the SP-6820-LR test unit each time that the credential is read. The LED changes briefly from Standby red to green, and a short beep (4 kHz tone) is heard. If the card or tag remains in the reader's effective RF field, reads repeat at about 3 per second (factory default rate).
- By moving the test tag in the space in front of the LR-3000 reader, the tester can map the extent of the effective RF field that is plotted in Figure 1. The reading distance should extend from the reader's face to the guaranteed 10 feet or 15 feet with the test tags. The maximum diameter of the field's cross-section, at half of the maximum range, should be about 6 feet.

5 INSTALLING THE READER

5.1 INTRODUCTION

Before installing the long-range readers and credentials, the rest of the application system is usually in place and tested. The system components for each entrance are commonly –

- Computer with the application program (may be shared)
- Controller panel and reader-input module
- Gate or door operator (control and motor)
- Status switch for gate or door
- Request-to-exit switch or sensor
- Safety loop detector beyond the gate or door
- Buried loop to detect approaching vehicles
- Independent power source (*not* from the panel)
- Cables in conduit

These installation instructions are for the LR-3000 reader's Wiegand interface, using Data-0 and Data-1 wires (like most readers in access control). ***Note**: LR-3000 wiring is <u>not</u> the same as a 125 kHz proximity reader. Follow the instructions in Section 5.3.* If a serial interface using RS-232 protocol will be used, please download AWID's Technical Reference on RS-232 Reader Interface.

Collect these items to install the readers and credentials at the site –

- LR-3000 readers
- Mounting brackets and housings for readers
- Power supplies, cables, and other material
- UHF long-range tags and cards
- LR-3000KIT Test & Set-up Kit
- "LR-3000 Installation and Operation Manual"

For additional information, please visit AWID's Web site www.awid.com. For technical support questions, visit www.awid.com/support, or call **<u>1-800-369-5533</u>** (in the U.S.) or **<u>+1-408-825-1100</u>** from 8:00 a.m. to 5:00 p.m. Pacific Time.

5.2 INSTALLING THE LR-3000 READER

1. Before starting installation at the site, *plan* the project. Study Sections 9 and 10 of this Manual.
2. Keep the reader assembled. Do *not* remove the aluminum plate behind the reader. Do *not* remove the plastic cover of the reader. Do *not* tighten or loosen the screws through the cover. This preserves your Warranty.
3. Attach the LR-MB mounting bracket to the reader's metal plate using 2 screws (1/4"-20, supplied).
4. To use a different mounting device, make an adapter plate or bracket that lets you fasten your mounting device to the two capture nuts at the center of the reader's aluminum plate (1/4"-20 thread). Do *not* drill holes through the aluminum plate. In most applications the mounting device must allow pan-and-tilt adjustment for the reader.
5. Inspect the installation space. The reader may be mounted on any material including metal, but there must be open space in front of the reader and to its sides. There must be no material interfering with the reader's effective RF field between the reader and the credentials' location.
6. Measure the mounting height. It must relate to the location of the credentials when they are read at the "sweet spot". For passenger vehicles it is typically at a height of 7 feet, to the side of the vehicle lane.
7. Be aware of the environment. Stay away from UHF communications devices. Avoid arc lighting fixtures by 3 or 4 feet. Aim neighboring readers so that their effective RF fields do not overlap. Mount readers for parallel lanes at least 12 feet apart, with the axes of their effective RF fields parallel to each other. Do not have LR-3000 readers facing each other (but "back-to-back" is OK). If reader is outdoors, mount it inside a plastic housing to protect it from direct sunlight and rain.
8. Test the site for electronic devices that may interfere with the LR-3000 reader. If interference is suspected, remove power from the other device while observing the LR-3000 reader's performance.
9. Fasten the reader's adjustable bracket or housing to the pole, post, pedestal, wall, beam or ceiling.
10. Aim the reader at the location of the credentials (cards or tags) in the vehicle, when the credentials are at their reading distance from the reader. AWID guarantees minimum reading distance for its UHF credentials of 10 feet to 15 feet, depending upon the credential type. When the credentials are at this "sweet spot", the reader and the credentials should be facing each other, and about *parallel* to each other.

5.3 WIRING THE READER (FOR WIEGAND INTERFACE -- Figure 3)

1. The cable between the LR-3000 reader and the controller panel should be (see complete specifications in Section 2.3) –
   - 5 conductors for data & power
   - 18 gauge for 2 power wires; 22 gauge for 3 Wiegand data wires
   - Stranded wire
   - "Bunched" (not twisted-pair) *
   - Color-coded insulation
   - Overall 100% shielded
   - High quality
   - Maximum length – 500 feet

   * *If the cable* is *twisted pair, combine negative (black wire) with one data line (green or white wire) in one twisted pair, and combine + DC power (red wire) with the other data line in a second twisted pair. This reduces crosstalk on the data lines.*
2. From reader to power supply – **Black** wire for DC negative (first connection), and **red** wire for DC positive (last connection). Each reader's power supply must be a separate supply (see specifications in Section 2.4) that is connected to nothing else.
3. Arming circuit – For continuous RF from the reader, connect its **yellow** wire to the black wire at the reader permanently. For control of the reader's RF transmission by a vehicle sensor, connect the yellow wire to the relay contacts of the vehicle sensor. To disarm the reader (no RF transmission from the reader), let its yellow wire float.
4. From reader to panel's reader input port – **Green** wire to Data-0, **white** wire to Data-1, and **blue** wire to Data-Common. For Data-Common, use a terminal with this name if available. If not, use this reader port's "Common" or "Ground" terminal.
5. Drains for shields – Tie the reader's **bare silver** wire to the shields of the power and data cables. **Do not ground the drain**.
6. Grounds – Connect the panel's ground to earth-ground only if instructed by the panel's manufacturer. The LR-3000 reader and its power supply have **no ground connection**. Do not connect black, blue and drain wires together.
7. Unused wires – Keep the reader's **orange** wire available to connect the LR-3000KIT's test unit during set-up and tests. Wrap or cap the **violet** and **brown** wires separately.
8. Testing – While the cable terminations and junctions are still accessible, test the system for full function and performance. Then seal the terminations.

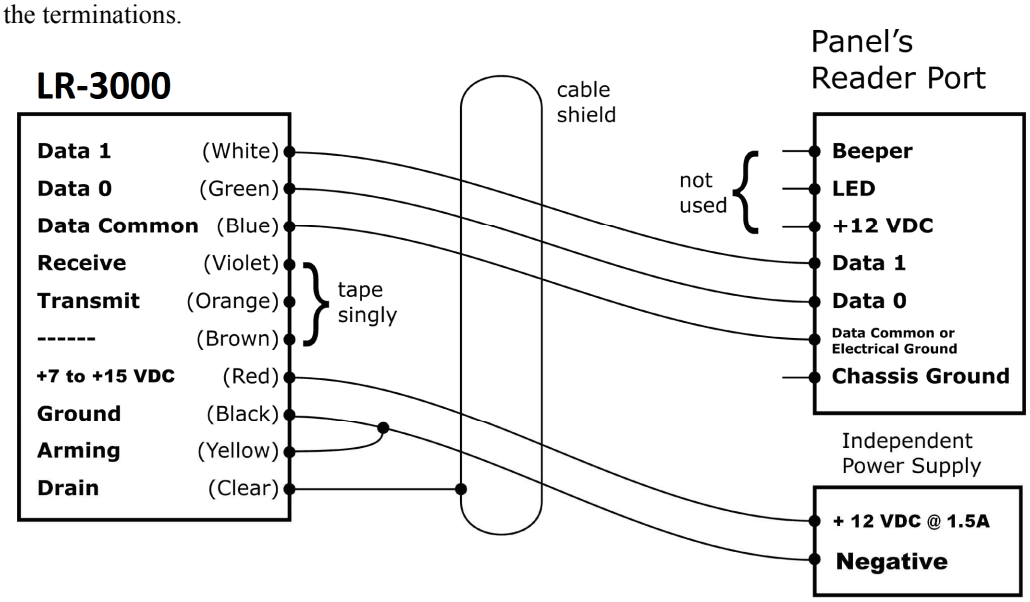


Figure 3. Wiring for LR-3000 installation.

5.4 AIMING THE READER

This step should be taken before the credentials are installed in or on the vehicles. From the LR-3000KIT Test & Set-up Kit, use the test unit, and one of the hand-held test tags, and the wiring diagram in Figure 2 on page 6. The reader does not have to be interfaced with the host system (but they *may* be connected together). Use the DC power module from the LR-3000KIT Test & Set-up Kit *only* if the independent DC power supply is not yet connected.

1. With no vehicle present, hold the hand-held test tag approximately where the vehicles' credentials will be located when they are read. This is typically at about 10 feet or 15 feet from the reader, depending upon the selected tag type.
2. With the test tag held at this "sweet spot", adjust the pan and tilt angles of the reader until the test unit indicates most robust reading. (Occasional reads will be missed normally because of the frequency-hopping feature of the LR-3000 reader.)
3. Map the outer limits of the reader's effective RF field by moving the tag slowly up-and-down and side-to-side through the field, and along the axis from the reader's face to the point of maximum range.

6 INSTALLING THE CREDENTIALS

6.1 GENERAL RULES

1. The relationship between the *reader's* location and aiming, and the location of the *credentials* (cards or tags) inside or outside the vehicle, is important for good performance. Plan the installation considering these factors before installation starts.
2. Start by testing the LR-3000 reader using the LR-3000KIT's test unit and the hand-held test credentials, with no vehicle present at the reader. When good read range has been proved, proceed to mounting the cards and tags in or on the vehicles.
3. The "*sweet spot*" for reading a credential in or on the vehicle is typically 10 feet to 15 feet, measured between the face of the reader and the location of the credential. Note: The sweet spot is shorter than the credential's rated "*read range*", which is the total distance between the reader and the farthest point at which a hand-held credential can be detected.
4. At the sweet spot, the credential should *face the reader*, with clear *line of sight* (through the windshield is OK) to the reader, and with the credential and the reader about *parallel to each other*. Aim the reader at the sweet spot.
5. Orientation of a credential may be "portrait" or "landscape" or diagonal. Reading will be most active when either long edge of the credential is closest to the reader as the tag approaches the reader's effective RF field.
6. Keep your hand and your body away from the cards and tags, to avoid blocking or reducing the card's or tag's RF field.
7. Before attaching WS-UHF tags to the windshield, clean the windshield near the tag, inside and outside.
8. To attach tags to side windows, select a window that does not lower into the door frame. Align tags with a reader at the side.
9. If necessary, turn off RF sources on the vehicle, such as pre-collision warning sensors and UHF communications gear.
10. Prevent buildup of snow over the tags. Use windshield wipers to remove water from the windshield. Near the ocean, wash the windshield near the credential to remove salt coating.
11. Prepare instructions for the users' staff member who will oversee tag installation. Copy the suggestions in the sub-sections below for the appropriate card or tag, and copy the sub-section in Section 9 – Applications that matches this installation.

6.2 VT-UHF-0-0 VISOR TAGS

1. Mount the reader, usually over the driver's side of the vehicle, or at the left side of the lane.
2. With the visor raised, clip the tag over the upper edge of the visor. The tag faces the driver.
3. As the vehicle approaches the reader's sweet spot, lower the visor so that the tag faces the reader and is parallel to the reader.
4. When the gate or door operation starts, swing the visor back to its raised position.

6.3 HT-UHF-0-0 HANGTAGS

1. For hanging tag, mount the reader over the center of the lane. For hand-held tag, mount the reader at the left side of the lane.
2. Hook the hangtag over the stem that fastens the inside rearview mirror to the windshield. Either side of the hangtag may face the windshield.
3. The hangtag may be read either by leaving the tag hanging from the mirror's stem, or by holding the tag between the fingers at the hook-end of the tag, with the tag facing the reader.

6.4 CS-UHF-0-0 CLAMSHELL BADGE and GR-UHF-0-0 GRAPHICS CARD

1. Mount the reader so that it faces the card when the driver holds it in the sweet spot through the driver's open window.
2. Present the card to the reader. Keep the fingers at the edge of the card. Hold the card parallel to the face of the reader.

6.5 RV-UHF-0-0 REARVIEW MIRROR TAG

1. Peel off the label that covers the tag's adhesive backing. Attach the tag to the housing of the inside rearview mirror, facing the windshield, at the driver's side of the stem that supports the mirror.
2. Mount the reader so that it is aimed at the tags at their "sweet spot". The reader's face should be about parallel to the tags.

6.6 WS-UHF-0-0 WINDSHIELD TAG

1. Mount the reader so that it faces the WS-UHF tag at the "sweet spot" reading location. See Figures 4 and 5 for typical uses.
2. Move the vehicle so that the windshield is at the reading distance. Press the large paper label of the WS-UHF tag flat against the inside of the windshield. Use a hand-sized block of plastic foam (flexible but firm), 2 inches thick, to press the tag.

3. Test the tag at different locations inside the windshield. Try high and low, several inches from the vehicle's door pillar, in "portrait" and "landscape" orientation. Avoid embedded wires, metal coating, dark tinting, RF emitting devices. If reading distance is too short, use a different AWID UHF card or tag.
4. Peel the paper label off the tag. Press the tag's adhesive flat against the inside of the windshield. This is a one-time application. The tag will not work after it is pulled from its original position. The tag can not be moved between vehicles.
5. WS-UHF tags will not read if held in the fingers, or carried, or taped. It reads only when adhered to the windshield glass.

6.7 MT-UHF-0-0 METAL-MOUNT TAG

1. Mount the reader so that it faces the MT tag at the "sweet spot" reading location. See Figure 6 for an example at the left side.
2. The MT tag may be hand-held, or attached inside or outside the vehicle. Attachment may be permanent or temporary. Inside the vehicle, use Velcro dots or the tag's adhesive. Outside, use rivets or plastic screws, or the tag's adhesive, or sealant.
3. The tag must remain flat when held or attached. Do not hold or cover the tag between the two lines molded in the plastic.
4. Try vertical and horizontal orientation. Outside, vertical orientation may give best reading. Face the tag parallel to the reader.
5. Test the tag. Then finish installation by snapping the screw-hole plugs in place, for security and good appearance.

7 TESTING THE INSTALLED SYSTEM

7.1 INTRODUCTION

Install the system's components, and apply power to all components. The LR-3000 reader and the UHF credentials may be tested in several ways that look at isolated parts of the system, and at the integrated system. This helps to assure that the complete system is functioning normally, and to identify a problem area, if any. (See Section 11 – Trouble-Shooting for solutions to particular problems.)

7.2 TESTING AWID'S PRODUCTS (ISOLATED)

At any time the LR-3000 reader may be disconnected from the other components of the system, and the performance of the reader and the credentials tested by themselves.

1. Disconnect the power supply cable and the data cable from the reader. Break these circuits at the reader, not at the power supply or at the controller panel, so that problems with the cables and junctions can be detected also.
2. Use the LR-3000KIT Test & Set-up Kit at the LR-3000 reader. Follow the instructions in Section 4, but keep the reader installed and the cards and tags mounted normally.
3. If the test unit indicates normal reader performance using the hand-held test tag, continue testing using the UHF cards, and tags that are mounted in the vehicles.
4. If the reader is not operating, contact your source of the AWID products for a Return Material Authorization (RMA).
5. When the LR-3000KIT indicates normal operation of the reader and credentials, connect other components of the application system one-by-one, watching for recurrence of the problem. Continue to use the LR-3000KIT as an indicator for the LR-3000 reader while the system is reconnected.

7.3 TESTING OUTPUT OF THE LR-3000 READER

The LR-3000 reader has two data outputs – Wiegand and RS-232. Wiegand is commonly used for access control systems including automated vehicle identification. RS-232 is suited for commercial systems like truck scales and supply chain management. There are simple techniques that show the condition of the reader's data interfaces.

1. To test the reader's **Wiegand** output:
   - Interface the reader's 3 Wiegand data lines to this system's controller, *or*
   - Interface the reader's 3 Wiegand data lines to a different access control system that works normally with other readers and cards, *or*
   - Connect a test, display or enrollment device, such as Cypress Computer Systems' WDG-5912 Keyboard Data Wedge, *or*
   - Use a dual-trace oscilloscope suitable for AWID's data output (100 microseconds pulse width, 2,000 microseconds interpulse spacing). Connect the oscilloscope's leads for Data-0 (green and black wires) and for Data-1 (white and black wires).

2. To test the reader's **RS-232** output:

   - Interface the reader's 3 RS-232 data lines to the system's controller, *or*
   - Interface the reader's 3 RS-232 data lines to a different commercial system that works normally with other readers and cards, or with other RS-232 output devices, *or*
   - Clip the test unit from AWID's LR-3000KIT Test & Set-up Kit to the LR-3000 reader, *or*
   - Interface the reader's 3 RS-232 data lines to the serial port of a PC, and run the Windows HyperTerminal program *, *or*
   - Connect the leads for a single-trace oscilloscope suitable for AWID's data output (9,600 bits per second) between the reader's Transmit Data and Data Common (Ground) wires.

     * In Microsoft Windows, the path is: Start → Programs → Accessories → Communications → HyperTerminal → Hypertrm.exe. Configuration is 9,600 bits per second, 1 start bit, 8 data bits, 1 stop bit, no parity, ANSI emulation, flow control = any. To open the port and start HyperTerminal, click on the Call tab at the top of the window, and select the option "Start Call".

7.4 TESTING AN APPLICATION SYSTEM

When the LR-3000 reader is interfaced to the reader input port of the application system, the format of displayed data depends upon the programming of the system. In a typical access control or automated vehicle identification system, the program allows selection of a code format that replicates the Wiegand-style encoding that AWID has programmed into the credentials. Therefore the system's monitor may display the code data in the same data fields, and the same number system (decimal), that AWID uses for its encoding. Testing may be as simple as reading the decimal values of the credential's data fields on the monitor.

If the system's monitor indicates that data are received from the reader but not recognized by the host ("Code format error", "Facility code error", "Parity error", etc.) –

- Check the host's programming.
- Check the reader's output.
- Check the wiring between the reader and the controller.
- Check the credential's code on a different reader or on a different system.

If the system's monitor indicates no data input from the reader –

- Test the LR-3000 reader and the credential by interfacing to a different controller that is known to work normally.
- Test the system by connecting the LR-3000 reader directly to the controller's reader port, bypassing the cable and junctions.
- Test the system's input substituting a different reader and a compatible card or tag.

8 INSTRUCTIONS FOR LR-3000HiLoMA READER SET

AWID's **LR-3000HiLoMA** is a set of two units that work together at a reader location. One unit is a Master Reader that controls the alternation of RF transmission between the two units. The second unit is a Remote Antenna, in an identical housing. The two units are interconnected by a coaxial cable. Instructions for installing the LR-3000HiLoMA reader set can be downloaded from the public documents in AWID's Web site, www.awid.com/support.

- Position: The master reader and the remote antenna may be in either position at the site. The deciding factor may be the position of the master reader that results in the easiest or shortest cabling.
- Protection: If you mount the reader units upside down, the coaxial connectors will have added protection from rain and snow.
- Separation: AWID supplies a 6 foot long coaxial cable to connect the remote antenna to the master reader. When installed on brackets, the practical maximum separation between the master reader and the remote antenna is about 4 feet. Do not attempt to substitute a longer cable, because electrical loss in the cable will reduce the emote antenna's read range.
- Accessories: All accessories for the LR-3000 reader apply also to the LR-3000HiLoMA reader set. Use the same LR-3000KIT.
- Reference Documents: o LR-3000HiLoMA Installation Sheet. o Technical Reference issues for description, applications, etc.

PART B PLANNING

9 APPLICATIONS

9.1 INTRODUCTION

The **LR-3000** reader is especially designed for Automated Vehicle Identification (AVI). The chief variables that must be considered in planning the readers and credentials for the system are –

- Lane characteristics
- Vehicle types
- Reader location
- Credential characteristics

The most important factors in planning a system are listed in Section 3.2. These must be considered carefully when laying out the plan for the installation.

The following paragraphs describe particular applications and recommend reader location and tag type for each application.

9.2 SMALL VEHICLES ONLY

If the reader is *beside the lane*, mount the reader as close to the edge of the lane as possible without damage to the reader. Choose the left side of the lane when possible, because this side is easier for the driver (in right-lane-driving countries) to judge the vehicle's location relative to the left edge of the lane. Mount the reader on an adjustable bracket at a height of about 7 feet (for small cars, 6 feet may suffice). Attach or hold a UHF card or tag on the same side of the vehicle as the reader. Aim the reader at the tags when they are at the "sweet spot" – about 10 to 15 feet direct measurement from reader to tag as the vehicle approaches the reader. See Figure 4.

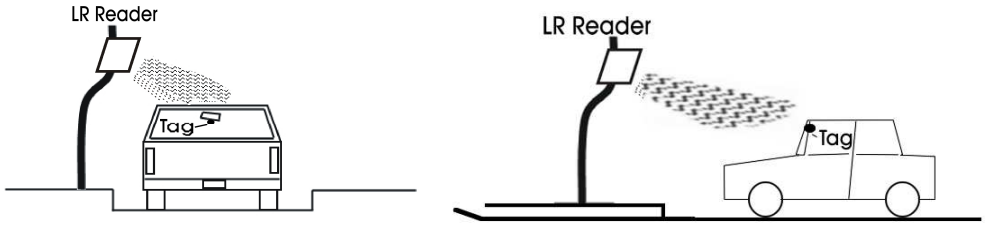


Figure 4. Passenger vehicles -- reader beside lane.

If the reader is *centered above the lane*, as inside a parking structure, mount the reader on an adjustable bracket at the lowest height that assures safe clearance between the reader and the highest vehicle. Hook a HT-UHF Hangtag over the inside rear-view mirror's stem, or attach an RV-UHF tag to the back of the mirror facing the reader, or adhere a WS-UHF Windshield Tag to the upper center of the windshield, behind the mirror, several inches below the top of the windshield. Aim the reader at the tags when they are at the "sweet spot". See Figure 5.

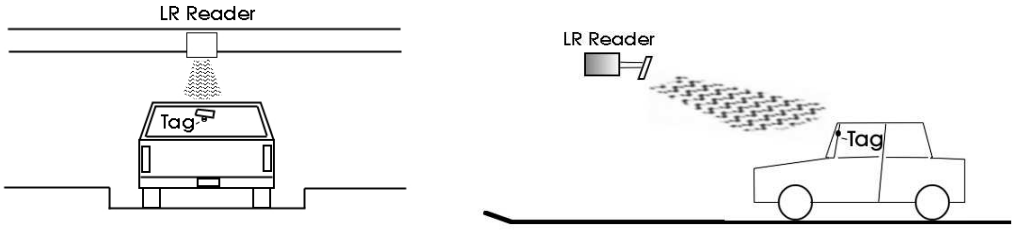


Figure 5. Passenger vehicles -- reader above lane.

9.3 MIXED PASSENGER CARS, PICKUPS, VANS AND SUVs

This application is a variation of Section 9.2. The reader beside the lane should be at about 7 feet height; the reader above the lane must be raised to clear the higher vehicles. Mount the tags and cards in small vehicles (sports cars) higher than in larger vehicles (SUVs). This places the tags and cards for all vehicles at about the same position relative to the reader. See Figure 4 and Figure 5.

9.4 LARGE TRUCKS AND BUSES

Follow the general suggestions for vehicles in Sections 9.2 and 9.3, regarding the location of the reader mounting (beside the vehicle lane or over the center of the lane). Select the UHF card or tag that performs best in the combination of vehicle lanes, vehicle types, reader locations, and credentials characteristics. See Figure 4 and Figure 5.

9.5 MIXED VEHICLES OF ALL SIZES

Use the **LR-3000HiLoMA** reader set, consisting of a Master Reader and a Remote Antenna. Mount the Master and Remote units on adjustable brackets at locations that are suitable for the type of tags and cards that will be used in the different vehicles. The reader brackets are usually supported by a single pole or pedestal, at heights that assure clear line of sight between the readers and the tags in all vehicles. (To reduce cable length, it is often best to mount the Master Reader lower than the Remote Antenna. Invert the units so that the coaxial connectors are at the *bottom* edge.)

Aim the readers individually at the locations of tags and cards when they are at the sweet spots for the two vehicle types or sizes.

9.6 SPECIAL CONDITIONS

The LR-3000HiLoMA reader set may be used also to spread out the effective RF field so that it covers a larger continuous area. (The read range does not become longer, but the cross-section size of the field may become larger.)

Spreading the field *horizontally* is helpful when –
- the vehicle lane turns – for example, the lane to the gate carries vehicles that turn off a through street, *or*
- the vehicle lane is wider than a single lane, and some vehicles may be farther from the edge of the lane where the reader is located.

Spreading the field *vertically* is helpful when –
- tags are on a mix of small and large vehicles, requiring the readers to be aimed at different heights to read all tags, *or*
- the reader is on a hill, or at the crest or dip in a hill, causing the tags to be at variable heights when they are read, *or*
- the reader is near a change in the elevation of the lane surface, as at a curb or gutter or drain.

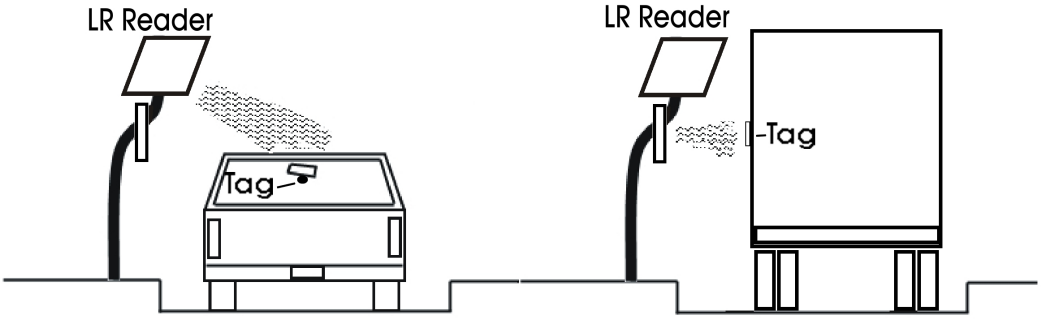


Figure 6. Mixed passenger vehicles and large trucks -- using LR-3000HiLoMA.

The LR-3000HiLoMA has a single data interface to a single reader port on the host panel. This reader set uses a single reader address in the host system.

10 PLANNING FACTORS

10.1 INTRODUCTION

Preparation for the LR-3000 installation pays dividends for the installer. The following topics cover the common questions. These topics apply generally to all forms of the LR-3000 reader. The environmental, electrical, interference and temperature range characteristics likewise apply to all forms of the LR-3000 reader. These characteristics are optimized if a buried-loop vehicle sensor arms the reader for RF transmission only when a vehicle is present at the reader.

10.2 ENVIRONMENT

- Physical obstructions: The space where the reader will be mounted and aimed must be clear.
- Weather: If the reader is installed outdoors, mount it inside a non-metal housing to protect the reader from direct rainfall and snow, and to shade the reader from bright sunlight. If ambient temperature is very high, use a vehicle sensor to arm the reader.
- RFI: Avoid sources of radio frequency emission that might interfere with the reader. Stay 3 or 4 feet from fluorescent lights.

10.3 LANE LAYOUT

- Lane geometry: The lane should be straight for about a vehicle length where the reader reads the tag. Avoid sharp turns from through streets into short driveways.
- Multiple lanes: Locate and aim readers so that they do not interfere with each other. For readers in parallel lanes, pointed in the same direction, minimum centerline distance between the lanes is 12 feet.
- Reader location: If readers are above the lanes, aim neighboring readers parallel to each other. If readers are on posts beside the lanes, aim the readers so that one reader is not aimed directly at the back of the neighboring reader.
- Eliminating cross-reader interference: If readers must be close to each other so that their effective RF fields overlap, use the LR-3000HiLoMA reader set. This set of 2 units transmits RF alternatively, so that only one unit is active at any time.

10.4 VEHICLE TYPES

- All passenger car types: A single LR-3000 reader usually works for sport cars, sedans, SUVs and pickups, unless tags are in diverse locations on the vehicles.
- Mixed small and large vehicles: The LR-3000HiLoMA reader set is available when cards and tags are spaced apart on vehicles of different sizes.
- See Section 9 for details on reader selection for mixtures of vehicle types and sizes, and on reader location.

10.5 VEHICLE MOTION – IDEAL CONDITIONS

- Vehicle in motion while the tag is read at the “sweet spot”.
- Vehicle moving in a straight line while the tag is read.
- Vehicle close to the reader location.
- Vehicle’s tag facing the reader’s front face, and about parallel to it, when the tag is at the sweet spot.
- Vehicle speed around 5 miles per hour for safety. (OK to experiment with higher speed.)

10.6 VEHICLE MOTION -- CONTROLS

- To enforce the vehicle speed – use signs, speed bumps, traffic signals (red/green lights), gates, instructions for drivers, .
- To enforce the vehicle path – use signs, painted stripes, cones, bollards, barriers, instructions for drivers.

10.7 READER TYPE

- Typical case: Most applications are served well by a single LR-3000 for each vehicle lane.
- Diverse vehicle sizes: For a combination of large and small vehicles in a lane, use LR-3000HiLoMA mounted *over-under* on the same post, for example. The “over” position may be for tags and cards in passenger cars. The “under” position may be for tags and cards on the side of buses and large trucks.
- Turning lanes: To increase the horizontal spread in a tight turn, use LR-3000HiLoMA mounted *side-by-side*. Aim the reader and remote antenna somewhat apart. Test for continuity of field using the LR-3000KIT Test & Set-up Kit.

10.8 READER POSITION

- Above the lane or beside it? – Either position works. If the reader is above the lane, the reader must be no higher than is required for vehicle clearance – typically less than 10 feet above the lane, unless the tags are all high on the vehicles. If the reader is beside the lane, the height and aiming depend on the type and location of tags on the vehicles.
- Which side? – Either right or left side works. Left side (driver’s side) is better, because the driver finds it easier to align the vehicle with the left side of the lane, and with the reader if it is on the driver’s side. (This applies to right-lane-driving countries.)

10.9 READER MOUNTING

- Adjustable bracket: The reader (and remote antenna) must be adjustable for both "pan and tilt" (in camera parlance – that is, horizontal and vertical panning) for proper aiming. See AWID's LR-MB (11 inch long arm, with a two-axis adjustable head). The installer may use a camera bracket effectively.
- Fixed reader: The reader may be fastened directly to a wall, flat against the wall, in applications where the tags are on the side of vehicles facing the reader, as on buses, large trucks and trailers, and on wheelchairs, gurneys, containers, etc. Distance between reader and tags should be about 4 feet to 10 feet.
- Distance from lane: For a reader on a side post, locate the reader close to the edge of the lane, but safe from side-mirrors and errant drivers. For a reader above the lane, locate the reader as low as possible while leaving clearance for roof-racks, etc.
- Reader aiming: The "sweet spot" for reading credentials is when the credential is typically about 10 feet to 15 feet from the reader. The goal is to have the tag facing and about parallel to the reader's face when the tags are read.

10.10 ELECTRIC POWER

- Isolation: For each LR-3000 reader, or for each LR-3000HiLoMA set, provide an independent DC power supply that is not used to power any other equipment. Use a separate DC power supply for each LR-3000 reader. A single power supply is used for LR-3000HiLoMA.
- Quality: The power supply should be regulated, linear-rated (where allowed). Use a switching power supply if required, 8 feet or more from the reader.
- Voltage: Voltage at the reader must be between 7 volts and 15 volts DC. Prevent voltage drop of more than several tenths of 1 volt between power supply and reader.
- Current: For a typical 12 volts to 13.8 volts supply, the current rating must be 1.5 amperes or more with a linear power supply, and 2.5 amperes or more with a switching power supply.

10.11 CABLE

- Number of conductors: Depends on whether DC power for the reader is combined with data transmission in the same cable. Cables are usually specified in multiples of 2 conductors.
- Power: 2 conductors in shielded cable. Use 18 gauge wires between the reader and the power supply.
- Data: 3 conductors for either Wiegand interface or RS-232 interface. Use 22 gauge (18 gauge is OK).
  For Wiegand, use parallel wires – not twisted pairs. For RS-232, Cat 5, twisted or untwisted, is good.
- Other specifications: Overall 100% shielded. Stranded wire. Color-coded insulation. Maximum length – 500 feet for Wiegand data and power; 75 feet for RS-232 data at 9,600 bits per second (up to 500 feet with certain terminal equipment). High quality.

10.12 MOUNTING THE TAGS AND CARDS

- See the complete instructions for installing all credentials in Section 6.
- Attachment: The different credentials have different requirements for mounting in or on the vehicles, or for holding by hand. Visor Tags use a molded clip for the sun visor. Hangtags hook on the inside rearview mirror or are held by fingers. Clamshell Badges and Graphics Cards are squeezed between a finger and thumb. Windshield Tags adhere inside the windshield glass. Rearview Mirror Tags adhere to the frame of the inside mirror, facing the windshield.
- Orientation: The flat surface of the credential should be about parallel to the face of the reader. The hand should be behind the tag when the tag is held by the fingers. The tag may be held "portrait" or "landscape" relative to the reader; the angle does not matter.
- Pre-installation testing: Hold the tag as intended in normal operation, or attach it temporarily (using masking tape, for example) in the planned location. Drive the vehicle slowly through the sweet spot. Observe the LR-3000KIT's test unit for consistent reading. Adjust the reader's position and aiming, and the credentials' location, and the vehicle's path and speed, as required.

10.13 ACCESSORIES

- LR-3000KIT Test & Set-up Kit: *Absolutely required*. AWID may not be able to support the installer if the Kit is not at the site.
- Documents: The complete LR-3000 Installation & Operation Manual must be at the site with the installer.

10.14 AVOID …

- "Toll-tag attitude": If the drivers are used to high-speed tollgates with active tags, they will feel restricted by a long-range reader using passive vehicle tags. Emphasize the desired goal of having the gate at the LR-3000 installation open, by driving at reasonable speed in a reasonable fashion near the reader. Point out the long life and the low cost of passive cards and tags.
- Metal in or on vehicle's windows: Anti-glare tinting … reflective coating … metallic coating for automatic windshield wipers … embedded wires for defrost or antenna. These metal materials can reduce or block transmission from tags to reader. ("Lead glass" does *not* reduce performance.)
- Electronics in the vehicle: Pre-collision warning sensors and certain communications gear, while they are active, may interfere with other RF transmission, including LR-3000's tags and cards. However, most communications devices (cell phones, portable radios) and GPS have no effect on the tags.

PART C REFERENCE

11 TROUBLE-SHOOTING

11.1 PRODUCTS AND TOOLS

AWID Products:

LR-3000 long-range reader
PS-12-3.3A DC power module *
SP-6820-LR test unit *
UHF cards or badges for LR-3000 *
Adapter cable, 3 clips to 9-pin "D" *

RF-SD Detector for RF fields *
"LR-3000 Installation Manual"

Required Tools:

Digital multimeter (20 VDC, 5 ADC)
Common hand tools
Back-up battery – 12 V, 7.5 A-hr

Desirable Tools:

Proximity reader (small) and card
Oscilloscope, dual-trace, 915 MHz
RF spectrum analyzer

* Component of the LR-3000KIT

11.2 SUMMARY

The following 4 steps summarize the trouble-shooting procedure for the LR-3000 reader, from the simplest combination of products and test tools, to the complete access control system. The detailed trouble-shooting subjects start at Section 11.3.

1. Bench-testing at your shop: Test the reader using the instructions in Section 4 with Figure 2. Follow all steps. Goal: To be confident that the LR-3000 works by itself stand-alone, communicating only with the test tags and the test unit..
2. Interfacing to a PC: Connect the reader's RS-232 output to the serial input port of a PC. Run the Microsoft Windows HyperTerminal program. Watch for a column of data in rows of 18 hexadecimal characters. Do not mount the reader yet. Goal: To see consistent data from the test tag's programmed code, at the programmed repetition rate.
3. Interfacing to the system: Connect the reader *directly* to the reader input port on the host system's controller panel. This bypasses the cable and junctions between the reader and the panel.
   Goal: To see the reader transmit the tag's code to the host system, with correct code consistently, and with access granted.
4. Connecting the complete system: Test the system as described in Section 7, using all components of the system. Goal: To confirm proper operation of the system in its final form.

11.3 GOOD IDEAS

- Do not "button up" the system mechanically or electrically until you have tested it thoroughly, and until you are confident that all components are working as specified.
  - Do not make final adjustments on the reader's mounting yet. Keep the fastener's accessible.
  - Do not cut and trim cables and wires yet. Keep all terminations available for measurements and for changes.
- Identify what the system is doing wrong, or what it isn't doing right.
  - Isolate the system's components. How does each component work alone? Decide which component is at fault.
- Keep the LR-3000KIT with you. It is absolutely necessary, and it may pay for itself in the first installation.
  - The Kit tells you when the reader reads a tag. It helps also in locating tags in the vehicle, and in aiming the reader.

11.4 POWER SUPPLY

- ☐ Use an independent power supply, not connected in any way to the controller panel or other system components.
- ☐ Do not connect other readers and other devices to the LR-3000 reader's power supply.
  - Connect only a single LR-3000 reader to a power supply, and no other electrical load – not even a small proximity reader.
  - Have a different power supply for each LR-3000 reader.
  - Multiple readers may connect to a single power source if the DC outputs are isolated electrically from each other.
- ☐ Check the power supply's specifications.
  - A separate DC power supply for every reader. Black and red wires connected only to this one power supply.
  - Voltage = between 7 volts and 15 volts DC (commonly 12.0 to 13.8 volts).
  - Current rating for a nominal 12 volt power supply: For a linear supply, at least 1.5 amperes for each LR-3000 reader. For a switching supply, at least 2.5 amperes; locate the supply at least 8 feet from the reader.
  - AWID's PS-12-3.3A plug-in power module (in the LR-3000KIT) is suitable for a single LR-3000 reader.
  - For Altronix power supplies, select "Linear" rating and minimum current rating of **2.5** amperes. Model LPS3 is good.
- ☐ Calculate voltage drop between the power supply and the reader. The 4-point test is --
  1. Measure voltage at the power supply with nothing connected to the supply (no-load test).
  2. Connect the cable to the power supply (but with the reader not connected). Measure voltage at the power supply.
  3. Measure voltage at the reader-end of the power cable before the reader is connected.
  4. Measure voltage at the reader when it is connected to the power supply (black and red wires).
  - Voltage drop is a combination of power supply regulation, and voltage drop in the cable. This should not exceed a few tenths of a volt. Check the reader's current draw, and the cable's wire gauge, and the power supply's current rating.
- ☐ Measure DC current in the reader's red wire.
  - Set the multimeter's function to DC Amperes, and the range to 2 A or 5 A or 10 A.
  - Disconnect the reader's red wire from the power cable.
  - Insert the multimeter's leads in series – positive lead toward the power supply, and negative lead toward the reader.
  - With voltage restored to the reader, its current is typically about 450 milliamperes in standby (no tag present), and about 900 milliamperes momentarily when the reader is processing and transmitting a tag's code.
- ☐ To evaluate the reader's DC power supply and the power cable, substitute a back-up battery in place of the power supply.
  - Disconnect the reader from the independent DC power supply and the power cable.
  - Replace the power supply temporarily with a back-up battery (typically 12 volts, 7.5 ampere-hours, fully charged). This will power the LR-3000 reader for a working day. Alternative: Connect long clip leads to your truck's battery.
  - A charged battery has perfect DC voltage quality and plenty of current rating.

11.5 CABLE

- ☐ Check the specifications of the cable between reader and panel, and between reader and power supply. They should be –
  - Stranded wires, color-coded insulation, overall 100% shielded, outside plastic sheath, high quality.
  - For *power*: 18 gauge wires, 2 conductors, twisted-pair is OK.
  - For *data*: 22 gauge wires, 3 conductors, not twisted-pair.
  - For *power and data* in same cable: 18 gauge, 5 conductors, not twisted-pair.
  - Maximum length for *Wiegand* interface (using the reader's Data-0 and Data-1 lines) is 500 feet. For longer cable runs, use a Wiegand extender or a wireless transmitter. See Cypress Computer Systems' Web site, www.cypressworld.com.
  - Maximum length for *RS-232* serial interface is 75 feet at 9,600 bits per second. 500 feet is possible in special cases.
- ☐ If existing cable is twisted-pair (rather than "bunched" wires), run Data-0 and Data-1 through different twisted pairs.
  - Example: Run Data-0 and DC power positive in one twisted pair, and run Data-1 and DC power negative in another pair.
- ☐ Check the cable's junctions and splices.
  - Be certain that they are solid, clean, dry, insulated, shielded and *tested*.
  - Do not let the cable shield touch metal conduit. Check metal conduit's ground. Check for water inside conduit.
- ☐ If a cable problem is suspected, disconnect that cable, and run a temporary cable on the surface.
  - If the reader now works normally, pull new cable through the conduit, with no splices or junctions.
- ☐ If existing power cable has 22 gauge wires, connect spare wires in parallel for both DC positive and DC negative.

11.6 WIRING

- **Wiring an LR-3000 reader is *not* the same as wiring other reader types.** For the Wiegand interface, Data-0 and Data-1 lines are the same, but all other wires are *different*. 8 of the reader's 10 wires must be used or reserved; 2 wires ate not used.
- Study the wiring diagram in Figure 3. Compare the actual wiring with this wiring diagram.
- The reader must be armed to transmit its RF field. To arm the reader, its *yellow* wire must be connected to its *black* wire.
  - To transmit RF only when a vehicle is present at the reader, use a buried loop or other vehicle sensor with relay contacts that connect the yellow and black wires temporarily.
- There must be no connection between the reader's power supply and the host system's panel – not even a ground connection. The power supply must be floating.
- The reader's drain wire and the cables' shields must be connected together, but they must not be grounded. These shields must be floating. (Induced noise is drained inside the LR-3000 reader.)
- *Never* connect 2 readers' data lines in parallel on one reader input port. Always use a separate port for every reader. This preserves the data pulse shape, and allows each reader to have its own address in the host system.
- To bypass a problem in the cable, wire the LR-3000 reader directly to the panel's reader input port.
  - Connect the reader's **3** data wires directly to the panel's reader input port – green to Data-0, white to Data-1, and **blue** to Data-Common on the *same reader port*. If there is no terminal labeled "Data-Common" on that reader port, connect the blue wire to the electrical Ground or Common terminal on that reader port, which serves as data-common also.
  - Use an independent DC power supply that meets AWID's specifications fully (Section 11.4). Do not connect the reader's black and red wires to the controller panel.
  - If the reader now operates normally, there may be a problem in the cable or its junctions, or in the conduit.
- Check the unused wires on the reader.
  - The unused wires must not touch each other or anything else. Tape them off singly.
  - The violet and brown wires are never used. They should be separately taped or capped.
  - The orange wire is used by the SP-6820-LR test unit (part of the LR-3000KIT Test & Set-up Kit). Keep this wire continually accessible for testing.
- For RS-232 serial interface, see AWID's Technical Reference "RS-232 Interface". Download it from www.awid.com/support.

11.7 GROUNDING

- **The LR-3000 reader has no grounded wires.** Three wires are used as common or negative wires – *black* wire for power supply negative, *blue* wire for data-common, and *drain* (bare silver) wire for shield draining.
  - These 3 wires *must* be wired correctly as shown in Figure 3. These 3 wires must *not* be connected to each other.
  - The reader's *yellow* wire must be connected to the *black* wire to arm the reader for RF transmission. (See Section 11.6.)
- The reader's power supply DC negative and the panel's electrical ground must be kept separate.
  - Do not wire these two negatives together. Let the power supply's secondary (DC) side float.
  - The panel and readers must be powered by different DC power supplies (or isolated outputs in a multi-channel supply).
- Check the reader's drain wire (silver stranded wire without insulation).
  - The drain must be tied to the shield of the cables between the reader and the panel, and between the reader and the power supply – **but** the shields must not be grounded anywhere. The shields must float. (Draining occurs inside the reader.)
- Measure voltage between earth-ground and the system's electrical ground.
  - Voltage must not exceed a few tenths of a volt in AC or DC. If it does, have a qualified electrical contractor check the 3-wire 120 VAC grounded power line and receptacle that feeds the DC power supply for both the panel and the reader.
  - Check that the 120 VAC green wire is at earth-ground. Check that the black and white AC wires are not reversed at a receptacle or junction.

11.8 ISOLATION

- “Green field test” = Disconnect everything from the reader, except power. Move the reader to a remote location that has no electrical or RF noise. Use a backup battery (12 volts, 7.5 ampere-hours, fully charged) instead of the DC power supply. Test using the test unit and test tags from AWID’s LR-3000KIT Test & Set-up Kit.
  - Observe the reader’s performance by itself. Map the reader’s effective RF field by moving the tag slowly, side to side, gradually farther from the reader. Measure the maximum width of the field, and the farthest point where the tag reads. (This is the reader’s read range for that tag.)
  - Reconnect the rest of the system, one component at a time. Observe the reader’s performance at each step. What is it that makes the problem re-appear?
- Disconnect other devices near the problem reader. Observe performance of the LR-3000 reader by itself.
  - Remove power temporarily from proximity card readers, communications gear, intercoms, telephone-access controllers, fluorescent and other arc-type lamps, PCs and monitors, transformers, motors, etc., that are near the LR-3000.
  - When the LR-3000 is connected directly to the system’s panel, disconnect other readers that are connected to that panel.

11.9 REPLACEMENTS AND SUBSTITUTIONS

- Try a different reader in place of the problem reader:
  - Is there a spare LR-3000 reader in your truck or at your shop? If so, use it in place of the original reader.
  - Is there another LR-3000 reader, installed at this site, operating correctly? If so, interchange the two readers, and observe if the malfunction moves with the reader or stays at the original location?
  - Do you have a different kind of reader, like a proximity reader and a compatible card or tag? If so, wire it into the panel in place of the LR-3000 reader. This may indicate a panel or system programming problem.
- Do all tags give the same results? Try other tags and compare results.
- Interface the LR-3000 reader to an access control system that has tested good previously with a different reader.

11.10 ENVIRONMENT

- Remove power temporarily from all other equipment near the reader that generates magnetic fields or electric fields.
  - Look for communications antennas, PC monitors, arc-type lighting (including fluorescent), heavy electrical equipment (elevator motors, air conditioners, etc.), RF-type telephone access panels, other RF-type readers (even 125 kHz proximity readers), high-voltage 60 Hz power lines, etc.
- If the reader’s cable to the system has a junction inside the gate-motor housing, try removing power from the gate motor for the reader performance tests.
- Shield the reader from possible RF noise sources:
  - Form a large sheet of aluminum foil into a hemisphere around the reader’s rear and edges, to block environmental RF interference. Leave the aluminum foil open in front of the reader so that the reader can communicate with the test tags.
- Remove power from other LR-3000 readers that are less than 12 feet from the tested reader if they are aimed parallel (as in neighboring lanes at the gates), or less than 30 feet from the tested reader if they are aimed head-on toward the tested reader.
  - Does the problem go away? Does the reader operate normally?
- To see how the reader performs when it is removed from possible RF interference, do a “green field” test.
  - Collect the LR-3000 reader, a back-up battery (or use your truck’s battery), a tag, and the test unit from the Test & Set-up Kit. Carry them to a remote site away from interfering devices. Test the reader’s performance under these conditions.

11.11 HOST SYSTEM

- Observe messages on the PC monitor while the access control program is running.
  - If no message – there may be no data input from the reader to the panel, or from the reader input module to the controller.
  - If no message – there may be input data but not with the number of bits for which the system is programmed. For example, induced noise or data collision may add bits to the normal bit stream from the reader (commonly 26 bits).
  - If the message indicates bit-count error, or format error, or parity error, or facility code error, or non-valid identification number – find the source of the error. It may be incorrect programming of the host system, or of AWID’s cards or tags.
  - Watch the “Access denied: …” message. The listed reason for denying access may point to the cause of failure.

- Program the host system to configure the data input from the readers.
  - Enter the code format of the tags (usually "26-bit Wiegand standard"), the tags' facility code or site code, and (in the cardholders database) the ID number for the individual tag.
  - Program your own test tag as an administrator, with top-priority level, access to all doors or gates, for all days and times.
- If the tag's code data shown on the PC monitor are different from the code that is printed on the tag's label –
  - *Consistently wrong* code for every read indicates that the tag is programmed wrong. Test the code from a different tag.
  - *Randomly different* code for every tag read indicates induced noise, intermittent wiring connection, or incorrect system grounding. Check for cable and wiring problems.
- If the problem is data collision in the host system because it can not process repeated code inputs quickly enough –
  - Use the reader's arming circuit to transmit a single code read to the system. Touch the yellow wire to the black wire for only about one-half second. Does the system process the single code transmission correctly, every time?
  - Contact AWID about slowing the LR-3000 reader's repetition read rate to prevent data collision in the host system.

11.12 POINTERS

- Keep the screws that fasten the aluminum plate to the reader's plastic housing in place. Do not drill holes in the plate.
- Shield the LR-3000 from direct rain, or from bright sunshine in hot weather. Mount the reader inside a plastic housing.
- Remove heavy snow from the face of the LR-3000 reader, and from the windshield over tags inside the vehicle.
- Wipe rain from the windshield. Wash salt coating from the windshield. Avoid metal films and embedded wires.

11.13 TESTING TOOLS AND TECHNIQUES

- Digital multimeter (DMM): Absolutely necessary for voltage checks, and for current measurements at the reader.
- Oscilloscope: Useful for observing digital data output at the reader and input at the panel, and for analyzing the pulse shape.
- Test tags: Test the tags on a reader that is known to work well, to be sure that the tags work at their full rating.
- Reader substitution: Indicates whether the problem is in the reader or in the other components at the "bad" location.

12 GLOSSARY

Controller panel ..... The electronic device that contains the input data port for the LR-3000 reader. For the Wiegand interface, this may be the access control system's panel or board near the reader or gate operator, or the reader input module (RIM). For the RS-232 interface, this may be the system controller or a PC's serial input port.

Credential ..... A token, such as a card or tag or wafer, that carries data to identify the individual token, and therefore to identify the person or vehicle by which the token is carried.

Effective RF field ..... The three-dimensional space in front of the LR-3000 reader in which the vehicle tag can be read by the reader. The field is circularly polarized. It has a circular cross-section at every distance from the reader. See Figure 1 for a diagram of the effective RF field.

Isolation ..... A trouble-shooting technique that separates the components of the system temporarily so that performance of the components can be observed and measured individually.

Lane..... The roadway that leads the vehicle past the reader and toward the gate. The ideal lane is a single vehicle width, or is marked by signs, painted stripes, cones, posts, bollards or barriers that remind the drivers to stay close to the reader.

Power supply, switching .... A DC power supply whose DC output is generated by a circuit that produces interrupted current flow, at a rate of around 25 kilohertz. (A **linear** power supply has continuous DC output, like a battery.)

Read range..... The space along the axis of the reader's effective RF field in which the tag can be read in hand-held testing. This extends from the LR-3000 reader's face to the maximum distance – typically between 10 feet and 15 feet, depending upon the tag. (See Figure 1, "Effective RF field".)

Substitution..... A trouble-shooting technique that replaces a component of uncertain performance with a similar component that you know works well.

Sweet spot ..... The space in front of the LR-3000 reader where most credentials in a given installation are read. This is typically about 10 feet to 15 feet direct measurement from the face of the reader. At the sweet spot, the reader's effective RF field has a cross-section with a diameter of about 4 feet or more.

Tag orientation..... Direction ("landscape" or "portrait") that tags are mounted in or on vehicles. If the reader looks down on a tag, landscape may give best reading. If the reader is at the side of the vehicle, portrait may be best.

Applied Wireless Identifications Group, Inc.
18300 Sutter Blvd., Morgan Hill, CA 95037 • Voice 1-408-825-1100 • Fax 1-408-782-7402 • www.awid.com

Quick Installation Guide – LR-2000KIT UHF Reader Test Kit

If you are new to the LR-2000, LR-2200 or LR-3000 reader, or if this is your first long-range installation, we suggest that you call AWID Technical Support at 408-825-1100.

The LR-2000KIT UHF Reader Test Kit is for planning, installing and testing the LR-2000, LR-2200 and LR-3000 readers, and their tags and cards. Keep the complete Kit, with this Guide, for quick access in your truck or shop. It is your prime tool to build confidence in performance of the LR-2000/3000-family reader and its tags.

Uses for the LR-2000KIT UHF Reader Test Kit

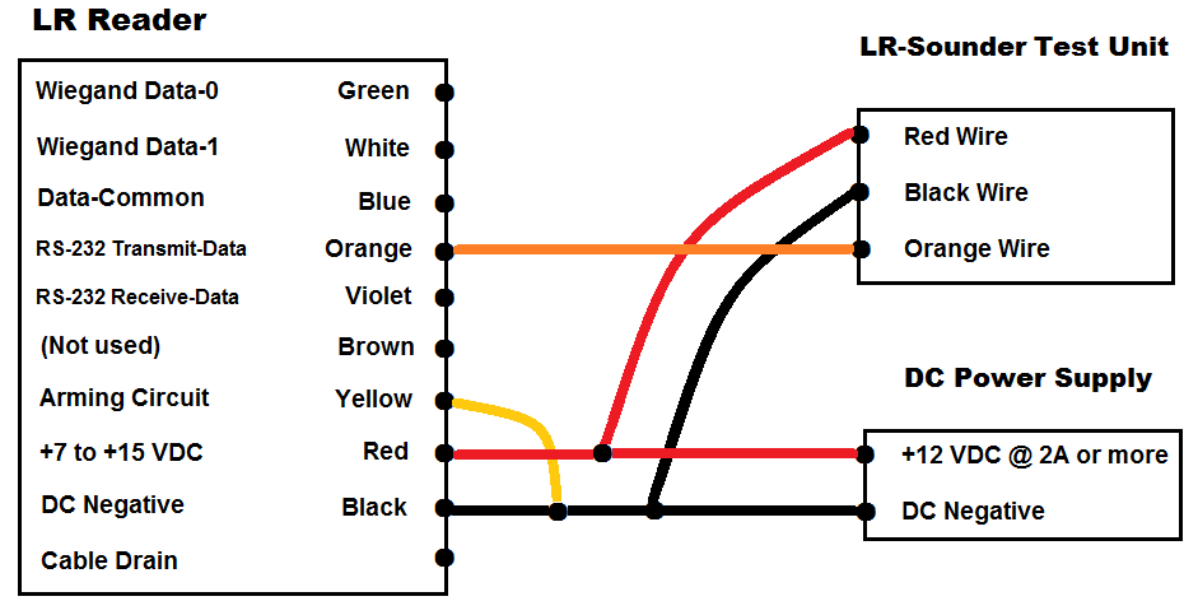
- Demonstrate the LR-2000-EVAL reader (special unit included in the Kit) to your sales prospects and customers.
- Test the planned location, to assure reliable operation of the long-range reader at the site.
- Observe performance of a regular LR-2000/3000-family reader, either in bench-testing or installed at the site.
- Select the ideal location for mounting the vehicle tags, or holding the cards, inside or outside the vehicles.
- Prove that the vehicle tags operate well after they are mounted in or on the vehicles.
- Substitute for the installed LR-2000/3000-family reader in a service call.

Inside the Kit's Case

- **"EVAL" Reader** – This is the 8 inch by 8 inch reader. It is a permanent part of this Kit. It has no data output. It can not interface to your system. It is for demo and test only. The "EVAL" reader contains *no* LED or beeper.
- **LR-Sounder Test Unit** – This unit (about 3 inches by 4-1/2 inches) alerts you to every read of the tag by the reader. It beeps and changes LED color when the tag is read. It is perfect for demoing and testing an installation.
- **USB-to-DB9 Adapter** – It extends the serial adapter below to a USB port on your PC or controller. (Black jacket.)
- **DB9-to-Clips Adapter** – It connects a reader to a PC or controller that has a 9-pin "D" serial port. (Gray jacket.)
- **DC Power Unit** – It provides 12 volts DC to test an LR-2000/3000-family reader, or to demo the "EVAL" reader.
- **Credentials** – 10 UHF tags and cards: GR-UHF Graphics Card, CS-UHF Clamshell Card, KT-UHF Keytag, HT-UHF Hangtag, VT-UHF Sunvisor Tag, WS-UHF Windshield Tag (on a piece of windshield glass), MT-UHF Metal-Mount Tag, RV-UHF Rearview Mirror Tag, SV-UHF Sideview Mirror Tag, and PT-UHF Portable Tag..
- **Instructions** – This Quick Installation Guide, laminated for long life.

Recommended Accessories

- Camera tripod, for temporary reader support at 6 feet height (supplied by the user).



Connections for Testing with the "EVAL" Reader

Use only the components from this LR-2000KIT UHF Reader Test Kit, including the "EVAL" Reader.

1. Clip together the LR-Sounder's black lead, the power module's black clip, and the reader's black and yellow wires.
2. Clip the LR-Sounder's orange lead to the "EVAL" reader's orange wire.
3. Clip together the LR-Sounder's red lead, the power module's red clip, and the "EVAL" reader's red wire.
4. Plug the power module into a 120 volts AC receptacle.

Connections to Test a Standard LR-2000/3000-Family Reader or a uAxcess Near-Field UHF Reader

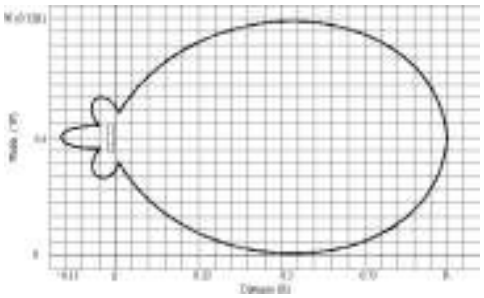
Use an LR-2000/3000-family reader that is installed and interfaced to the host system, or being tested before installation.

1. Clip together the LR-Sounder's black lead, the power module's black clip, and the reader's black and yellow wires.
2. Clip the LR-Sounder's orange lead to the LR-2000/3000-family reader's orange wire.
3. Clip together the LR-Sounder's red lead, the power module's red clip, and the LR-2000/3000 reader's red wire.
4. Plug the power module into a 120 volts AC receptacle.

Connections to Interface a Reader with RS-232 Data Output into a PC

Use an AWID UHF reader, either long-range (LR) or near-field (uAxcess).

1. Clip the three spring clips of the gray RS-232 Cable Adapter to the same colors of the reader's RS-232 data lines.
   For **uAxcess** readers, connect the adapter's orange wire to the reader's violet wire.
2. Plug the 9-pin "D" connector on the adapter into the serial port of the PC or controller
   If the PC has only **USB** ports, use the black USB Cable Adapter to extend the RS-232 adapter.
3. In the PC, run the AWIDACReaderSettings downloaded program. Print out the Instructions, which are zipped with it.
4. Observe the reader's RS-232 data output as a row of 18 hexadecimal characters for each read of a tag or card.



Measuring Performance

Test for these standard performance parameters.

(Note: Avoid holding the reader by hand. You will measure best read range when the reader and tags are away from your hands and body.)

- Hang the reader in a large open space, 8 feet from the floor and side walls, clear in front for 30 feet or more.
- Starting close to the "EVAL" reader, move the test tag back along an imaginary line from the front of the reader. Search for the farthest point at which a read is indicated by the LR-Sounder – often 25 feet or more for the tags and cards. This determines the maximum range of the reader.
- Holding the tag at half of the maximum range, move the tag up and down, and side to side, to determine the height and width of the effective RF field. This may be a circle with cross-section diameter up to 16 feet.
- Hold the test tag at 15 to 20 feet in front of the reader. Move the tag around to measure the cross-section of the effective RF field. This is the "sweet spot" at which most vehicle tags will be read after the reader is installed.
- Attach the vehicle tag temporarily inside the vehicle at the proposed location. Support the "EVAL" reader outside the vehicle, facing the tag, parallel to the tag. Move the reader away from the tag to find the maximum reading distance. (When holding the reader for portable testing, keep your fingers away from the edges of the reader.)

Suggestions

LR-Sounder: The tester is not necessary with the LR-3000 reader. This reader has built-in LEDs that show DC power and tag reads.
Tags: Use only one UHF tag or card in the reader's Effective RF Field. Move other tags and cards 30 feet behind the reader.

More Information

Visit AWID's web site (www.awid.com) for product data and downloads. For Technical Support questions, contact www.awid.com/support, or call in the U.S. +1-408-825-1100 from 5:00 a.m. to 5:00 p.m. Pacific Time.

AWID

Maximum RFID



LR-TEK™
LR Reader Tech Kit

AWID's LR-TEK UHF Installation Kit is the tool that –

- helps to sell a new UHF long-range reader,
- tests a new reader before you leave for the installation site,
- shows correct performance of the reader during installation,
- identifies the source of problem during a service call, and
- provides visible and audible feedback as the reader reads its tags.

The LR-TEK is provided in a small, sturdy carton with fitted padding. It works also with the UA-612 UHF switchplate-type reader, and even with HF and LF (proximity) readers. The LR-TEK is a low-cost way to observe the performance of a reader without interface to the controller of an access control system, and to change the LR reader repetition rate and RF power level.

* * *

The LR-TEK does 10 valuable things that can quickly pay for the Kit.

Demonstrate your UHF Long-Range reader and tags

- The test unit clips to the reader's wires and power supply's terminals.

Test the proposed reader location

- Scan the area for extraneous RF that might interfere with the reader.
- Show the long-range reader working as rated with tags and cards.

Bench-test the products at your shop before going to the site

- Be confident of products' good performance before leaving your shop.

Test the reader before interfacing it to the system

- See the reader reading tags, held in fingers and mounted in vehicles.
- Connect the reader to a PC to observe codes, and to change reader's repetition rate or RF field strength (with AWID's free program).

Test the completed installation

- Prove that reader mounting, power, cable, wiring and tags are good.
- Test everything up to the system's wiring and programming.

Trouble-shoot an installed system

- Save time by isolating reader and tagged vehicles, substituting the DC power source, or the cable, or the reader, or the tags for test.

Save the LR-TEK kit for use by others when needed

- Store the Kit in a handy place for demos, scans, tests, and repairs.

FEATURES

- Self-contained Kit …
  All components in a small fitted carton
- Easy to use …
  Simple instructions are included
- Quick set-up …
  Items connect by clip leads
- Variety of uses …
  Kit contains all necessary items
- For effective presentations …
  Your reader gives real reads fast
- Build confidence at your office …
  See actual operation on your bench
- Answers questions at installation ...
  Kit shows isolated reader & tags working
- Trouble-shooting in a service call …
  Isolates components of the system
- Shows where repair is needed ...
  Substitutes for parts of the installation
- A valuable investment by you …
  Payback from time saved and confidence

See page 2 for Instructions.

LR-TEK™

LR Reader Tech Kit



COMPONENTS OF THE LR-TEK KIT

LR-Sounder Test Unit Contains a beeper and an LED to indicate every tag read, and a cable with clip leads for DC power and RS-232 Transmit Data. Clips to the power supply and to the reader being tested.

DC Power Module AWID's PS-123.3A plug-in "brick" with nominal 12 volts output up to 3.3 amperes.

RS-232 Cable Adapter Short cable with female DB9 connector, and 3 clip leads for RS-232 interface.

Test Tags AWID's WS-UHF windshield tag (on windshield glass) and CS-UHF clamshell card, for hand tests.

Carton A sturdy container with fitted foam padding to support and protect the components between uses.

INSTRUCTIONS

Start here . . . 1. Connect your LR reader's yellow wire to the reader's black wire. This arms the reader.

2. Clip the LR-Sounder's black and red wires to the same color wires on the reader. (Keep yellow connected.)
3. Clip the power module's black and red wires to other wires with same colors. Plug in the power module.

Then select a task . . .

A. To test or demonstrate an AWID UHF long-range reader

A1. Clip the LR-Sounder's orange wire to the orange wire on your reader.
A2. Present 1 test tag or card to the reader. The LR-Sounder beeps and the LED changes color for every read.

B. To test or demonstrate any other reader (with RS-232 interface)

B1. Clip the LR-Sounder's orange wire to your reader's wire for RS-232 Transmit Data.
B2. Present 1 tag or card that works with that reader. The LR-Sounder beeps and the LED changes color.

C. To interface the reader to a PC's serial port (running a suitable program on the PC)

C1. Clip the RS-232 cable adapter's orange, blue and violet wires to the same color wires on your reader.
C2. Plug the cable adapter's DB9 connector into the 9-pin serial input port on your PC. If the PC has only USB ports, use a USB-to-9-pin-serial adapter (available at local electronics stores).
C3. Present a single card or tag to the reader. Observe tag reads on the PC's screen.

D. To observe tag reads on a PC

D1. Start AWID's "LRR Settings" program (downloaded from AWID's Web site > "Support" > "Downloads").
D2. Present a single card or tag to the reader. Observe reads as a line of 18 ANSI characters for each read.

E. To program the long-range reader for "Read Rep Rate" and "RF Power Level"

E1. Start AWID's "LRR Settings" program (downloaded from AWID's Web site > "Support" > "Downloads").
E2. Make the desired change in Read Rep Rate or in RF Power Level. Read the program's Instructions sheet.
E3. After you "Apply" or "Set" the change, check the change immediately by holding a tag or card at the reader and watching the list of Tag Read data.

DISCLAIMER: Specifications are subject to change without notice. AWID reserves the right to make changes to improve performance without impacting form, fit or function. The LR-KIT model designations are Trademarks of Applied Wireless Identifications Group, Inc. All other trademarks are property of their respective owners.

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Product Instructions

Card & PIN Readers -- Changing the Keypad

*These instructions are for AWID's Model **KP-6840** or **XK-3640** combination card reader and PIN-pad. Components of these readers are (a) the base reader, (b) the keypad assembly that mates with the base reader, and (c) the snap-on cover that secures the reader after it is installed.*

Removing the Original Keypad Assembly

1. Remove the cover of the Card & PIN Reader –
   (a) Insert a *wide* screwdriver blade into the slot at the bottom edge of the reader-keypad unit.
   (b) Press the screwdriver firmly against the reader's base. Twist the screwdriver handle to release the cover.
2. If the reader is installed, locate the two screws (near the top and bottom ends of the unit) that fasten the reader on the single-gang utility box or the wall or other surface. Remove these two mounting screws.
3. Grasp the keypad assembly by your thumb and fingers at the top and bottom edges, near the holes for the mounting screws. Gently pull the keypad assembly straight forward, until it is free of the base reader.
4. **KP-6840**: Protect the copper antenna, around the edge of the base unit, from any contact.
   XK-3640: Protect the wires on the base unit from any contact.
5. If the replacement keypad assembly is not immediately available, cover the base reader securely so that it is not visible, or dismount and disconnect it entirely from the wall.

Installing the New Keypad Assembly

1. If the reader's cover is on the reader, remove it as in step 1, above.
2. If the reader is installed using mounting screws, remove the screws as in step 2, above.
3. Look for the 4 alignment split-pins on the back of the new keypad assembly. (Figure 1.)
4. Hold the new keypad assembly in position in front of the base reader, with the keypad in normal orientation.
5. Align the 4 pins with the round sockets near the corners of the base reader. Gently press the keypad assembly on the base reader. (Figure 2.)
6. Insert the 2 mounting screws through the holes near the top and bottom of the reader, into the wall.
7. Hang the cover over the reader's top edge. Press the cover's bottom firmly to secure it on the base reader.
8. To initialize the new keypad assembly, remove DC power from the reader, and then restore power.



1. KP-6840 keypad assembly, back view, with alignment pins.



2. KP-6840 base reader, front view, with sockets for pins.

Installation Sheet (Wiegand Interface)
XR-3600 UHF Card Reader

These instructions are for AWID's Model XR-3600 mullion-mount reader, using compatible UHF credentials from AWID.

Parts List

(a) 1 Installation Sheet XR-3600

(b) 1 Model XR-3600 Reader

(c) 2 #6-32 X 1" self-tapping screw (for sheet metal, wood, plastic, screw anchor, etc.)

Preparation

Reader Location: Select the reader's mounting location. The XR-3600 Reader may be screwed to a door mullion or window mullion, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The XR-3600 Reader may be exposed directly to rain or snow.

DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use an independent power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be nominal +12 volts DC (as low as +5 volts is OK); 1 ampere capacity; linear-rated; regulated DC output.

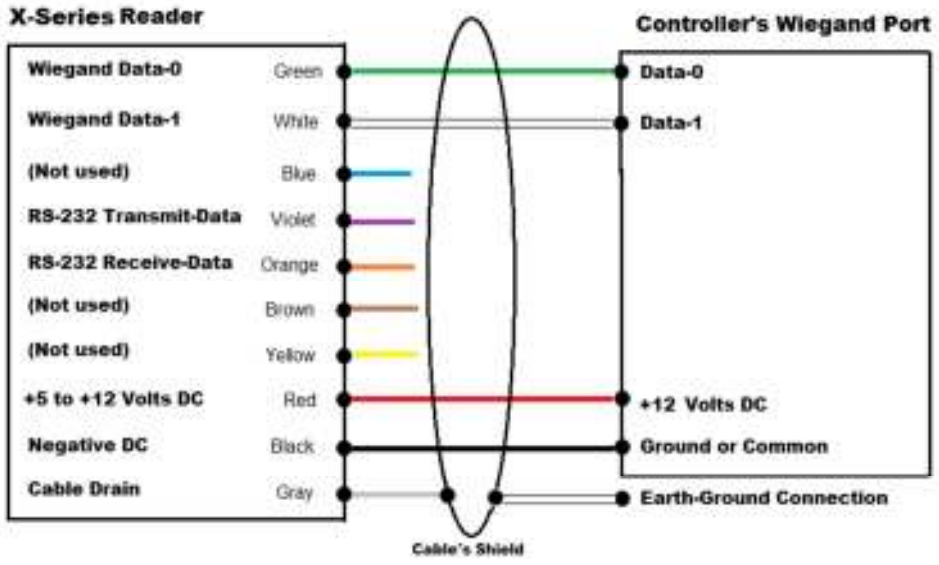
Cable to Controller and Power Supply: 4 conductors from reader to the system (2 wires for DC power, and 2 wires for Wiegand data). 22 gauge. Overall 100% *shield for both power and data*. 500 feet maximum length.

- If the DC power supply is *independent* from the panel's reader port, the reader's **Black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel's Ground terminal.
- If the DC power supply is *close to the reader*, run two 22 gauge cables – 2 wires for DC power, and 3 wires for Wiegand data. Both cables must be overall-shielded and earth-grounded.
- Conduit: If cables are pulled through *metal conduit*, the conduit should be earth-grounded (like the cables).

(continued)

Procedure

1. Connector – Cut off the white 10-pin connector from the end of the reader's cable. Discard the connector.
2. Wire Connections – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable.
   If power and data are in separate cables, connect all three drain/shields together near the reader.
   d. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   e. Last, connect **red** to the DC Positive terminal.



3. Reader Mounting – Feed the reader's cable through the cable opening in the mullion or wall. Mark and drill lead-holes in the surface where the reader will be mounted. Fasten the reader to the mullion or wall, with screws through the holes at the ends of the reader. Use supplied screws if suitable.
4. Screw-Hole Plugs – ***After*** *you have tested the reader,* press the plugs over the screw heads in the reader.
5. Reader Test – When power is applied to the XR-3600, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID UHF card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 6 inches.
6. System Test – Wire the reader to the system's controller. Program the code for the AWID UHF card or keytag into the host system, with full priority, all doors groups, and all time zones. Present the card or keytag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support • Call 408-825-1100, option 1. E-mail Support@awid.com.

Installation Sheet (Wiegand Interface)
XP-3620 UHF Card Reader

These instructions are for AWID's Model XP-3620 switchplate-type reader, using compatible UHF credentials from AWID.

Parts List

(a)	1	Installation Sheet XP-3620
(b)	1	Model XP-3620 Reader
(c)	2	#6-32 x 1" machine screw (for single-gang utility box)

Preparation

Reader Location: Select the reader's mounting location. The XP-3620 Reader may be screwed to a single-gang utility box like a cover plate, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The XP-3620 Reader may be exposed directly to rain or snow.

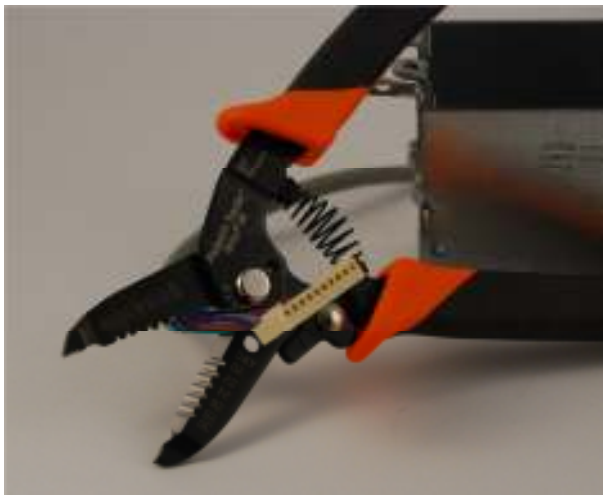
DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use an independent power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be nominal +12 volts DC (as low as +5 volts is OK); 1 ampere capacity; linear-rated; regulated DC output.

Cable to the system's panel: 4 conductors from the reader to the panel (2 wires for DC power, and 2 wires for Wiegand data). 22 gauge. Overall 100% *shield for both power and data*. 500 feet maximum length.

- If the DC power supply is independent from the panel's reader port, the reader's **Black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel's Ground terminal.
- If the DC power supply is close to the reader, run two 22 gauge cables – 2 wires for DC power, and 3 wires for Wiegand data. Both cables must be overall-shielded and earth-grounded.
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Procedure

1. Connector – Cut off the white 10-pin connector from the end of the reader's cable. Discard the connector.

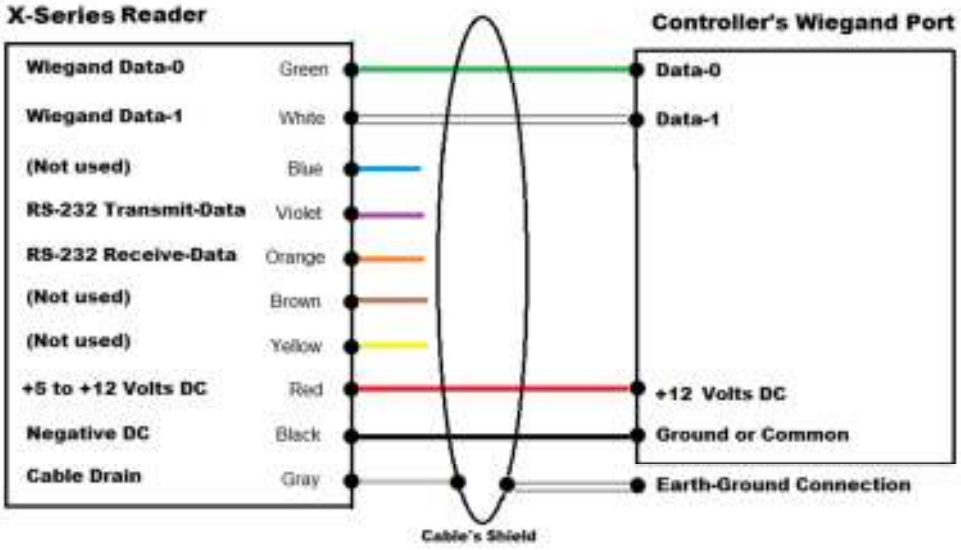




(continued)

2. Open the Reader – Snap open the reader's front frame by inserting a wide screwdriver blade in the slot at the bottom edge of the frame. Twist the blade gently. Do not remove the reader's central area (with the LED and logo).

3. Wire Connections – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable.
      If power and data are in separate cables, connect all three drains or shields together near the reader.
   d. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   e. Last, connect **red** to the DC Positive terminal.





4. Reader Mounting – Feed the reader's cable through the utility box or the wall's cable opening. Fasten the reader to the utility box or the wall, with screws through the holes inside the open reader. Use the supplied screws for mounting on a utility box. When mounting is finished, snap the cover frame on the reader.

5. Reader Test – When power is applied to the XP-3620, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID UHF card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 6 inches.

6. System Test – Wire the reader to the system's controller. Program the code for the AWID UHF card or keytag into the host system, with full priority, all doors groups, and all time zones. Present the card or keytag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support • Call 408-825-1100, option 1. E-mail Support@awid.com.

Installation Sheet (Wiegand Interface)
XK-3640 UHF Card & PIN Reader

These instructions are for AWID's Model XK-3640 reader, using compatible UHF credentials from AWID.

Parts List
(a) 1 Installation Sheet for XK-3640
(b) 1 Model XK-3640 Reader/Keypad
(c) 2 #6-32 × 1" machine screw (for single-gang utility box)

Preparation

Reader Location: Select the reader's mounting location. The XK-3640 Reader may be screwed to a single-gang utility box like a cover plate, or to a wall or other surface. On a metal surface, read range is reduced about 20%. The XK-3640 Reader may be installed indoors or outdoors, but needs protection from direct rain or snow.

DC Power Supply: DC power for this reader is usually supplied from the +DC and Ground terminals of the Wiegand reader port on the system's panel. If this is not possible, use an independent power supply. Power may be shared with other readers if the supply has sufficient current capacity. The power supply should be nominal +12 volts DC (as low as +5 volts is OK); 1 ampere capacity; linear-rated; regulated DC output.

Cable to Controller and Power Supply: 4 conductors from reader to the system (2 wires for DC power, and 2 wires for Wiegand data). 22 gauge. Overall 100% *shield for both power and data*. 500 feet maximum length.

- If the DC power supply is independent from the panel's reader port, the reader's **Black** wire *must* be connected to *both* the DC power supply's Negative terminal and the panel's Ground terminal.
- If the DC power supply is close to the reader, run two 22 gauge cables – 2 wires for DC power, and 3 wires for Wiegand data. Both cables must be overall-shielded and earth-grounded.
- Conduit: If cables are pulled through metal conduit, the conduit should be earth-grounded (like the cables).

Programming

The XK-3640 reader is shipped with the keypad's output set for buffered 26-bit output, and its facility (site) code set at 000. These two features can be programmed at your shop before you go to the installation site. Just connect DC power from a bench supply or from a 9 volt or 12 volt battery to the **red and black** wires. Start either programming routine with DC **removed** from the XK-3640 unit. Keep the unit fully assembled.

- **Keypad's Output Format**
  1. While the DC power is disconnected . . . press and hold the **4** key if format is to be 4-bit data burst; or hold the **8** key for 8-bit data burst, or hold the **2** key for 26-bit buffered data.
  2. With the **4** or **8** or **2** key still pressed in, connect the DC power. Within 3 seconds there is a beep sequence, and the LED changes to standby-red.
  3. Now release the pressed key. The change in keypad output format has been saved.
- **Facility Code in Keypad's 26-bit Buffered Output**
  1. Connect the DC power. Watch the unit's LED. While it is amber, slowly enter the 10-digit password **9 1 4 3 6 9 8 8 0 0**; end with #. Press each key solidly. There is a short beep during each keystroke.
  2. Within 3 seconds, enter the facility code's **3 digits** (between 000 and 255); end with #.
  3. There is a long beep and the LED color changes to standby-red. The facility code has been saved.

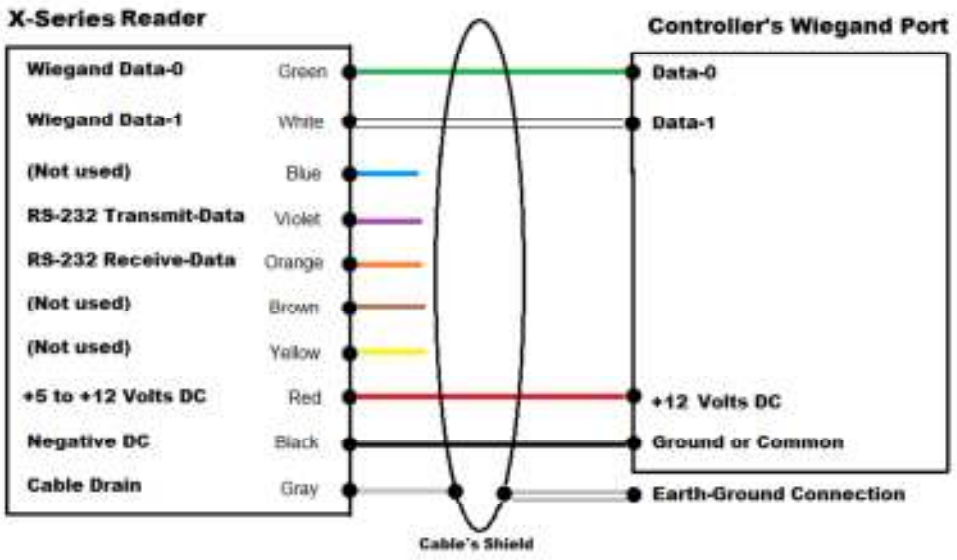
Programming can be done also on an installed XK-3640. The keypad's **format** can be changed anytime to any of the three formats, and the 26-bit's **facility code** can be changed to any value between decimal 000 and 255. Programming for **Operation Mode** (mix of card read and/or PIN) is done only in the host system's software.

Procedure

1. Connector – Cut off the white 10-pin connector from the end of the reader's cable. Discard the connector.

2. Open the Reader – Snap open the reader's front frame by inserting a wide screwdriver blade in the slot at the bottom edge of the frame. Twist the blade gently. Do not remove the keypad assembly.

3. Wire Connections – Connect the reader's wires to the cable(s) for power and data.
   a. First, connect **black** to the panel port's Ground terminal, and, if separate, to the power supply Negative.
   b. Connect **green** to the Data-0 terminal. Connect **white** to the Data-1 terminal.
   c. Connect the **gray** drain wire to the shield of the connecting cable.
      If power and data are in separate cables, connect all three drain/shields together near the reader.
   d. At the end of the cable(s) near the panel (and near the power supply, if separate), connect the **shield** to a verified earth-ground.
   e. Last, connect **red** to the DC Positive terminal.





4. Reader Mounting – Feed the reader's cable through the utility box or the wall's cable opening. Fasten the reader to the utility box or the wall, with screws through the holes inside the open reader. Use the supplied screws for mounting on a utility box. When mounting is finished, snap the cover frame on the reader.

5. Reader Test – When power is applied to the XK-3640, the LED initializes to steady-red for standby, and the beeper sounds. With every presentation of an AWID UHF card to the reader, the LED changes color momentarily, and the beeper sounds briefly. Read range with a compatible AWID card is up to 6 inches.

6. System Test – Wire the reader to the system's controller. Program the code for the AWID UHF card or keytag into the host system, with full priority, all doors groups, and all time zones. Present the card or keytag to the reader. Observe door unlock or gate opening, indicating "Access Granted" by the system.

Technical Support • Call 408-825-1100, option 1. E-mail Support@awid.com.

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Technical Reference

UHF Long-Range Readers

Trouble-Shooting: Setting a Performance Benchmark

When installation of the UHF long-range reader results in less than expected performance level, this "benchmark test" procedure may prove that the reader and tag themselves are working well, and may identify the cause of the reduced performance.

Definitions

"Performance": Longest distance in front of a reader at which a tag or card, held by fingers, gives steady reading.
"Benchmark": A "standard" for comparing results of testing under typical conditions
"Standard": The results of tests under ideal conditions, that is, everything that affects the tests being ideal.
"UHF long-range readers": AWID's reader models LR-2000, LR-2000HiLo, LR-2200 and LR-3000.

A. Benchmark Testing

To see the reader operate at its best performance level, the reader should be isolated from all other components of the installed system that can affect the reader's performance. For example –

Test location: Select a place far from the installation site (a block or more). Your shop may be ideal.

Test space: Set up the test-set in a wide-open *empty* space, like a warehouse or a parking lot. Minimum clear space = 40 feet in front of the reader, ceiling at 20 feet, and walls at 10 feet on each side of the reader's central axis. Have nothing between the reader and the test-tag – no person, bushes, signs, posts, walls . . .

Mounting: A ¼"-20 screw, inserted in one of the capture nuts on the reader's back-plate, is a convenient way to hang the reader on a ladder or other support. Have the reader at 8 feet height above the floor or ground. Aim the reader horizontally. Have nothing in front of the reader. Do not hold the reader by hand.

DC power: Use a back-up battery, nominal 12 volts, 7.5 ampere-hours, well charged. (Do *not* use a plug-in or wire-in DC power supply.) Measure voltage on the reader's black and red wires, commonly 12.3 to 12.8 volts.

Wiring: Connect only the black and red wires to the battery's terminals, and the yellow arming wire to black.

You observe the tag reads by clipping the LR-Sounder (from the LR-TEK kit) to 3 wires on the reader. The LED and beeper in the LR-Sounder tell you when each read occurs.

Method for Benchmark Tests

Look at the product sheets for the credentials for AWID's UHF readers – the table of rated reading distance for each credential. To get the best distance, use a glass-mounted windshield tag, from AWID's test/demo Kits.

Hold the credential so that it is facing the reader. Support the tag upright between your thumb and fingertips. Do not cover the face of the tag with your fingers. Hold the credential to your side at arm's length.

Hold the test tag starting close to the reader, moving it up and down and from side to side. Do this to map the size of the field in which the tag reads steadily (normally missing an occasional read). Gradually move the tag away from the face of the reader, observing the farthest distance at which the tag reads steadily.

Results of Benchmark Tests

The longest steady reading distance should be the rating shown for that tag type in the credentials' product sheets. This distance means that the reader is performing normally. This sets the desired benchmark.

(continued)

B. Portable Test Set

Use these same items (reader, battery, LR-Sounder, and test tag) as a portable test-set to confirm the same performance at other locations, especially at the intended installation site. Remote test results should be identical to the benchmark tests. If reading distance is less at one particular location, look for a source of interfering RF, perhaps from a voice communications transmitter. Moving the reader as little as 12 feet may avoid RFI.

C. Trial Installation

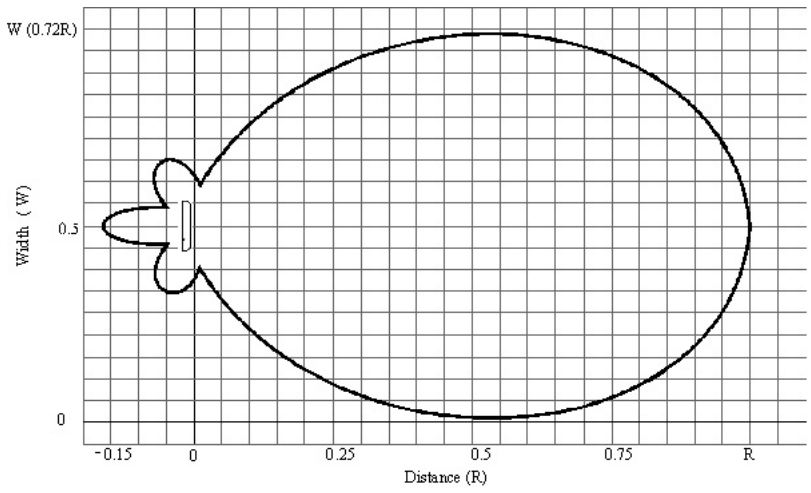
Now you are ready to install the reader. Continue to use the LR-Sounder to indicate reads even when the reader is not interfaced to the system. Make each step of the installation **one at a time**, and observe results for each step:

1. Connect the DC power from the power supply, substituting for the battery.
2. Mount the reader on its adjustable bracket or other device;
3. Connect the cable for data interface to the system's controller.

If performance drops at any step, this should identify the source of reduced performance. Then you can correct that part of the installation.

References

- "Effective RF Field" diagram (below).
- Product sheets "UHF Credentials", for vehicle-mounting, and for holding by hand.
- Instructions sheets for all UHF credentials.
- Product sheet for LR-TEK test/demo kit.



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Technical Reference

UHF Long-Range Readers

Preventing Reading Tags on Cars in Line

In some applications of long-range readers and vehicle tags, it is possible for cars to stand in line before the gate, waiting for the first car to move forward through the gate. If the tag on a waiting car is read while the first car is being processed, there may be confusion in the host system. This may be a concern especially in revenue systems. These suggestions can prevent this condition.

Option 1 – Locating the Reader

Move the reader closer to the gate. Then the reader can be aimed downward toward the location of the tag on the first car in line, and away from tags in waiting cars behind the first car.

Option 2 – Aiming the Reader

For any location of the reader, try aiming the reader downward toward a reading zone that is closer to the reader. This shortens the distance at which tags can be read. It will help to keep tags on waiting cars from being read.

Option 3 – Avoiding Reflection from Metal

Choose a reader mounting location that keeps the reader's effective RF field away from metal, which may reflect back to waiting cars and cause their tags to read. See the diagram, below.

Option 4 – Reducing the Reader's RF Field Strength

Run AWID's "LongRangeReaderSettings" program, downloaded from AWID's Web site ("Support" tab on the Home page). Reduce the RF power by sliding the "RF Power Attenuation" pointer to the right in 32 steps. Watch for the end of tag reads from cars in line behind the first car.

Option 5 – Substituting a Different Credential

The various UHF tags and cards work at different locations, and have different read ranges. Experiment with different tags and cards. Observe the basic requirements for the client's application – vehicle-mounted vs. hand-held credentials, permanent vs. movable tags, alignment with the reader, cost, etc.

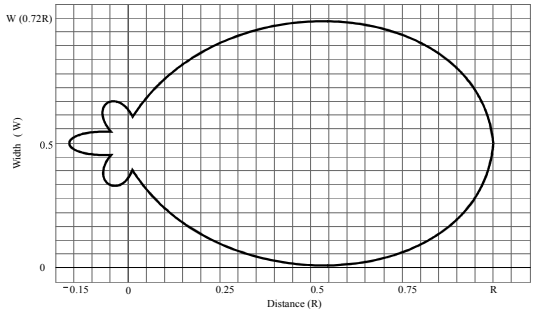
Good Ideas

Use a buried loop sensor close to the gate, for vehicles that are approaching the gate. Use the Normally Open relay contacts on the loop's controller to arm the reader (by shorting the reader's yellow wire to the black wire). Then the reader will generate RF, and actuate the tag, only when the car arrives close to the gate.

Material List • LR-TEK or LR-2000KIT test/demo kit • Laptop PC (to run the LRReaderSettings program)

Reference

- Technical Reference "UHF Long-Range Readers – Suppressing Multiple Reads, Etc."



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Technical Reference

UHF Long-Range Readers – Basic Tests

Proof of normal operation of a UHF long-range reader can be important – to bench-test a new reader, start an installation, trouble-shoot an existing installation, or test tags and cards. These tests are done quickly with a reader by itself (no access control system needed) and a hand-held tag (no car needed).

Test Tools

- AWID's kit LR-TEK or LR-2000KIT, with the LR-Sounder test unit (3 spring clips), and tags and cards
- Back-up battery – 12 volts, 7.5 ampere-hours, well charged
- DC voltmeter
- ¼"-20 screw (for suspending the reader during tests)
- For a "HiLo" reader set: A sheet of aluminum foil, larger than the reader; two ¼"-20 screws

Starting Steps for All UHF Reader Models

1st Have the reader completely disconnected from everything else. If the reader is new, clip off and discard the cable's 10-pin in-line connector.

2nd Connect the readers yellow wire to the black wire, arming the reader for RF generation.

3rd Suspend the reader 6 feet to 8 feet high, with 30 feet of open space in front of it, and 8 feet at the sides. (For the LR-911 reader, only half as much clear space is necessary.)

4th Connect the back-up battery to the reader's black (negative) and red (positive) wires.

5th Check DC voltage on the red and black wires. If it is below 12.2 volts, find the cause of low voltage.

6th When testing with the tag or card, measure the maximum distance at which steady reading occurs.

LR-2000 and LR-2200 Readers

1. Connect the LR-Sounder test unit to the reader's orange, blue and violet wires. Match wires color-for-color.
2. Present a single tag or card to the reader. (Have all other tags or cards 30 feet behind the reader.)
3. Observe a beep and a brief LED color change on the LR-Sounder for *every* tag read.

LR-2000HiLo and LR-2200-HiLo Readers

1. Use the three steps for LR-2000 and LR-2200 readers.
2. To test the "HiLo" set's **Master Reader** (where the battery is connected): Disconnect the remote antenna's mini-coaxial cable. Hold the tag or card in front of the master reader. Observe beeps and LED color change.
3. To test the **Remote Antenna**: Connect the mini-coax cable between the master reader and the remote antenna. Cover the front of the master reader with aluminum foil. Hold the tag or card in front of the remote antenna. Observe beeps and LED color changes.

(continued)

LR-3000 Reader

Locate the two LEDs on the edge of the reader, near the cable. Observe brief lighting of the green LED indicating every read of the tag or card when it is held in front of the reader.

Using the LR-3000 reader's built-in green LED to observe tag reads is a good basic test.. Connecting the LR-Sounder test unit makes these basic tests more convenient – a *one-man* job.

1. Connect the LR-Sounder test unit to the reader's orange, blue and violet wires. Match wires color-for-color.
2. Present a single tag or card to the reader. (Have all other tags or cards 30 feet behind the reader.)
3. Observe a beep and a brief LED color change on the LR-Sounder for *every* tag read.

LR-911 Reader

1. Connect the LR-Sounder test unit to the reader's orange, blue and violet wires. Match wires color-for-color.
2. Present a single tag or card to the reader. (Have all other tags or cards 15 feet behind the reader.)
3. Observe a beep and a brief LED color change on the LR-Sounder for *every* tag read.

Note: The LR-911 reader reads only WS-1216 and MT-1014 tags. Their read ranges are shorter than for AWID's other UHF long-range products.

UHF Credentials

The reader itself is the best way to test tags and cards. Use a reader that is compatible with the tags and cards. Connect the reader as described above. Present a single tag or card to the reader. The LR-Sounder test unit or the LR-3000 reader's green LED indicates each read.

Notes

(a) These basic tests indicate only that the tag or card is being read – a yes-or-no test. There is no display of the numeric code that is programmed into the tag or card.

(b) The LR-Sounder test unit connects to the reader's RS-232 Transmit Data line. It is possible for it to indicate a good read when the reader's Wiegand data is damaged. In this unusual event, contact AWID's Technical Support for separate testing of the Wiegand output.

(c) If a reader that tests good by these basic tests does not read in an access control system, contact AWID's Technical Support for review of the system's DC power supply, cable specifications, wire connections, and alignment of the reader and tags on vehicles.

(d) The LR-Sounder test unit works as well on *every* AWID reader except the low-frequency (proximity) SR-2400. On low-frequency readers and the X-series UHF readers, connect the LR-Sounder's orange wire to the reader's violet wire (RS-232 Transmit Data). Connect black and red wires as usual (color-for-color).

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Technical Reference

UHF Long-Range Readers -- Application

People at Portals: Holding the Tag or Hands-Free?

The primary purpose of AWID's UHF long-range readers and tags is automated **vehicle** *identification (AVI) for access at gates. When the same products are used to grant access for* **people** *walking up to doors, different factors must be considered.*

Application

In common use, a person approaches a doorway with a compatible card or tag, to gain access at a secured portal. In some cases, the person physically presents a card or tag to the reader as the person passes through the reader's "effective RF field". For *hands-free* access, the person may have a card or tag clipped to the clothing or on a lanyard.

Products

The **reader** in this application is any of the AWID UHF long-range readers with model number LR-3000 or LR-2000 (LR-2200 in Europe), including the "HiLo" dual-antenna set. (Use LR-3000 if the reader is exposed to the environment.)

The **credentials** may be any of AWID's UHF "hand-held" cards or tags, and the portable "vehicle-mounted" tags if they are presented to the reader by the user, with clear line-of-sight between the tag and the reader, and away from metal.

The "vehicle-mounted" tags that may be suitable for some "people" applications are:
SV-UHF Sideview Mirror Tag, **PT-UHF** Portable Tag, **VT-UHF** Sunvisor Tag, and **HT-UHF** Hangtag.

Special Considerations

- There should be only *one or two tags* present in the reader's effective RF field at any time while reading.
- The tag must be in clear *line-of-sight* to the reader, aligned with the reader, and about parallel to it.
- If held in the *fingers*, do not cover the card's antenna. Clamp the card between your thumb and fingertips.
- The tag must not be covered by *clothing* or any other material. It needs open space to read the code.

RF Field Size

Some applications work better if the size of the reader's RF field is made smaller, for example, to cover a narrow aisle in front of the door. The field size can be reduced by changing the aiming of the reader, or by using AWID's no-cost downloaded program, "LongRangeReaderSettings" (LRRS). It is zipped with an instruction sheet.

RF Field Characteristic

Both the reader and the credentials are directional. This should be considered when planning an application, and when installing the products. The directional nature of the products, and the ability to adjust the size of the effective RF field, let you use the products at a multi-door site, where the readers may be separated by just the width of the door.

Special Applications

Car-pooling: Present one card at a time to the reader. Other passengers may need to cover their cards to prevent reading.

Sally ports: The hands-free nature of these products can be important in this application for law enforcement.

Mustering: These products may be useful for mustering people. Special software in the host system may be necessary.

(continued)

Tip for Good Reading

Avoid multiple cards: In the "People at Portals" application, the AWID card or tag should be carried or attached alone – not combined with other cards or other devices. The UHF cards and tags need clear, open space facing the reader.

Effective RF Field

LR- . . . Long-Range Reader

Effective RF Field with UHF Credentials

READER'S EFFECTIVE RF FIELD

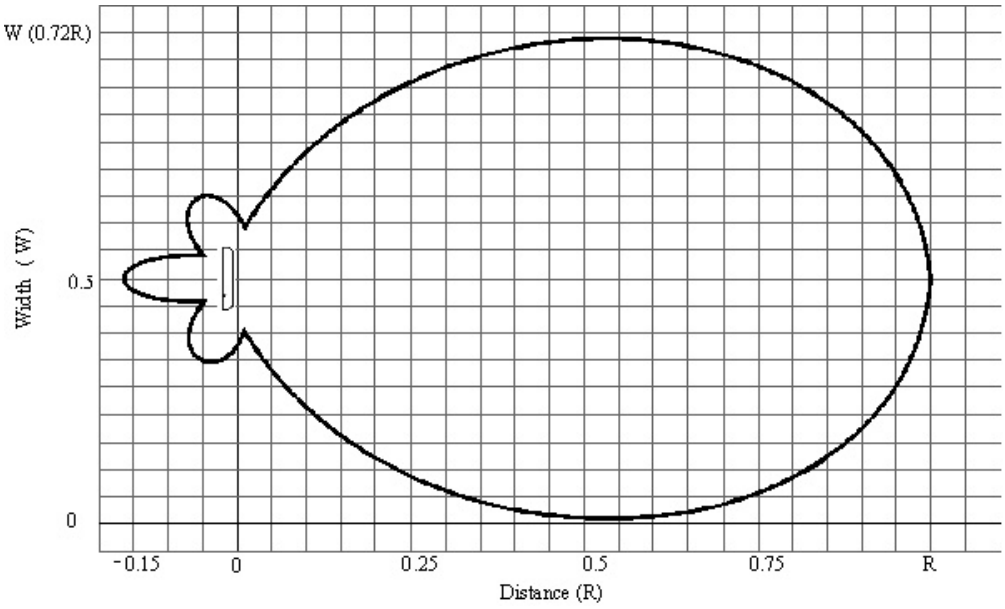


Figure 1. Effective RF field for tags with long-range reader.

- The effective RF field is a 3-dimension figure of rotation of this diagram about its horizontal axis.
- Polarity of the reader's transmitted RF is circular.
- Distance "R" is the read range for AWID's UHF tag or card. It varies with different credentials and installations.
- Typical reading distance of 15 feet to 25 feet, depending upon the tag or card type, is less than "R".
- In a typical installation, maximum field width "W" may be about 16 feet. This width can be reduced in the field.

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Technical Reference

Card & PIN Readers

Replacing the Numbered Keymat

When the keys of a reader-keypad unit are damaged, these suggestions may be useful.

What Models Does This Affect?

AWID has two reader models that have a 12-key keypad integrated into the "switchplate" type units. These are –

KP-6840 for low-frequency (proximity) applications.

XK-3640 for ultra-high-frequency applications.

What is the "Keymat"?

The numbered keys are molded from a single piece of rugged material. The keymat is held in place by the secured cover of the reader-keypad unit. This assures solid operation when the keys are pressed, and long life for the keys.

What Happens Occasionally to Keypads?

In cases of extremely heavy use, the visible numerals may be worn away. Also, the keys of a keypad may be subject to vandalism. The keypad probably continues to work, but the appearance of the unit may be compromised.

What Can You Do?

Please arrange with your distributor or supplier for a Return Material Authorization (RMA). Return the *complete* reader-keypad unit for AWID. AWID assures that the replacement keymat is correct for that reader-keypad model, and that the entire unit is working perfectly when it is shipped back to you. If anything else needs repair or replacement, AWID's RMA Department will contact you for your approval. The cost is usually modest compared with purchase of a new unit.

Please contact your distributor or supplier of the KP-6840 or XK-3620 reader-keypad to request the RMA.

How Can You Prevent Future Damage?

- Instruct users to remove gloves, and to press the keys only with the fingertips.
- Press the key in straight, firmly, one key at a time.
- Move the reader-keypad unit to a location where it is less visible to vandals, or less accessible to them.
- Mount the reader-keypad unit inside a *plastic* hood or enclosure, or even a box with a locked, hinged cover. You can read a card or tag through the closed plastic box.

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Technical Reference

UHF Readers -- Frequencies for RFID

To all resellers of AWID's ultra-high-frequency readers – to assure that UHF reader models are sold where they can be used, and to offer special frequency bands when required:

Normal Conditions

All of AWID's UHF access control reader models (with one exception: LR-2200) operate in the 902-928 MHz band for communications between the reader and its credentials (encoded tags and cards). Around the world, many countries use this same band for ISM (Industrial, Scientific, Medical) applications.

Exceptions

Each country makes its own decisions on this matter of frequency allocation. For example, the European Union and Middle East countries may use the 865-868 MHz band for this application. (This is where AWID's LR-2200 long-range reader communicates.) In some countries, the government agency that allocates frequency bands may assign frequencies differently for various industries or user types.

When This Becomes an Issue

Questions have developed in some countries in Central America, and the Caribbean area, and North Africa. AWID wants to be pro-active when we sell readers that were ordered for ultimate use in these and other countries where there may be uncertainty about the correct frequency band.

For UHF Long-Range Readers . . .

Most of these readers are produced with the 902-928 MHz frequency band. They are suitable for installation in the United States, Canada and Mexico, and some other countries.

If you know that the ultimate location of the reader will be another country, please try to learn what range of frequencies is acceptable in that country. If possible, AWID will program the readers with the frequency band that you give us in your Purchase Order.

For UHF uAxcess™ Readers . . .

These readers are available only with the 902-928 MHz frequency band. They can be sold for installation in the United States, Canada and Mexico, and in some other countries. They should not be sold for installation in countries where regulations require a different range of frequencies for these applications.

What AWID Can Do

In your Purchase Order for long-range readers, please give AWID the frequency band for physical access control that is accepted in the country of destination. With your help, we can then open the Sales Order.

If the reseller is not certain about the assigned frequency band, AWID can e-mail a document that contains the most recent collection of assigned frequency bands for specified uses, covering many countries around the globe. AWID's *Technical Support* people can discuss the options with the reseller, so that your Purchase Order contains best available frequency information.

Worst Case

If an AWID model LR-_ reader is rejected by Customs in a country that does not accept the programmed frequency band for physical access control, AWID can issue an RMA to our direct customer for return of the reader to AWID. We may be able to reprogram the reader, for a nominal fee, to make it acceptable in the country of installation. However, our goal is to catch these cases *before* they reach this need.

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Technical Reference

Tags for Long-Range UHF Readers

RF Blocking by Vehicle Features

There is no definitive list of vehicles on which the tags for UHF long-range readers will not read well. The features of the vehicles that may cause interference with the tags' transmission are generally options -- either factory "packages" or after-market additions. The following notes help to identify the small number of vehicles that may block the codes from AWID's windshield tags. These vehicles are almost always "high-end" passenger cars – typically expensive makes. Suggested solutions are shown.

A. Metal Coating on Windshield

Kinds of Coating:

- Automatic windshield wipers, using a coating outside the windshield to sense moisture.
- Anti-glare coating that blocks polarized light, with a purple appearance outside the windshield.
- Absorbent coating to reduce infrared and ultraviolet. (High-end Mercedes cars with windshield marked "Sungate" have a coating to reflect infrared.)

Effect: Metal coating may block the tag's code from inside the car to the reader, causing the tag not to read.

Solutions (**in sequence** – for both LR-2000 and LR-911 except as noted):

(a) Install WS tag in an area of the windshield that has no metal coating – perhaps lower left corner (where state registration or inspection stickers attach) or top center of windshield (where toll tags attach).

(b) (LR-2000 only) Try other adhesive or clip-on tag types – rear-view mirror or sun-visor or hang-tag.

(c) Support MT tag on dashboard (away from windshield glass), using a Velcro dot; or hold in fingertips.

(d) Attach MT tag outside vehicle, using the tag's adhesive, screws, pop rivets or wire ties.

(e) (LR-2000 only) Hold a UHF card (clamshell or graphics type) at the driver's side window, aimed at the reader. This is not a hands-free option.

B. Metal Embedded in Windshield

Kinds of Embedded Wires:

- Heated wires inside laminated glass to defrost or demist the windshield.
- Wire grid inside laminated glass for radio antenna.

Effect: Metal wires may reduce the RF field strength for the tag's code, causing shorter read range.

Solutions (**in sequence** – for both LR-2000 and LR-911 except as noted)

(a) Install WS tag in an area of the windshield that has no metal wires – perhaps top center.

(b) (LR-2000 only) Try other adhesive or clip-on tag types – rear-view mirror or sun-visor or hang-tag.

(c) Support MT tag on dashboard (away from windshield glass), using a Velcro dot; or hold in fingertips.

(d) Attach MT tag outside vehicle, using the tag's adhesive, screws, pop rivets or wire ties.

(e) (LR-2000 only) Hold a UHF card (clamshell or graphics type) at the driver's side window, aimed at the reader. This is not a hands-free option.

C. Metal Compounds in the Glass

Kind of Metal: Heavy tinting for sunlight attenuation, usually in a band along the top of the windshield.

Effect: Heavy tinting may reduce the RF from the tag, or block it. This is unusual in cars from recent years.

Solution: Move the tag so that, when the tag is at the rated reading distance from the reader, it has clear line-of-sight through a non-tinted area on the windshield.

D. RF Transmission from On-Vehicle Devices

Sources of RF Interference:

- Pre-collision warning system – radar-like devices at front and rear of vehicle, to detect roadway hazards.
- RF communications equipment in the vehicle. (But cell phones, GPS, LoJack and "OnStar" type devices do not affect the reader and tag.)

Effect: RF from other sources may reduce the tag's read range, and may overwhelm tag code transmission.

Solution:

(a) Install a switch to disable the RF source's transmission while the tag is in the reader's effective field.

(b) Install an MT tag outside the vehicle, away from the RF source, close to and facing the reader.

(c) (LR-2000 only) Hold a UHF card (clamshell or graphics-quality) at the driver's side window, aimed at the reader. This is not a hands-free option.

Notes

- AWID's Installation Kit (required for installers) contains each tag and card type for testing the long-range reader.
- At the rated reading distance from the reader, the tag must be about *parallel* (facing straight on) to the reader.
- The MT tag offers great variety of uses. It almost always works when a WS tag may be blocked. If the MT tag is blocked inside the car, it can be mounted in many places outside the car.
- The WS tag must be adhered permanently inside windshield glass to develop its full rated reading distance.
- The WS tag may work on a coated windshield if a small rectangle is cut from the coating, large enough for the WS tag to be attached inside the cleared space.
- The WS tag may be applied inside a *side* window of the vehicle if the tag faces a reader, and if the window is fixed in position (that is, will not lower the tag inside the door's metal body).
- Highways using UHF tags for toll collection share the RF blocking problem. Toll road operators may require that the tag be mounted on a special bracket outside the vehicle when traveling. (See the "SunPass" reference, below.)
- "Lead" glass has no effect on RF transmission. Virtually every kind of glass contains lead.

References

- Instructions for mounting AWID's UHF tags in Manuals (Section 6) and separate sheets.
- Technical Reference, "Readers, UHF – Planning Questions to Define System"
- Technical Reference, "Tags, UHF – WS, Testing Before Installing".
- Technical Reference, "Tags, UHF– WS & RV, Testing Installed Tags in Vehicles"
- Florida's SunPass Web site: www.SunPass.com > "How SunPass Works" > "Problem Windshields".

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Technical Reference

LR-3000 for Portable Offline Testing

AWID's LR-3000 UHF Long-Range Reader can be used even before it is installed. It is self-testing through its two LEDs, which indicate DC power applied and each read of a compatible credential. By powering the LR-3000 with a battery and holding a credential in front of the reader, it acts as a portable tester, completely isolated from the rest of the access control system. This is done before the actual installation, resulting in high confidence of excellent performance.

Components of the Test Pack

- **LR-3000**-B-U UHF long-range reader (standard reader, ready for installation)
- **Battery** for reader power (standard backup battery for alarm panels, 12 volts, 7.5 ampere-hours, full charge)
- **Credential** – tag or card for the LR-3000 reader (from the customer's stock, or from AWID's demo/test kit)
- (Optional) **LR-Sounder** test unit (from the LR-TEK or LR-2000KIT demo/test kit; powered by the battery)

Applications

A. Scan the entire area of the planned installation, to be certain that it is suitable for these products.
B. Observe good reading distance, for confidence that the reader and the tag are functioning normally.
C. Quickly replicate the planned location of the reader, and of the tag, to predict good results for the installation.
D. Identify external features that might interfere with good performance: tree, wall, structure, pole, RF source, etc.
E. Move the tag or card to various positions and orientations, inside or outside the vehicle, for best performance.

Procedure

1. Collect the test pack's components. Include the optional LR-Sounder only if desired. (See Note 1.)

2. Test the items at your shop or in an off-site place, to be sure of its operation. Watch for full rated reading distance for the selected tag or card, as listed in the "Credentials for UHF LR-2000-3000 Reader" product sheet.

3. Move to the proposed site. Suspend the reader so that it has open space in front of it in a "balloon" 30 feet long and 18 feet diameter. For full effective RF field, have nothing in front of the reader, or close beside the reader.

4. To arm the reader, connect the reader's yellow wire to its black wire.

5. To power the reader, connect the reader's black and red wires to the battery's negative and positive terminals.

6. The reader's red LED indicates the DC power. The green LED blinks off briefly for each read of the test tag.

7. When testing, have a single tag in front of the reader. Move all other tags 30 feet behind the reader.

8. First, do hand-held testing with the tag or card. With no vehicle present, move the selected tag to map the space in which reads occur.

9. Second, test the selected tag or card in a typical vehicle. Try different locations and orientations as the vehicle moves through the reading space. Observe the reading distance, and compare it with the published ratings.

Notes

1. For **one-person** operation, clip the optional LR-Sounder test unit to the black, orange and red wires on the LR-3000 reader's cable. The LR-Sounder beeps and shows an LED color change for every read of the tag or card by the LR-3000 reader. The operator then does not need to watch the LR-3000 reader's green LED.

2. For convenience in handling the battery, use a **long cable** (18 gauge, 2 conductors, perhaps **20 feet** long) between the battery and the reader.

3. For quick and simple support for the reader, use a **camera tripod**. This raises the reader as high as 6 feet. The ¼"-20 screw in the tripod's camera pad matches the capture nuts behind the LR-3000 reader.

4. Observe AWID's "**Guidelines**" for good performance. They are important to assure excellent results.

Reference

- **LR-3000** Reader's product sheet and Quick Installation Guide
- **LR-TEK** product sheet and instructions
- "**Credentials** for UHF LR-2000-3000 Readers" product sheet and instructions

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Technical Reference

LR-911 Installation – Material List

The listed products are required in most installations of AWID's LR-911 long-range reader. Items 1 to 5 are AWID's standard products. Items 1 through 8 are described in AWID's technical documents. Items 6 through 12 are available from local distributors or online suppliers.

	Qty.	Part Number	Product	Source
1.	__	LR-911-B-U	Long-Range UHF Reader, 902-928 MHz band, with antenna, in a single unit.	AWID
2.	__	LR-MB-0-0	Mounting Bracket for LR-911 reader, 11 inches long, pan-and-tilt adjustable head.	AWID
3.	__	(see instruction sheet or price list)	Tags selected for the application: WS-1216 Windshield Tag, MT-1014 Metal-Mount Tag. (Include code information in order: bit format, facility or site code, and starting ID number.)	AWID
4.	1	LR-TEK-0-0	LR Reader Tech Kit with LR-Sounder test unit, PS-123.3A power module, WS-UHF tag adhered to a piece of windshield glass, CS-UHF card, cable adapter, instructions, and fitted carton. (LR-TEK is a ***required*** first-time order for each installing company.)	AWID
5.	__	PS-123.3A-0-0	DC Power Module for LR-911 reader (1 power supply dedicated to each reader), plug-in type, ~12 volts, 3.3 amperes maximum load. (DC power specifications for LR-911 = 12.0 to 13.8 volts DC, 2.5 amperes or 3.5 amperes rating, linear, regulated. See Note 1.)	AWID
6.	__	_____	Pole, post, pedestal or arm, to locate LR-911 reader (if required): For passenger vehicles, 8 feet high, at side of lane. Reader may be mounted above vehicle lane, using a bracket. Mounting for other vehicle types: Call AWID's Technical Support; see LR-911 Manual.	(Note 2)
7.	__	_____	Cable for DATA: 22 gauge, 3 conductors, overall shielded, not twisted-pairs, color-coded insulation, plastic jacket. Length = up to 500 feet. For Wiegand or RS-232 data interface between one reader and the controller panel. See Note 3.	Distributor
8.	__	_____	Cable for POWER: 18 gauge, 2 conductors, overall shielded*, color-coded insulation, plastic jacket. Length = must be **at least** 12 feet, up to 500 feet. For DC power between one reader and its dedicated power supply. See Note 3. (* *Power cable **must** be shielded.*)	Distributor
9.	__	_____	Vehicle sensors: safety loop (1 required for each gate); reader arming loop (1 for each reader if presence of vehicle arms the reader).	Distributor
10.	__	_____	Gate, Gate Motor and Controller as selected by the installer.	Manufacturer
11.	1	_____	Access Control or A.V.I. System (the "head end") as selected by the user or installer.	Distr. or Mnfr.
12.	__	PCH196	Polycarbonate Housing. Use if reader is installed outdoors, exposed directly to weather.	(Note 4)

Note 1 Each LR-911 reader must have 1 independent, dedicated DC power supply. For permanent installations, AWID recommends Altronix SMP3 or LPS3 if the power cable is up to 300 feet, and Altronix SMP5 or LPS5 if the power cable is between 300 and 500 feet long. Include the required transformer for low voltage AC. Install the power supply 12 feet or ***more*** (both power-cable length and straight-line distance) from the LR-911 reader.

Note 2 Sources for mounting hardware (item 6): See www.Tapconet.com or other supplier of parking or traffic control products.

Note 3 Cables in items 7 and 8 may be combined in a single 18 gauge, 5-conductor, overall-shielded cable for each LR-911 reader. ** Important: All cables, including power, **must** be shielded.*

Note 4 Source of this housing is The Housing Company (www.TheHousingCompany.com) or a local distributor.

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LR-911 Installation – Material List

The listed products are required in most installations of AWID's LR-911 long-range reader. Items 1 to 5 are AWID's standard products. Items 1 through 8 are described in AWID's technical documents. Items 6 through 12 are available from local distributors or online suppliers.

	Qty.	Part Number	Product	Source
1.	__	LR-911-B-U	Long-Range UHF Reader, 902-928 MHz band, with antenna, in a single unit.	AWID
2.	__	LR-MB-0-0	Mounting Bracket for LR-911 reader, 11 inches long, pan-and-tilt adjustable head.	AWID
3.	__	(see instruction sheet or price list)	Tags selected for the application: WS-1216 Windshield Tag, MT-1014 Metal-Mount Tag. (Include code information in order: bit format, facility or site code, and starting ID number.)	AWID
4.	1	LR-TEK-0-0	LR Reader Tech Kit with LR-Sounder test unit, PS-123.3A power module, WS-UHF tag adhered to a piece of windshield glass, CS-UHF card, cable adapter, instructions, and fitted carton. (LR-TEK is a ***required*** first-time order for each installing company.)	AWID
5.	__	PS-123.3A-0-0	DC Power Module for LR-911 reader (1 power supply dedicated to each reader), plug-in type, ~12 volts, 3.3 amperes maximum load. (DC power specifications for LR-911 = 12.0 to 13.8 volts DC, 2.5 amperes or 3.5 amperes rating, linear, regulated. See Note 1.)	AWID
6.	__	_____	Pole, post, pedestal or arm, to locate LR-911 reader (if required): For passenger vehicles, 8 feet high, at side of lane. Reader may be mounted above vehicle lane, using a bracket. Mounting for other vehicle types: Call AWID's Technical Support; see LR-911 Manual.	(Note 2)
7.	__	_____	Cable for DATA: 22 gauge, 3 conductors, overall shielded, not twisted-pairs, color-coded insulation, plastic jacket. Length = up to 500 feet. For Wiegand or RS-232 data interface between one reader and the controller panel. See Note 3.	Distributor
8.	__	_____	Cable for POWER: 18 gauge, 2 conductors, overall shielded*, color-coded insulation, plastic jacket. Length = must be **at least** 12 feet, up to 500 feet. For DC power between one reader and its dedicated power supply. See Note 3. (* *Power cable **must** be shielded.*)	Distributor
9.	__	_____	Vehicle sensors: safety loop (1 required for each gate); reader arming loop (1 for each reader if presence of vehicle arms the reader).	Distributor
10.	__	_____	Gate, Gate Motor and Controller as selected by the installer.	Manufacturer
11.	1	_____	Access Control or A.V.I. System (the "head end") as selected by the user or installer.	Distr. or Mnfr.
12.	__	PCH196	Polycarbonate Housing. Use if reader is installed outdoors, exposed directly to weather.	(Note 4)

Note 1 Each LR-911 reader must have 1 independent, dedicated DC power supply. For permanent installations, AWID recommends Altronix SMP3 or LPS3 if the power cable is up to 300 feet, and Altronix SMP5 or LPS5 if the power cable is between 300 and 500 feet long. Include the required transformer for low voltage AC. Install the power supply 12 feet or ***more*** (both power-cable length and straight-line distance) from the LR-911 reader.

Note 2 Sources for mounting hardware (item 6): See www.Tapconet.com or other supplier of parking or traffic control products.

Note 3 Cables in items 7 and 8 may be combined in a single 18 gauge, 5-conductor, overall-shielded cable for each LR-911 reader. ** Important: All cables, including power, **must** be shielded.*

Note 4 Source of this housing is The Housing Company (www.TheHousingCompany.com) or a local distributor.

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Technical Reference

LR-MB Mounting Bracket for UHF Long-Range Readers

Installing the Mounting Bracket

AWID's Model LR-MB-0-0 Mounting Bracket, for UHF long-range readers, can be installed in a variety of ways. This memo suggests methods to attach the bracket to a wall, cabinet, pole, post or pedestal.

Purposes and Benefits

The LR-MB Mounting Bracket is used in most applications for AWIDôs UHF long-range readers -- Models LR-2000, LR-2200, LR-3000 and LR-911. (If the reader is aimed straight across the vehiclesô path, the bracket may be omitted.)

The bracket offers two main benefits ï

- The bracketôs 11-inch-long arm moves the reader to an improved location for good tag reading; and
- The bracketôs adjustable mounting head provides pan-and-tilt aiming for the reader.

These benefits are the same when you use a camera-mount with a CCTV security camera.

A UHF long-range reader gives best performance (usually stated as the *read range*) if ï

- the vehicleôs tag moves straight toward the readerôs front face, not across the readerôs *RF field**; and
- the tag and reader face each other, aligned on the same axis, spaced apart at the *rated reading distance***.

Construction

The LR-MB bracket is like a camera-mount arm, upside down (see Figures 1, 2 and 2) ï

- The adjustable head has similar slots for standard size and spacing of the fastening screws, matching the two capture-nuts on the back-plate of AWIDôs long-range readers.
- The base is flat, approximately 2.9 inches wide and 3.6 inches high. The base has 4 holes for mounting screws.
- The open-box arm is about 11 inches long. (Install the arm with the open side facing down. Invert the adjustable head so that it is suspended beneath the arm.)

Fastening to a Flat Surface

The LR-MB bracket may be fastened directly to any flat surface of any material ï a wall, ceiling, cabinet é The arm may be installed horizontally or vertically.

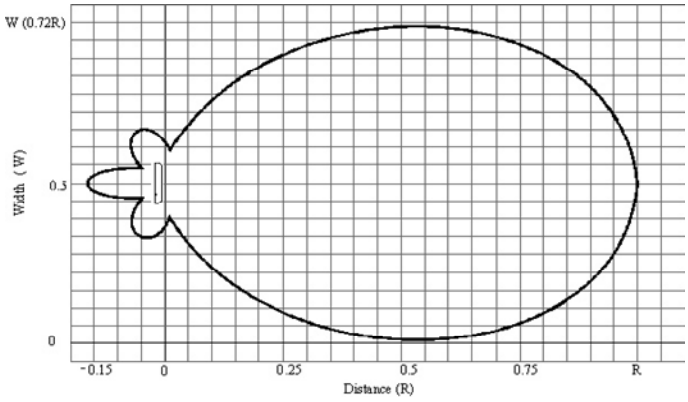
Fastening to a Square Post or Pedestal

The LR-MB bracketôs base may be fastened directly to a 3-inch (or larger) post with rectangular cross-section. It can also be mounted on a narrower post, say 2 inches, if there is space for the bracketôs 3-inch-wide base.

Fastening to a Round Pole or Pedestal

A popular way to attach the LR-MB bracket to a round pole or pedestal is by U-bolts and adapters with a flat surface. These are available from local suppliers and on-line. For quick-test mounting, automotive screw-type hose clamps or even long locking cable ties (as in the LR-KIT Installation Kit) may be used. Sources of universal post clamps (Figure 2, top) are security supply houses. Sources of U-bolt clamps are auto parts stores (Figure 2, right ï muffler clamp) and general hardware stores (Figure 2, left ï standard U-bolt and plates).

* Effective RF Field diagram:



** *Rated reading distances* for AWIDôs long-range readers with UHF tags and cards are in AWIDôs product sheet ñCredentials for UHF readersò.

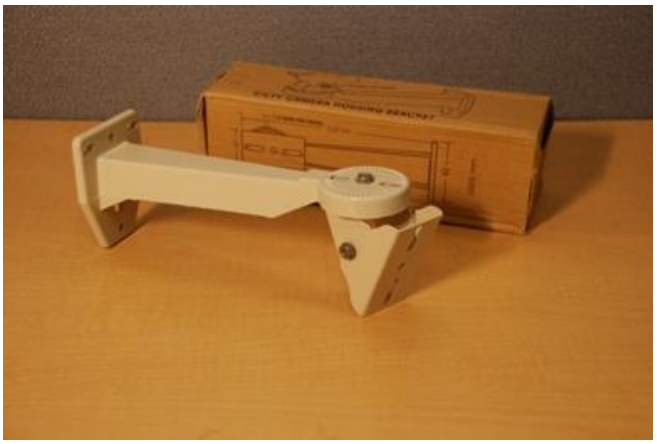


Figure 1. LR-MB Mounting Bracket, adjustable head inverted.



Figure 2. Clamps for LR-MB (available from others).



Figure 3. LR-MB with LR-3000 reader, clamped to round pole.

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Technical Reference

LR-3000 Installation – Material List

The listed products are required in most installations of AWID's LR-3000 long-range reader. Items 1 to 5 are AWID's standard products. Items 1 through 8 are described in AWID's technical documents. Items 6 through 11 are available from local distributors or online suppliers.

	Qty.	Part Number	Product	Source
1.	__	LR-3000-B-U	Long-Range UHF Reader, 902-928 MHz band, with antenna; weather-protected; 2 LEDs.	AWID
2.	__	LR-MB-0-0	Mounting Bracket for LR-3000 reader, 11 inches long, pan-and-tilt adjustable head.	AWID
3.	__	(see product sheet or price list)	Tags and Cards (select): WS-UHF Windshield Tag, RV-UHF Rear-View Mirror Tag, VT-UHF Sun Visor Tag, HT-UHF Hangtag, MT-UHF Metal-Mount Tag, ST-UHF Steel Tag; CS-UHF Clamshell Card, and/or GR-UHF Graphics Card. (Include code information in order: bit format, facility or site code, and starting ID number.)	AWID
4.	1	LR-TEK-0-0	LR Reader Tech Kit with LR-Sounder test unit, PS-123.3A power module, WS-UHF tag adhered to a piece of windshield glass, CS-UHF card, cable adapter, instructions, and fitted carton. (LR-TEK is a ***required*** first-time order for each installing company.) See Note 1.	AWID
5.	__	PS-123.3A-0-0	DC Power Module for LR-3000 reader (1 power supply dedicated to each reader), plug-in type, ~12 volts, 3.3 amperes maximum load. (DC power specifications for LR-3000 = 12.0 to 13.8 volts DC, 2.5 amperes or 3.5 amperes rating, linear, regulated. See Note 2.)	AWID
6.	__	_____	Pole, post, pedestal or arm, to locate LR-3000 reader (if required): For passenger vehicles, 8 feet high, at side of lane. Reader may be mounted above vehicle lane, using a bracket. Mounting for other vehicle types: Call AWID's Technical Support; see LR-3000 Manual.	(Note 3)
7.	__	_____	Cable for DATA: 22 gauge, 3 conductors, overall shielded, not twisted-pairs, color-coded insulation, plastic jacket. Length = up to 500 feet. For Wiegand or RS-232 data interface between one reader and the controller panel. See Note 4.	Distributor
8.	__	_____	Cable for POWER: 18 gauge, 2 conductors, overall shielded*, color-coded insulation, plastic jacket. Length = must be **at least** 12 feet, up to 500 feet. For DC power between one reader and its dedicated power supply. See Note 4. (* *Power cable **must** be shielded.*)	Distributor
9.	__	_____	Vehicle sensors: safety loop (1 required for each gate); reader arming loop (1 for each reader if presence of vehicle arms the reader).	Distributor
10.	__	_____	Gate, Gate Motor and Controller as selected by the installer.	Manufacturer
11.	1	_____	Access Control or A.V.I. System (the "head end") as selected by the user or installer.	Distributor or Manufacturer

Note 1 LR-2000KIT UHF Reader Test Kit is a recommended alternative. It contains also the LR-2000-EVAL reader, and a set of 7 UHF tags and cards (all except ST-UHF). For stand-alone demo, site evaluation, and reader testing by substitution.

Note 2 Each LR-3000 reader must have 1 independent, dedicated DC power supply. For permanent installations, AWID recommends Altronix SMP3 or LPS3 if the power cable is up to 300 feet, and Altronix SMP5 or LPS5 if the power cable is between 300 and 500 feet long. Include the required transformer for low voltage AC. Install the power supply 12 feet or ***more*** (both power-cable length and straight-line distance) from the LR-3000 reader.

Note 3 Sources for mounting hardware (item 6): See www.Tapconet.com or other supplier of parking or traffic control products.

Note 4 Cables in items 7 and 8 may be combined in a single 18 gauge, 5-conductor, overall-shielded cable for each LR-3000 reader. ** Important: All cables, including power, **must** be shielded.*

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Technical Reference

Credentials for UHF Long-Range Readers --
Alternatives for "Difficult" Cars

There is no definitive list of cars in which RF-encoded tags may have difficulty sending their codes to the readers. Features of the cars that can interfere with successful code reading are usually options for the cars' owners – either factory-installed "packages" or after-market purchases. This memo suggests solutions to assure successful code reading. It applies to credentials for all AWID UHF readers (LR-2000, LR-2200, LR-3000, LR-911 and others).

This information may be needed for only a small number of cars at a site. Most cars will work uniformly with the selected tag at a consistent location in all vehicles. A few high-end cars may need this special attention.

Sources of Interference

Metal coating on the windshield -- Tags inside vehicles may have their code transmission blocked by coatings for --
(a) sun-glare reduction by reflecting polarized light (the windshield often has a purple color outside the windshield), and
(b) absorption of infrared and ultraviolet light, and
(c) sensing rain drops on the windshield to start automatic windshield wipers.

Metal embedded in the windshield -- Tags inside vehicles may have shorter read range because of –
(a) heated conductors printed on the glass to evaporate mist from the glass, and
(b) radio antenna wires between the windshield's glass layers .

Tinting the windshield by metal -- Older vehicles (up to the early 2000s) used metal in the glass for tinting, usually in a band at the top of the windshield. This is seldom a factor in reading a tag's codes now.

RF transmission from devices in the vehicle -- Codes sent by tags inside or outside the vehicles may be hidden by transmission from --
(a) collision avoidance systems, which send and receive RF radiation like a radar set from both ends of the car, and
(b) radio communications equipment in the vehicle, operating at UHF (but cell phones, GPS, OnStar, etc. are OK).

Characteristics of AWID's Credentials

For permanent, one-time application -- **WS windshield tags** and **RV-UHF rear-view mirror tag** are designed for use inside a vehicle. They are attached by strong adhesive . They will not read if they are pulled off their mounting surface after the adhesive cures. The WS tags generate their rated reading distance only when they are permanently adhered to windshield glass.

For portability inside a vehicle or between vehicles -- **VT-UHF sun-visor tag** and **HT-UHF hangtag** are easily clipped or hooked inside a vehicle. Then they may be carried to another vehicle, or held in the fingers, for reading.

For reading either inside or outside a vehicle -- **MT bar-type tags** and **ST-UHF Supertag** may be fastened outside a vehicle and exposed to weather. They also read through the windshield if they are inside a vehicle.

For people holding a card at a reader for gate access or at a small reader for door access -- **CS-UHF clamshell card** and **GR-UHF graphics-quality card** are held squeezed between thumb and finger, and aimed at the reader.

Solutions for Particular Situations

If metal on or in the windshield glass affects code reading -- Alternatives =

(a) Move the WS windshield tag to the clear space at *top-center* of the windshield, where the metal is omitted to accommodate toll highway tags. This may be indicated by a dot-pattern printed on the glass, about 8 inches wide by 6 inches high. Locate the WS tag so that it faces the AWID reader head-on – aligned and parallel at the reading distance.

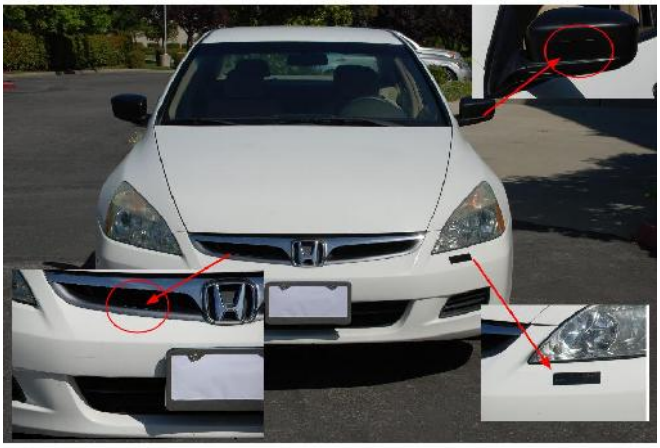
(b) On a few high-end cars, the clear space without metal is visible at the lower left corner of the windshield. If so, try the WS windshield tag there.

(c) The RV-UHF rear-view mirror tag, adhered to the mirror's shell, is already inside the top-center of the windshield. A reader mounted above the center of the vehicle lane may read the RV-UHF tag well.

If a tag will not read anywhere *inside* the windshield -- Alternatives =

(a) Use the MT tag or the ST-UHF tag *outside* the vehicle. See instructions for these tags (download from Web site).

(b) Use the RV-UHF tag *outside* the vehicle, as in the picture. Try a flat surface in the grille, or on the bumper under the headlamps, or on a side-view mirror. Align the tag with its black side facing the reader at the reading distance. Attach the tag to a clean surface by its adhesive.



(c) Reposition the reader at the side of the lane, aimed toward the side window of the vehicle through which the tag can be read without interference.

(d) Substitute a CS-UHF or GR-UHF hand-held card for the vehicle tag. The driver can present the card through the driver's side window, aimed toward the reader on that side when the card is at the reading distance from the reader.

If external radiation interferes with code reading -- Alternatives =

(a) Experiment with other tags and cards, used in others ways in or on the vehicle. Try each credential.

(b) Move the MT tag to a position on the vehicle where it is close to the reader, directly facing the reader.

(c) Identify the source of the offending radiation. Then locate the vehicle's tag as far from the RF source as possible.

Notes

1. AWID's LR-2000KIT Test Kit contains a sample of each encoded credential for the LR-2000 through LR-3000 readers, except the ST-UHF Supertag.

2. With an existing reader, the LR-TEK LR Reader Tech Kit has a test unit for stand-alone testing. The LR-3000 reader can serve as a stand-alone portable tester.

3. MT tags are not designed for fastening on license (registration) plates. They need to be mounted on a large area of metal for best reading. They are directional, so the tag needs to face the reader head-on.

4. CS-UHF and GR-UHF cards are not a hands-free solution. These cards must be squeezed between fingertips, with the hand behind the card, and then aimed facing the reader head-on.

Reference

- Product sheets and instruction sheet for UHF credentials. (Download from AWID's Web site.)

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Technical Reference

Tags and Cards for Long-Range Readers – Instructions for Users

Change History

Version	Date	Author	Comments
1.0	19 September 2012	L. Hickcox	First release.

When an AWID long-range UHF reader is installed for parking access, garage door operation, or automated vehicle identification, it is best if a specialist in operation of the system supervises the attachment of tags on vehicles and advises the users on good driving techniques. This contributes to good tag-reading performance by the reader.

This memo contains instructions for using the tags and cards, and information for the users (drivers).

Tags and Cards

The attached "Installation Instructions" show the Credentials (encoded tags and cards) that match the UHF reader model. These General Rules also are in the "Installation & Operation Manual" for the UHF long-range reader (Section 6.1).

1. Study the General Rules. Select the rules that apply to this installation. Use these when instructing the users.
2. Identify the tag or card type that is used in this installation. Use these instructions for attaching the tags to vehicles, or for holding the cards.

Readers

The "Installation & Operation Manual" contains much information that may be helpful to users, as well as installers. The Manual can be downloaded from AWID's Web site.

The "Quick Installation Guide" for this reader is inserted in the white carton in which AWID ships the reader. It too has useful information in short form.

In the Manual's Section 9, "Applications", select the sub-section that describes this type of reader and tag configuration. Use this to picture the arrangement of the reader and tags.

Driving Techniques

The drivers easily learn the techniques that result in quick and reliable tag reading.

1. Use the assigned tag or card in the way that the system's administrator advises.
2. Drive in the marked lane, as instructed by the administrator.
3. Drive in a straight line, as close to the reader as allowed by the lanes, as the tag passes in front of the reader.
4. Align the tag or card with the reader at that reading zone. They should be about parallel (same slope and angle).
5. Drive at a speed of about 15 miles per hour through the reading zone – faster if possible, slower if necessary.
6. Continue moving toward the gate. Stop the vehicle only if necessary while waiting for the gate to open.

Reference AWID's "FAQs" for the LR-2000 reader contains much useful information.

Attachment Installation Instructions for compatible tags and cards.

Notes AWID's long-range UHF readers and credentials are *not* like toll highway tags. AWID's credentials use passive tag technology (no battery). Reading distance and vehicle speed are less than with toll tags.

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Technical Reference

TAGS FOR LR-911 READERS – READING ON ALL VEHICLES

There is no list of vehicles on which the tags for UHF long-range readers will or will not read well. The characteristics of the vehicles that may cause interference with the tags' transmission are generally options (either factory "packages" or after-market additions). The following notes help to identify the individual vehicles that may not have good performance with AWID's WS tag. These vehicles are almost always "high-end" passenger cars – typically expensive makes. Suggested solutions are shown.

Metallic Coating on Windshield

- Automatic windshield wipers, using a coating outside the windshield to sense moisture.
- Anti-glare coating that reflects polarized light, identified by a purple appearance.

Solution: MT tag on dashboard (away from windshield), or MT tag outside vehicle.

Metal Embedded in Windshield

- Heated wires inside laminated glass for defrosting or demisting the windshield.
- Wires inside laminated glass for radio antenna.

Solution: MT tag on dashboard (away from windshield), or MT tag outside vehicle.

Metal Compounds in the Glass

- Heavy tinting for sunlight attenuation, especially in a band along the top of the windshield.

Solution: WS tag moved to clear area of windshield, or MT tag on dashboard.

RF Transmission from On-Vehicle Devices

- Anti-collision sensors – radar-like devices at front and rear of vehicle, to detect roadway hazards.
- Various RF communications equipment in the vehicle.

Solution: Switch installed to disable device's RF transmission while tag is in reader's effective field, or MT tag held by hand out of side window toward the reader.

Notes

- The MT tag offers great flexibility of use. It almost always works when a WS tag may be blocked. If the MT tag is blocked inside the vehicle, it can be mounted outside in many places.
- The WS tag may work on a coated windshield if a small rectangle is cut in the coating, just large enough for the WS tag to be attached inside the cleared space.
- The WS tag may be applied inside a *side* window of the vehicle if the tag faces a reader, and if the window is fixed in position.
- Highways that use UHF readers and tags for toll collection have the same problem. They often require that the tag be mounted on a special bracket outside the vehicle when traveling.
- "Lead" glass has no effect on RF transmission. Virtually every kind of glass contains lead.

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Technical Reference

Tags for UHF Long-Range Readers

Comparing "Passive" and "Active"

AWID's credentials (tags and cards) for all reader technologies are passive – that is, they are energized by the RF field that the reader generates, not by a battery inside the credential. For vehicles, passive tags are commonly used in gate control and automated identification applications. Active tags may be used on vehicles at high speed and in large spaces.

"Passive" Tags

All credentials (encoded cards, tags and wafers) from AWID are "passive" – that is, they have no battery to power the credentials' internal circuits (integrated circuit and antenna assembly). A passive credential's power is derived from the RF field that is generated by the AWID reader, with which the credential communicates like a transponder. The passive credential is completely disabled until the reader's RF field energizes the credential's circuits.

"Active" Tags

The tags from companies like Nedap, 3M (Sirit) and Transcore are typically "active" – that is, they contain a battery to supply the electrical power that is required to energize their internal circuits. The active tag may be in "sleep" mode, not able to transmit its programmed code until the tag is brought into the RF field that its corresponding reader generates. The active tag recognizes the communications from the reader, and the tag enters its active mode.

Comparisons – UHF Long-Range Readers

(Typical data for popular applications)	**Passive Tags from AWID**	**Active Tags from Others**
Read Range	20 feet to 30 feet	30 feet to 50 feet
Common Reading Distance (as Installed)	10 feet to 20 feet	30 feet
Vehicle Speed as Tag Passes Read Zone	15+ miles per hour	30+ miles per hour
Width of Travel Lane	12 feet to 15 feet	24 feet to 30 feet
Credential Types	All, even 0.030" graphics cards	Tags & cards -- thicker for battery
Tag Size	Thin, small area, light weight	Thicker, larger, heavier
Tag Life	No limit inherent in credentials	Depends on use (battery drain)
Reader Size	8 inches to 9-1/2 inches square	Larger; may be an array of antennas
Prices of Tags and Readers	Moderate	Higher – 2 to 3 times
Cost of Installation	Moderate	Higher – up to 2 times

Applications

Passive tags are ideal when vehicles can move in a uniform manner (travel-lane width, vehicle approach path, vehicle speed) past the reader, and when the user's budget is restricted, and when installation space is limited.

AWID's "HiLo" reader offers twice the space for reading tags, compared with the single UHF readers. For any AWID UHF tag type, the "HiLo" reader set is preferred for mixed cars and trucks, curved lanes, change in grade, and wide lanes.

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Reader Size	8 inches to 9-1/2 inches square	Larger; may be an array of antennas
Prices of Tags and Readers	Moderate	Higher – 2 to 3 times
Cost of Installation	Moderate	Higher – up to 2 times

Applications

Passive tags are ideal when vehicles can move in a uniform manner (travel-lane width, vehicle approach path, vehicle speed) past the reader, and when the user's budget is restricted, and when installation space is limited.

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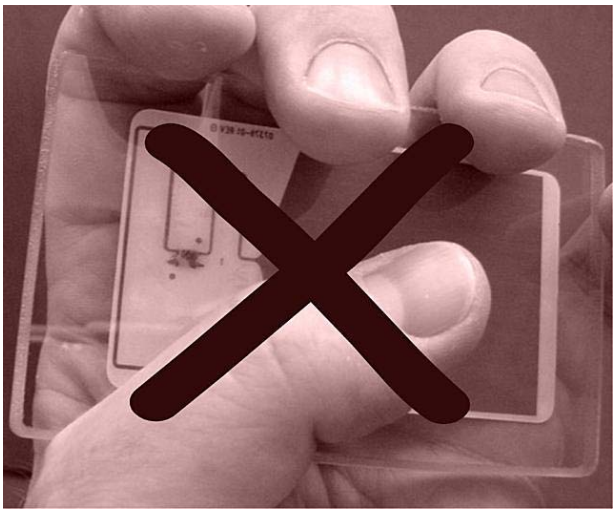
Applied Wireless Identifications Group, Inc.

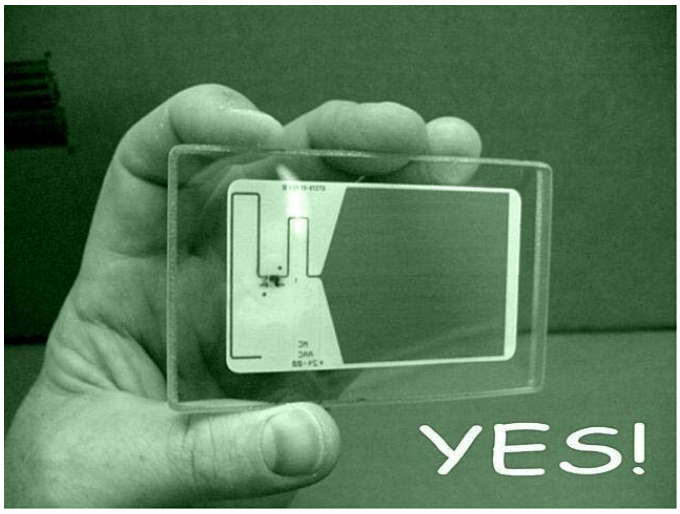
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Technical Reference -Instructions

GMWS Glass-Mounted Windshield Tags

Instructions for Holding





Body-blocking of the GMWS Glass-Mounted Windshield Tag, for use with AWID's LR-911 Long-Range Reader, can be eliminated by holding the glass rectangle as shown in the photograph above. This method of holding the tag keeps the hand behind the glass, away from the reader.

Be sure that the tag is on the side of the glass away from the reader, so that the copper circuit and integrated circuit face the reader through the glass.

For best read range, hold the glass rectangle so that the glass and the reader are approximately parallel to each other, with the edges of the glass piece and the edges of the reader case aligned with each other.

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Technical Reference

WS-_ Windshield Tags for UHF Readers

Testing for Good Location in Vehicles

The WS-UHF-0-0 and WS-1216-0-0 tags generate their full read range only when they are permanently attached by their adhesive to windshield glass inside the vehicles. When they are held in air by the fingertips, they may read only 3 feet from the reader. But when they are properly applied to windshield glass, the WS tag's reading distance increases to about 15 feet for LR-2000 readers, and to about 8 feet for LR-911 readers. This memo describes tests for best reading.

A. Testing Tag by Hand

When you hold a WS-_ tag by hand (a) to test the tag or reader, or (b) to self-enroll the code into a system –

1. Squeeze the tag between your thumb and forefinger at the edge of the protective plastic sheet that covers the tag's adhesive. Keep your hand behind or to the side of the tag.
2. Hold the tag close to the reader, parallel to the reader's face, with the tag's plastic sheet facing the reader.
3. Have a clear line-of-sight between the tag and the reader.

B. Finding Good Tag Location Inside Windshields

To select the best location for WS-_ windshield tags inside vehicles, we must consider all of these factors – the model of the long-range reader, its location, its method of mounting, its aiming, the types and sizes of vehicles, characteristics of the windshields, and features of the vehicles.

When a good tag location on the windshield is identified for a typical vehicle, the tags in *all other* vehicles of that type will usually read well in the same location. A few high-priced cars may require you to identify their ideal tag location.

To test the performance of a new WS-_ tag in various locations inside a windshield, before the tag is attached by its adhesive to the glass –

1. Use the SP-6820-LR **test unit** from the Installation Kit. Clip its wires to the reader's black, orange and red wires.
2. Move the **vehicle** to be tested so that its windshield is about 15 feet (5 meters) in front of the reader. Aim the reader at the windshield.
3. Use a block of flexible **plastic foam** that can be held by hand (3 or 4 inches thick, flat on one side).
4. Hold the **WS-_ tag** with its removable plastic sheet still covering the tag's adhesive, inside the windshield. Place the plastic sheet against the windshield glass, facing the reader.
5. With the plastic foam block, **press the tag** flat against the windshield. Keep your fingers away from the tag.
6. Observe the test unit on the reader. It indicates each read of the tag by a short **beep and LED** color change.
7. To find the best tag location, move the tag to **different locations** inside the windshield. Try both **portrait and landscape** orientation of the tag.
8. When you find the best location, peel the plastic sheet from the tag without bending the tag. **Attach the tag** by its adhesive to the glass. Use your fingers or the heel of your hand to press the tag flat against the glass. Do not press hard directly over the tag's integrated circuit.

Steps 4-7 take just a few seconds. This is a valuable procedure for the few vehicles at a typical installation that may block the tags' RF code transmission to the reader. (See References, page 2, for Technical Reference, "RF Blocking".)

C. Attaching Tag to Other Material

To develop full rated read range with the WS-_ windshield tags, they must be attached by their own adhesive only to windshield glass. When attached to any other material (for example, Plexiglas), or if held in fingers, the reading distance will be greatly reduced. The WS-_ tags must be permanently adhered to windshield glass to make use of the dielectric constant of windshield glass, which becomes a parameter in the tags' circuits.

D. Trouble-Shooting the System

Common reading distance for all AWID tags and cards for long-range readers is 15 feet (5 meters). If you measure considerably less than 15 feet, there are other system factors to check. (Contact AWID's Technical Support.) Check on –

- Power supply – rating; dedicated to this one reader; not grounded.
- Cable specifications – always shielded; proper gauge.
- Wire connections – 7 wires connected; 3 unused wires insulated separately.
- Draining – all cable shields tied together, but *not* grounded anywhere.
- Presence of another UHF reader (use AWID's "HiLo" reader set for 2 readers close together).
- RF interference from another UHF source, for example, fluorescent light close to the reader.
- Presence of more than one tag in the reader's effective RF field.

E. Installation Kit

AWID offers Installation Kits for the long-range readers. The Kit is a required first-time, one-time purchase for every installing company. For the LR-2000 reader, use LR-2000KIT-0-0. For the LR-911 reader, use LR-911KIT-0-0. The Kit contains the SP-6820-LR clip-on test unit, a set of compatible encoded tags, a plug-in DC power module, and other items.

Notes

1. WS-_ tags can be adhered just once to the windshield. If a tag is pulled from the glass, it will no longer read.

References

- Technical Reference: "Long-Range Readers – Questions for **System Planning**"
- Product sheet: "**Credentials** for UHF Readers LR-2000 & UA-612"
- Installation Instructions: "**Credentials** for LR-2000 Long-Range Reader"
- Installation Instructions: "**Credentials** for LR-911 Long-Range Readers"
- Product Sheet: "LR-2000KIT UHF **Installation Kit**"
- Quick Installation Guide: "LR-2000KIT **Installation Kit**"
- Quick Installation Guide: "LR-911KIT **Installation Kit**"
- Technical Reference: "Tags for Long-Range Readers – **RF Blocking** by Vehicle Features"
- Diagram: "Long-Range Readers – Effective **RF Field** with UHF Tags"

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2. Move the **vehicle** to be tested so that its windshield is about 15 feet (5 meters) in front of the reader. Aim the reader at the windshield.
3. Use a block of flexible **plastic foam** that can be held by hand (3 or 4 inches thick, flat on one side).
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Common reading distance for all AWID tags and cards for long-range readers is 15 feet (5 meters). If you measure considerably less than 15 feet, there are other system factors to check. (Contact AWID's Technical Support.) Check on –

- Power supply – rating; dedicated to this one reader; not grounded.
- Cable specifications – always shielded; proper gauge.
- Wire connections – 7 wires connected; 3 unused wires insulated separately.
- Draining – all cable shields tied together, but *not* grounded anywhere.
- Presence of another UHF reader (use AWID's "HiLo" reader set for 2 readers close together).
- RF interference from another UHF source, for example, fluorescent light close to the reader.
- Presence of more than one tag in the reader's effective RF field.

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AWID offers Installation Kits for the long-range readers. The Kit is a required first-time, one-time purchase for every installing company. For the LR-2000 reader, use LR-2000KIT-0-0. For the LR-911 reader, use LR-911KIT-0-0. The Kit contains the SP-6820-LR clip-on test unit, a set of compatible encoded tags, a plug-in DC power module, and other items.

Notes

1. WS-_ tags can be adhered just once to the windshield. If a tag is pulled from the glass, it will no longer read.

References

- Technical Reference: "Long-Range Readers – Questions for **System Planning**"
- Product sheet: "**Credentials** for UHF Readers LR-2000 & UA-612"
- Installation Instructions: "**Credentials** for LR-2000 Long-Range Reader"
- Installation Instructions: "**Credentials** for LR-911 Long-Range Readers"
- Product Sheet: "LR-2000KIT UHF **Installation Kit**"
- Quick Installation Guide: "LR-2000KIT **Installation Kit**"
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- Diagram: "Long-Range Readers – Effective **RF Field** with UHF Tags"

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Technical Reference

LR-911-HiLo LONG-RANGE READER SET

(MASTER – ANTENNA)

AWID's LR-911-HiLo (Master-Antenna) is a set of interconnected UHF readers serving as long-range tag readers with particular characteristics. The general application is automated vehicle identification (AVI).

Description

The LR-911-HiLo consists of a pair of identical plastic and metal housings, containing in one the Master Reader, and in the other the Remote Antenna. At any instant there is RF transmission from either the master reader or the remote antenna, but never from both. Each housing can be mounted like a regular LR-911 reader. The two housings are connected by a 6-foot coaxial cable. There is a single interface to the host system's reader input port. (See "Product Description" for LR-911-HiLo.)

Purposes

- To spread the effective RF field horizontally – increasing reliability of reads when vehicles are turning as they approach the reader. Or …
- To spread the effective RF field vertically – increasing reliability of reads when tags are mounted at different heights on vehicles. Or …
- To provide two independent fields when vehicles combine passenger cars or small trucks, and also really big trucks and buses – allowing use of WS tags on smaller vehicles, and MT tags on trucks.

Advantage

For a modest increase in price over a single LR-911 reader, the LR-911-HiLo functions like two readers but with no cross talk between the readers when their effective fields intersect. So the master reader and the remote antenna can be mounted very close together (and up to about 4 feet apart).

Installation and Application

- The LR-911-HiLo does not increase the read range (that is, the maximum distance at which the reader can read a tag) or the distance of the "sweet spot" (see Definitions, below). It can expand the width or height of the effective RF field; or it can create a second field as large as the first. But the range remains the same. (Either the master reader or the remote antenna is transmitting at any instant.)

- The average delay in reading a tag that enters one of the two RF fields (0.3 second) is double the average delay for a single LR-911. This added delay should not be noticeable to any driver.

- The housings need to be protected from direct precipitation. Use a rain and sun shield when necessary.

- The coaxial connectors need to be sealed by silicone sealant, or equivalent. Suggestion: Mount the housings upside down, so that the coaxial connectors on both housings are at the bottom edge.

- It is possible to use the master reader by itself, without the remote antenna. But the duty cycle is reduced from 100% to 50% (assuming that the master reader is armed continually, by grounding the yellow wire).

Electric Power

- The LR-911-HiLo has a peak electrical load that is about 50% more than the single LR-911.
- A typical 12-volt to 13.5-volt DC power supply should have a minimum of 1.5 ampere capacity for the LR-911-HiLo.
- The power supply should be a linear design, with regulated DC output.
- Use a separate DC source for each LR-911-HiLo set; or use a DC source with isolated output terminals for each DC device.
- Connect no other load to the DC terminals supplying the LR-911-HiLo.
- If the power supply is based upon switching technology, have at least 3 amperes current capacity for each LR-911-HiLo set. Select a power supply model with linear DC output rating.

Definitions

- "Effective RF field" = the extent of three-dimensional space in which the tag (either a properly held test tag or a properly mounted vehicle tag) is detected and decoded by the reader.
- "Sweet spot" = the ideal location of the tag as it is read by the reader. This is typically 8 feet to 6 feet from the reader. At that distance the width and height of the effective field is optimized.

References

- Installation Sheet – LR-911-HiLo MA Installation Sheet

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The LR-911-HiLo consists of a pair of identical plastic and metal housings, containing in one the Master Reader, and in the other the Remote Antenna. At any instant there is RF transmission from either the master reader or the remote antenna, but never from both. Each housing can be mounted like a regular LR-911 reader. The two housings are connected by a 6-foot coaxial cable. There is a single interface to the host system's reader input port. (See "Product Description" for LR-911-HiLo.)

Purposes

- To spread the effective RF field horizontally – increasing reliability of reads when vehicles are turning as they approach the reader. Or …
- To spread the effective RF field vertically – increasing reliability of reads when tags are mounted at different heights on vehicles. Or …
- To provide two independent fields when vehicles combine passenger cars or small trucks, and also really big trucks and buses – allowing use of WS tags on smaller vehicles, and MT tags on trucks.

Advantage

For a modest increase in price over a single LR-911 reader, the LR-911-HiLo functions like two readers but with no cross talk between the readers when their effective fields intersect. So the master reader and the remote antenna can be mounted very close together (and up to about 4 feet apart).

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Installation and Application

o The LR-911-HiLo does not increase the read range (that is, the maximum distance at which the reader can read a tag) or the distance of the "sweet spot" (see Definitions, below). It can expand the width or height of the effective RF field; or it can create a second field as large as the first. But the range remains the same. (Either the master reader or the remote antenna is transmitting at any instant.)

o The average delay in reading a tag that enters one of the two RF fields (0.3 second) is double the average delay for a single LR-911. This added delay should not be noticeable to any driver.

o The housings need to be protected from direct precipitation. Use a rain and sun shield when necessary.

o The coaxial connectors need to be sealed by silicone sealant, or equivalent. Suggestion: Mount the housings upside down, so that the coaxial connectors on both housings are at the bottom edge.

o It is possible to use the master reader by itself, without the remote antenna. But the duty cycle is reduced from 100% to 50% (assuming that the master reader is armed continually, by grounding the yellow wire).

Electric Power

- The LR-911-HiLo has a peak electrical load that is about 50% more than the single LR-911.
- A typical 12-volt to 13.5-volt DC power supply should have a minimum of 1.5 ampere capacity for the LR-911-HiLo.
- The power supply should be a linear design, with regulated DC output.
- Use a separate DC source for each LR-911-HiLo set; or use a DC source with isolated output terminals for each DC device.
- Connect no other load to the DC terminals supplying the LR-911-HiLo.
- If the power supply is based upon switching technology, have at least 3 amperes current capacity for each LR-911-HiLo set. Select a power supply model with linear DC output rating.

Definitions

- "Effective RF field" = the extent of three-dimensional space in which the tag (either a properly held test tag or a properly mounted vehicle tag) is detected and decoded by the reader.
- "Sweet spot" = the ideal location of the tag as it is read by the reader. This is typically 8 feet to 6 feet from the reader. At that distance the width and height of the effective field is optimized.

References

- Product Description – LR-911-HiLo (Master-Antenna) -- 1 page
- Installation Sheet – LR-911-HiLo (Master-Antenna) -- 2 pages

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Technical Reference

LR-911-HiLo Reader Sets – Comparison of two set Types

This table compares features of two forms of LR-911-HiLo readers (MA or MS), to select the best set for an application.

Comparison Factors	LR-911-HiLo (MA)	LR-911-HiLo (MS)
Simple name	**"Master-Antenna"**	**"Master-Slave"**
Units in the set	Master Reader + Remote Antenna	Master Reader + Slave Reader
Housing of the units (2 per set)	Standard LR-911 plastic housing with aluminum reflector plate	Standard LR-911 plastic housing with aluminum reflector plate
Mounting the housings	LRMB Mounting Bracket or similar adjustable bracket	LRMB Mounting Bracket or similar adjustable bracket
Number of posts	Usually 1 post for both units	Usually 2 posts – 1 for each unit
Orientation of the 2 reader units	Over-and-under, or side-by-side	Any orientation
Wiring from LR-911-HiLo to controller panel	Same as for a single LR-911 reader	Same as for a single LR-911 reader
Number of Wiegand reader ports required in controller panel	1	1
Wiring between two housings in the LR-911-HiLo set	Coaxial cable (6 foot long cable supplied with the set by AWID)	Data: 22 gauge, not twisted pair Power: 18 gauge, twisted pair OK
Distance between 2 housings in the LR-911-HiLo set (maximum)	6 feet (maximum length of coax cable); typically 4 feet	50 feet (RS-232 standard specification for data lines)
Applications for the LR-911-HiLo reader set	• Reading tags on combination of big and small vehicles, or • Reading tags on vehicles that are turning at the readers, or • Reading WS tags on cars, and MT tags on side of trucks	• Reading tags on vehicles that are at different locations on a wide lane
Aiming the 2 units -- goal	To expand either width or height of the RF field's cross-section	To create 2 independent effective RF fields
Effect on read range (maximum distance from tag to reader)	As rated for LR-911 (maximum range does not increase)	As rated for LR-911 (maximum range does not increase)
Programming the units	AWID programs the Master Reader for remote antenna connection	AWID programs both units, one as Master Reader, one as Slave Reader
RS-232 interface available ?	Yes – both Wiegand and RS-232	No – Wiegand interface only
Power supply specification (typical)	For the complete "MA" set: 12 VDC, 1.5 A, linear, regulated (if Altronix, 3 A minimum)	For **each** reader in the "MS" set: 12 VDC, 1.5 A, linear, regulated (if Altronix, 3 A minimum)
Price	Ask AWID's Sales Rep or Customer Support (lower price)	Ask AWID's Sales Rep or Customer Support (higher price)
Installation Kit for this set	LRIN (same as for LR-911 reader)	LRIN-HiLo (with **4** spring clips)
Reference documents available	Product Description for "MA" Installation Sheet for "MA" Technical Reference: Summary Technical Reference: Application	Product Description for "MS" Installation Sheet for "MS"

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Technical Reference

LR-2000 Installation – Material List

The listed products are required in most installations of AWID's LR-2000 long-range reader. Items 1 to 5 are AWID's standard products. Items 1 through 8 are described in AWID's technical documents. Items 6 through 12 are available from distributors or online suppliers. FOR OUTDOOR INSTALLATION EXPOSED TO WEATHER, USE LR-3000.

	Qty.	Part Number	Product	Source
1.	__	LR-2000-B-U	Long-Range UHF Reader, 902-928 MHz band, with antenna, in a single unit.	AWID
2.	__	LR-MB-0-0	Mounting Bracket for LR-2000 reader, 11 inches long, pan-and-tilt adjustable head.	AWID
3.	__	(see product sheet or price list)	Tags and Cards (select): WS-UHF Windshield Tag, RV-UHF Rear-View Mirror Tag, VT-UHF Sun Visor Tag, HT-UHF Hangtag, MT-UHF Metal-Mount Tag, ST-UHF Steel Tag; CS-UHF Clamshell Card, and/or GR-UHF Graphics Card. (Include code information in order: bit format, facility or site code, and starting ID number.)	AWID
4.	1	LR-TEK-0-0	LR Reader Tech Kit with LR-Sounder test unit, PS-123.3A power module, WS-UHF tag adhered to a piece of windshield glass, CS-UHF card, cable adapter, instructions, and fitted carton. (LR-TEK is a ***required*** first-time order for each installing company.) See Note 1.	AWID
5.	__	PS-123.3A-0-0	DC Power Module for LR-2000 reader (1 power supply dedicated to each reader), plug-in type, ~12 volts, 3.3 amperes maximum load. (DC power specifications for LR-2000 = 12.0 to 13.8 volts DC, 2.5 amperes or 3.5 amperes rating, linear, regulated. See Note 2.)	AWID
6.	__	_____	Pole, post, pedestal or arm, to locate LR-2000 reader (if required): For passenger vehicles, 8 feet high, at side of lane. Reader may be mounted above vehicle lane, using a bracket. Mounting for other vehicle types: Call AWID's Technical Support; see LR-2000 Manual.	(Note 3)
7.	__	_____	Cable for DATA: 22 gauge, 3 conductors, overall shielded, not twisted-pairs, color-coded insulation, plastic jacket. Length = up to 500 feet. For Wiegand or RS-232 data interface between one reader and the controller panel. See Note 4.	Distributor
8.	__	_____	Cable for POWER: 18 gauge, 2 conductors, overall shielded*, color-coded insulation, plastic jacket. Length = must be **at least** 12 feet, up to 500 feet. For DC power between one reader and its dedicated power supply. See Note 4. (* *Power cable **must** be shielded.*)	Distributor
9.	__	_____	Vehicle sensors: safety loop (1 required for each gate); reader arming loop (1 for each reader if presence of vehicle arms the reader).	Distributor
10.	__	_____	Gate, Gate Motor and Controller as selected by the installer.	Manufacturer
11.	1	_____	Access Control or A.V.I. System (the "head end") as selected by the user or installer.	Distr. or Mnfr.
12.	__	PCH196	Polycarbonate Housing. Use if reader is installed outdoors, exposed directly to weather.	(Note 5)

Note 1 LR-2000KIT UHF Reader Test Kit is a recommended alternative. It contains also the LR-2000-EVAL reader, and a set of 7 UHF tags and cards (all except ST-UHF). For stand-alone demo, site evaluation, and reader testing by substitution.

Note 2 Each LR-2000 reader must have 1 independent, dedicated DC power supply. For permanent installations, AWID recommends Altronix SMP3 or LPS3 if the power cable is up to 300 feet, and Altronix SMP5 or LPS5 if the power cable is between 300 and 500 feet long. Include the required transformer for low voltage AC. Install the power supply 12 feet or ***more*** (both power-cable length and straight-line distance) from the LR-2000 reader.

Note 3 Sources for mounting hardware (item 6): See www.Tapconet.com or other supplier of parking or traffic control products.

Note 4 Cables in items 7 and 8 may be combined in a single 18 gauge, 5-conductor, overall-shielded cable for each LR-2000 reader. ** Important: All cables, including power, **must** be shielded.*

Note 5 Source of this housing is The Housing Company (www.TheHousingCompany.com) or a local distributor.

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Technical Reference

LR-2000HiLo Installation – Material List

The listed products are required in most installations of AWID's LR-2000HiLo long-range reader. Items 1 to 5 are AWID's standard products. Items 1 through 8 are described in AWID's technical documents. Items 6 through 12 are available from local distributors or online suppliers. "HiLo" set uses 1 DC power supply and 1 reader port, and 2 Housings if needed.

	Qty.	Part Number	Product	Source
1.	__	LR-2000HiLoMA-B-U	Long-Range UHF Reader Set, 902-928 MHz band, 2 antenna units, and 6 ft coaxial cable.	AWID
2.	__	LR-MB-0-0	Mounting Bracket, 11 inches long, pan-and-tilt adjustable head. 2 Brackets for "HiLo" set.	AWID
3.	__	(see product sheet or price list)	Tags and Cards (select): WS-UHF Windshield Tag, RV-UHF Rear-View Mirror Tag, VT-UHF Sun Visor Tag, HT-UHF Hangtag, MT-UHF Metal-Mount Tag, ST-UHF Steel Tag; CS-UHF Clamshell Card, and/or GR-UHF Graphics Card. (Include code information in order: bit format, facility or site code, and starting ID number.)	AWID
4.	1	LR-TEK-0-0	LR Reader Tech Kit with LR-Sounder test unit, PS-123.3A power module, WS-UHF tag adhered to a piece of windshield glass, CS-UHF card, cable adapter, instructions, and fitted carton. (LR-TEK is a ***required*** first-time order for each installing company.) See Note 1.	AWID
5.	__	PS-123.3A-0-0	DC Power Module for LR-2000HiLo reader set (1 power supply dedicated to each set), plug-in type, ~12 volts, 3.3 amperes maximum load. (DC power specifications for LR-2000HiLo = 12.0 to 13.8 volts DC, 2.5 amperes or 3.5 amperes rating, linear, regulated. See Note 2.)	AWID
6.	__	_____	Pole, post, pedestal or arm, to locate LR-2000HiLo reader (if required): Mount 2 units on 2 brackets up to 4 ft apart, aimed in different directions. For mix of big trucks and cars, or for cars from different directions. Call AWID's Technical Support; see LR-2000 Manual.	(Note 3)
7.	__	_____	Cable for DATA: 22 gauge, 3 conductors, overall shielded, not twisted-pairs, color-coded insulation, plastic jacket. Length = up to 500 feet. For Wiegand or RS-232 data interface between one reader and the controller panel. See Note 4.	Distributor
8.	__	_____	Cable for POWER: 18 gauge, 2 conductors, overall shielded*, color-coded insulation, plastic jacket. Length = must be **at least** 12 feet, up to 500 feet. For DC power between one reader and its dedicated power supply. See Note 4. (* *Power cable **must** be shielded.*)	Distributor
9.	__	_____	Vehicle sensors: safety loop (1 required for each gate); reader arming loop (1 for each reader if presence of vehicle arms the reader).	Distributor
10.	__	_____	Gate, Gate Motor and Controller as selected by the installer.	Manufacturer
11.	1	_____	Access Control or A.V.I. System (the "head end") as selected by the user or installer.	Distr. or Mnfr.
12.	__	PCH196	Polycarbonate Housing. Use if reader is exposed to weather. 2 Housings for 1 "HiLo" set.	(Note 5)

Note 1 LR-2000KIT UHF Reader Test Kit is a recommended alternative. It contains also the LR-2000-EVAL reader, and a set of 7 UHF tags and cards (all except ST-UHF). For stand-alone demo, site evaluation, and reader testing by substitution.

Note 2 Each LR-2000HiLo reader set must have 1 independent, dedicated DC power supply. For permanent installations, AWID recommends Altronix SMP3 or LPS3 if the power cable is up to 300 feet, and Altronix SMP5 or LPS5 if the power cable is between 300 and 500 feet long. Include the required transformer for low voltage AC. Install the power supply 12 feet or ***more*** (both power-cable length and straight-line distance) from the LR-2000HiLo reader.

Note 3 Sources for mounting hardware (item 6): See www.Tapconet.com or other supplier of parking or traffic control products.

Note 4 Cables in items 7 and 8 may be combined in a single 18 gauge, 5-conductor, overall-shielded cable for each LR-2000HiLo reader set. * *Important: All cables, including power, **must** be shielded.*

Note 5 Source of this housing is The Housing Company (www.TheHousingCompany.com) or a local distributor.

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Technical Reference

LR-2000HiLo Long-Range Reader Set

APPLICATION: Mixed Trucks and Cars at Same Gate

*An advantage of the **LR-2000HiLoMA** reader set is the ability to have two long-range readers close together, aimed at different locations of the vehicle tags. This allows a mixture of big trucks and buses, and also passenger cars of all sizes, at the same gate. There is a single interface from the LR-2000HiLoMA to the controller panel. The features and options for this application are described below.*

Product Description

The LR-2000HiLoMA reader set consists of two similar units – a master reader and a remote antenna. The housings are the same as the standard LR-2000, except that a brass mini-coaxial connector has been added on one edge of both units. The LR-2000HiLoMA set includes a 6-foot-long coaxial cable that allows the two units to communicate with each other. Both units contain an antenna and an aluminum reflector plate, in an ABS plastic housing. Only the master reader has the integrated cable that connects DC power from an external power supply, and transmits code data to the host system.

The DC power specification is the same as for the standard LR-2000 long-range reader. The data interface to the host system is the same also – only a single reader input port is required at the host panel.

Function

The LR-2000HiLoMA reader set gives the installer a means of (a) spreading out the effective RF field in the same direction from the units, to enlarge the size of the field either horizontally or vertically – or of (b) creating two separated RF fields. The HiLo feature does not make the effective field *longer*, so the maximum read range or the guaranteed reading distance remains the same as with a standard LR-2000 reader.

Applications

The LR-2000HiLoMA reader set with the RF field **spread horizontally** is used where the vehicles turn as they approach or drive through the tag-reading zone near the reader, or where the roadway is wider than the usual single lane. This is common if the reader is at a driveway where vehicles turn from a through street, or if there is a curve in the lane at the tag-reading zone.

With the RF field **spread vertically**, tags on vehicles at a change in grade on the lane at the tag-reading zone can be read with assurance. This arrangement also applies to vehicles of different sizes in which the tags may be at different heights above the lane surface.

The two units of the LR-2000HiLoMA reader set can even be facing in **opposite directions** at a set of IN and OUT gates, for example, with the two reader units mounted back-to-back at the same height on the same pole. The master reader may be aimed at tags in entering vehicles, and the remote antenna may be aimed 180° away at tags in exiting vehicles. This application is practical if the system does not need to know whether the vehicle was entering or exiting the facility – only that it was an authorized vehicle with a valid tag code.

A special case occurs when the vehicles are of great diversity – say, passenger vehicles, and vans or pickups, and semi-trailer trucks or buses. In this case, the best results may come from use of different tag types on small and big vehicles. The LR-2000HiLoMA's units should be at different heights on a single pole, and the units aimed in different directions. Here are the details . . .

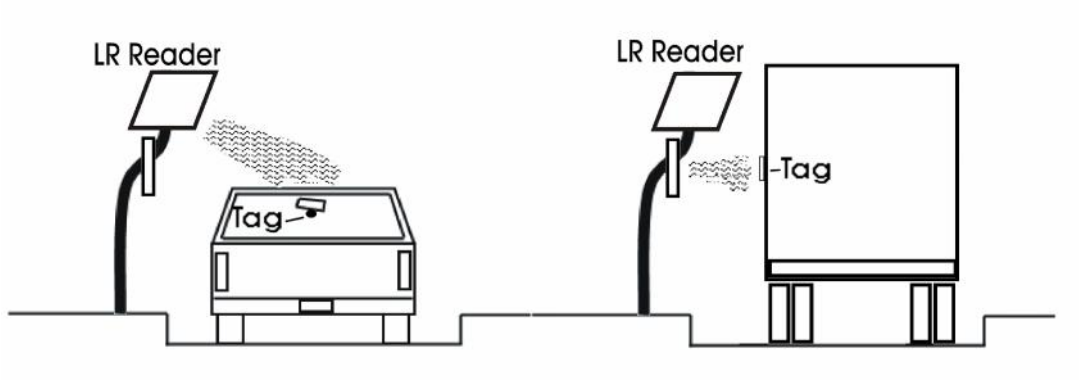
Mixing Passenger Cars and Big Trucks or Buses

A popular solution for this mix of vehicles is the LR-2000HiLoMA reader set with the two units mounted on LR-MB mounting brackets fastened to a single square pole or post at either side of the vehicle lane, close to the edge of the vehicle lane.

For the passenger cars (including sedans, vans, SUVs and pickup trucks), mount the reader so that it is about 7 feet above the lane's surface. Attach the selected vehicle tag (like the **WS-UHF** on the windshield) according to AWID's instructions, on the same side of the car as the reader. Aim the reader at the location of tags on the windshields when the distance between the reader's front face and the tags' locations on cars approaching the reader is 10 feet.

For the big trucks and buses, mount the reader so that it is about 4-1/2 feet above the lane's surface. Attach the **MT-UHF** tag with vertical orientation on the side of the truck, on a flat surface that is about 4-1/2 feet above the lane, on the same side of the truck or bus as the reader. Aim the reader's RF field horizontally across the lane, perpendicular to the path of the vehicles. The ideal distance between the reader's front face and the tag, when the tag is just opposite the reader, is between 4 feet and 10 feet.

It does not matter whether the LR-2000HiLoMA master reader or remote antenna is at the high or low position on the pole. It is usually best to have the master reader low (for the big trucks and buses), to keep the cable run from underground conduit shorter. Then the high remote antenna (for the passenger cars) is connected by the coaxial cable to the low master reader. Using the LR-MB mounting brackets, the two brackets may be as much as 4 feet apart vertically.



Alternative Plan

It is possible to use tags inside all of the vehicles for this mix of small and large vehicles. For example, if the **WS-UHF** windshield tags are used in both passenger cars and big trucks or buses, the LR-2000HiLoMA set's master reader may be at the 7 foot high bracket location to read tags inside the cars, and the remote antenna may be at a higher position, perhaps around 9 feet above the lane, to read tags inside the trucks or buses. In this case, both readers will be aimed at the location of their respective tags when the tags are at the typical 10 foot reading distance from the reader's front face. The goal is to have the tags and the face of the reader about parallel to each other when the tags are at the typical reading distance.

Site Layout

Other factors relating to the installation, as described in AWID's LR-2000 Installation & Owners Manual and Technical Reference issues, should be considered in all applications. These include . . .

- Location of the readers relative to the gate.
- Specifications for power supply and cables and wiring.
- Plastic enclosure for both of the reader units if they are mounted outdoors and exposed directly to precipitation, or exposed to bright sunlight in a location with high ambient temperature.
- Selection of 5 vehicle-mounted tags and 2 hand-held cards that work with the LR-2000 reader.
- Use of the LR-2000KIT Installation Kit.
- Vehicle path and speed.

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Technical Reference

LR-3000 UHF Long-Range Reader

Comparison with LR-2000 Reader

The LR-3000 UHF Reader offers advantages to the installers compared with the LR-2000 UHF Reader. The benefits, differences, and compatible features are described.

Advantages

- The LR-3000 Reader does *not* need to be installed inside a protective housing. It can be exposed directly to all weather conditions, and to sunlight at any temperature.
- The LR-3000 Reader's appearance is sleek and slim, with narrow edges and clean white color.
- The LR-3000 has 2 LEDs on the lower edge – **red** when DC power is on, and **green** blinking when a tag is present.
- The dimensions (9.8 X 9.8 X 1.3 inches) are *much smaller* than the LR-2000 reader's protective housing.
- The LR-3000 uses the same encoded *tags and cards* as AWID's other UHF readers.
- The LR-3000 is fully *compatible* with systems using AWID's LR-2000 long-range reader and its credentials.
- The LR-2000 may be mixed with the LR-3000 for outdoor installation – LR-2000 where the reader is *sheltered* from direct precipitation and sunlight; LR-3000 where the reader is *exposed*.

Differences

- 2 *LEDs* indicate status of the reader – DC power applied, and reading a compatible tag or card.
- External *dimensions* are only a little larger than the LR-2000 Reader without its protective housing.
- C*able* integrated with the LR-3000 exits the reader at its lower edge, not through the back-plate.
- Cable *connections* near the reader are in a junction box or closed space, not inside the protective housing.

Same Features

- Performance is the same – reading distance matches the tags and cards with the LR-2000 Reader.
- Function is the same – reading vehicle-mounted tags and hand-held cards; transmitting data to the controller.
- Mounting method is the same – two ¼" X 20 screws into capture nuts in the reader's aluminum back-plate.
- DC power supply is the same – typically 12 volts; 2 amperes capacity or more; linear rated; regulated output.
- Wiring is the same – arming circuit; power supply; Wiegand (or RS-232) data; drain/shields.
- Interface to the system's controller is the same.
- Application software in the host access control system is the same.

References

- Product sheet "LR-3000 Extra Long-Ranger Reader"
- Installation Sheet "LR-3000 Quick Installation Guide"
- Product sheet "Credentials for UHF Readers"

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Technical Reference

LR-2000 Reader in ADA Application – Tags on Wheelchairs

Change History

Version	Date	Author	Comments
1.0	02 July 2009	L. Hickcox	First release.

The Americans with Disabilities Act requires public accommodations and services that are operated by private entities to make access possible for individuals who are not able to use common facilities. One application is for people in wheelchairs – to provide access to mechanically actuated door and elevator entrances, to track the movement or location of wheelchairs, and to trigger a "wandering patient" alarm.

Tag: Attach the MT-UHF-0-0 metal-mount tag on the side of the wheelchair that faces the reader as the wheelchair passes the reader. Ideal height of the tag above the floor is around 4 feet or 4-1/2 feet. The MT tag may be fastened to a side-member of the wheelchair's frame, or to a side-bag, by screws (non-metal screws are ideal), or pop-rivets, or cable ties, or tape at the ends of the tag, or the tag's own adhesive. Vertical orientation of the tag is ideal. After fastening the tag, insert the screw-hole plugs.

Reader: Mount the LR-2000-B-U reader directly on the wall or on other structure at the side of the lane in which the wheelchairs will move. The reader should be at the same height above the floor as the MT tags. The tags and reader should face each other and be about parallel to each other at the reading area.

Mounting : To mount the reader on a pedestal where the reader must be aimed at the tags' reading area, use AWID's LR-MB-0-0 adjustable-head bracket, or a similar camera-mount-type bracket with adjustable head.

To mount the 8-inch-square LR-2000 reader on a wall or other surface that is parallel to the tags on the wheelchairs at the reading area, make a mounting adapter. This may be a square plate of clear plastic, about 12 inches square. Use two ¼"-20 flat-head or round-head screws to match countersunk or recessed holes that are drilled through the plastic plate. Screw holes must align with the two capture-nuts on the reader's aluminum back-plate. After attaching the reader to the adapter plate, fasten the plastic plate's outer edges to the wall.

Other mounting techniques may use an adapter for a single-gang electrical utility box on the wall, for the reader's cable junction; or The Housing Company's Model PCH196 Lexan housing, with the reader mounted inside the housing.

Use the PCH196 housing also if the reader is mounted outdoors and exposed directly to rain or snow, or if the reader faces bright sunlight in a hot environment.

Lane: The lane for passage of the wheelchairs should allow for a horizontal distance between the reader and the tags of around 4 feet to 10 feet at the reading area. The reading area is where the tag and the reader face each other and are about parallel to each other. In the reading area there is sufficient diameter to the reader's effective RF field so that reading is robust as the wheelchair passes the reader. If necessary, mark the lane on the floor so that users are guided into the proper distance between the tag and the reader.

Line-of-Sight: The tags and reader need a clear space between them at the reading area. The tag on a wheelchair should not be covered by clothing, a blanket, the user's arm, etc.

Special Cases: If the wheelchair must be monitored in two directions at the reader, fasten a second MT tag to the other side of the wheelchair. AWID can provide tag sets in which pairs of tags have the same code.

Motor-driven wheelchairs will not interfere with the tag and read function.

Reference: Technical Reference "LR-2000 – Material List".

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Technical Reference

LR-2000 Reader – Application: Big Trucks and Buses

Change History

Version	Date	Author	Comments
1.0	19 May 2011	L. Hickcox	First release.

These suggestions apply equally well to big delivery and utility trucks, tractors of semi-trailer trucks, big buses, forklifts, and off-road construction machines. We offer three alternative plans, which work well to match common conditions of the installation. Start by deciding if the application is to identify trucks, or their drivers and passengers.

A. Reader Over Center of Lane

- The reader may be suspended from the ceiling of the parking structure, or fastened to a beam across the lane near the gate, or supported on a long arm from a side wall or column. The reader should be centered over the lane. A mounting bracket with adjustable head for pan-and-tilt aiming is necessary. (Note 2)
- Height of the reader should be enough to clear the highest truck or trailer or load, but no higher than necessary for safe clearance.
- The tags must be at the center of the trucks, inside or outside the cab (note 3). For selection of suitable tags and cards for all conditions, see note 4. The MT tag, fastened outside the truck, may be above or below the windshield. Use "landscape" orientation of the tags if possible.
- Aim the reader toward the location of tags on the approaching trucks, for example, the center of the windshields. Measure out to the "sweet spot" distance of 15 feet in front of the reader (note 5). The reader will be aimed somewhat downward below horizontal, and straight at the center of the lane.
- Trucks may travel at speed up to about 15 miles per hour in this application, depending on distance from the reader to the gate, time for the gate to open, and other site conditions.

B. Reader High at Side of Lane

- The reader may be installed on either side of the lane. The left side is ideal, so that the driver can visually align the truck with the reader at the side of the lane. The installer may use a pole or post or column near the side of the lane, or a wall or fence, or the ceiling or beam. A mounting bracket with adjustable head for pan-and-tilt aiming is necessary. (Note 2)
- Height of the mounted reader should be enough so that the reader's face and the truck's tags are about parallel to each other at the "sweet spot" distance (about 15 feet). This generally positions the reader higher than the location of tags by 1 or 2 feet – often about 9 feet above the lane surface.
- The tags must be on the front of the truck, near the side on which the reader is mounted. The tags may be inside or outside the cab. For selection of suitable tags and cards, see note 4. "Portrait" orientation of the tags may be best.
- Aim the reader toward the location of tags on the approaching trucks, for example, the trucks' windshield toward the side nearest the reader. Measure out to the "sweet spot" distance of 15 feet in front of the reader (note 5). The reader will be aimed somewhat downward below horizontal, and out into the lane to the tags' position.
- Trucks may travel at speed up to about 15 miles per hour in this application, depending on distance from the reader to the gate, time for the gate to open, and other site conditions.

C. Reader Low at Side of Lane

- The reader may be installed on either side of the lane. The left side is ideal, so that the driver can visually align the truck with the reader at the side of the lane. The installer may use a post or pedestal or stand near the side of the lane, or a wall or fence. A mounting bracket with adjustable head is convenient for pan-and-tilt aiming. But a bracket may not be necessary if the reader and the tags on trucks are mounted at the same height above the lane. (Note 2)
- Height of the mounted reader is typically about 4-1/2 feet above the lane. This is a convenient height for mounting tags on the side of trucks. If the reader is mounted lower, its read range may be reduced.
- Use MT tags only. The tags must be on the side of the trucks facing the reader, usually toward the front end of the truck (fender or door or quarter panel). Use "portrait" orientation of the tags if possible, to assure best reading characteristics. For mounting, MT tags require a flat surface 8 inches high by 1 inch wide.

  In a few reported installations, this type of installation used WS tags mounted by their adhesive on the inside of the vehicles' side windows. The windows must be in a fixed position, and the height of the tags and the reader must match.
- Aim the reader horizontally, straight across the lane, toward the location of tags on the approaching trucks. Most reliable reading occurs when the distance from the reader to the tags is between 4 feet and 10 to 12 feet. In this range the reader's effective RF field has a large circular cross-section – around 4 feet diameter or larger.
- Trucks may travel at speed up to about 10 miles per hour in this application, depending on distance from the tag to the reader, distance from the reader to the gate, time for the gate to open, and other site conditions.

Notes

1. Tag information:
   (a) Plan the tag type and location from the start of the project. Select the tag or card type that suits the application best (note 4).
   (b) Readers read tags equally well in all orientations. The path of the tag as the truck carries it past the reader determines whether "portrait" or "landscape" orientation is better for a particular application.
   (c) A tag should face the reader and be about parallel to it at the "sweet spot" distance (about 15 feet from the reader, at which most tags will read). If this is not possible, choose the tag's orientation so that either long edge of the tag is closest to the reader – but not a short edge of the tag.
   (d) Install the tags on all trucks in about the same location relative to the *reader*.
2. If the reader is installed outdoors *and* is exposed directly to rain and snow, or to bright sunlight in a hot environment, mount the reader inside a protective Lexan housing. Contact AWID for further information.
3. At the reading distance typically 15 feet from reader, tags must face reader and be about parallel to face of reader.
4. See the product sheet and mounting instructions for UHF Credentials.
   (a) Inside the cab – use all tags and cards. . . . Outside the truck – use MT tag only.
   (b) Permanent, secure attachment – use WS, RV and MT tags. (WS and RV tags are destroyed if removed after adhesion.) . . . Mobile, portable applications – use VT, HT and MT tags, and CS and GR cards.
   (c) Hanging inside the cab – use VT and HT tags. . . . Lying on the dashboard or other surface – use MT tags only.
   (d) Hand-held reading – use HT and MT tags, and CS and GR cards. (Hold cards and tags in fingertips, away from hand. Aim card through windshield or out of driver's side window, facing reader.)
   (e) At the center of the vehicle – use WS, RV, HT and MT tags (and possibly VT tag). . . .
   At one side of the front of the vehicle – use WS, VT and MT tags (and possibly HT tag).
5. Most tags and cards will read at the "sweet spot", 15 feet in front of the reader. If the trucks are turning or changing grade as they approach the reader at the "sweet spot", or if the trucks are of different sizes, substitute the LR-2000HiLoMA reader (2 antenna units) in place of the standard LR-2000. Use the LR-2000KIT Installation Kit's test units to assure best aiming.

Reference: Product sheets; installation sheets; "LR-2000 – Effective RF Field" diagram; Technical Reference "Material List".

Are the Tags for Permanent or Temporary Application?

For permanent use, the MT-UHF-0-0 metal-mount tag is good for industrial environments, wet or dry. It is easily applied to a flat surface using its own adhesive, or screws (ideally plastic) or pop-rivets through the end mounting holes.

For temporary use or for transfer between different vehicles, the CS-UHF-0-0 clamshell card and the GR-UHF-0-0 graphics-quality card work well. The HT-UHF-0-0 hangtag, with the hook at one end, may be convenient to hold or hang.

Other tag types are not suitable unless they can be mounted away from metal and protected from mechanical damage.

Typical Set-Ups

- When the forklift's direction is a factor – Attach the metal-mount tag, or hold the card or hangtag, on one side of the forklift (the same side for all forklifts). Fasten the reader to a wall or post or pedestal on the same side of the lane, at the same height as the tags or cards. Now a forklift traveling in the other direction will not be detected.

- When the readers must be on one side only – Forklifts traveling in both directions can be detected by readers all on the same side of the lane by attaching tags (or holding cards) on *both sides* of the forklift. This may eliminate the need for posts or pedestals in open spaces. This set-up may still identify the direction of travel because the two tags on each forklift have different ID numbers, which can be used for different purposes in the system's control logic or reports.

- When the reader must be high above the travel lane – The reader can be mounted on the ceiling (if not too high) or on a truss or ceiling beam, or from a bracket arm or pipe stand that supports the reader above the lane. The MT tag can then be attached to the top of the forklift.

- When only one reader at a door must read the tag or card – Use the host system's timed antipassback feature to accept a tag's code from the first reader, but to block the repeated code when that tag passes the second reader on the exit side of the door or gate. This prevents a reader on the exit side of the door from re-opening the door after the forklift exits.

Installation Notes

The "sweet spot" for reading tags and cards is in a range between 4 feet and 12 feet from the reader to the tag or card. This assures large cross-section of the effective RF field for reliable reading as the tags pass through the reader's field.

The reader and all tags and cards are somewhat directional. They should be about parallel to each other at the sweet spot.

Speed of travel for forklifts depends somewhat on the distance between the reader and the tags or cards. Limit speed to 5 or 10 miles per hour as the forklift moves through the reading location.

There must be a single tag or card in the reader's effective RF field at any time.

A safety loop in the pavement beyond the door or gate can be used to delay closing until the forklift leaves the area. A buried loop may be used also to trigger a door for egress, if the code on the exiting forklift's tag is not significant.

Accessories from AWID

- Mounting bracket, LR-MB-0-0
- Installation Kit, LR-2000KIT-0-0 (required for installers)
- DC power module, PS-123.3A-0-0

Reference

- Product sheets for LR-2000 reader and UHF credentials
- Diagram for LR-2000 reader's Effective RF Field
- Mounting instructions for UHF credentials
- Technical Reference "LR-2000 Installations – Material List"
- Installation & Operation Manual for LR-2000 reader & UHF credentials

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Technical Reference

Forklifts with Tags for LR-2000 Reader – Identification and Access

Change History

Version	Date	Author	Comments
1.0	22 January 2011	L. Hickcox	First release.

The same AWID products that provide identification and access for vehicles at parking structures and garage entrances may be used with forklifts in industrial and commercial applications. The reader is the LR-2000 long-range reader. The credentials are the MT-UHF metal-mount tags, the HT-UHF hangtags, and the CS-UHF and GR-UHF hand-held cards.

What is Being Tagged and Identified?

In these applications it is possible for the item with the encoded identification credential to be –

- the "vehicle" – a forklift of any type or size, or
- the "load" – a product or container or pallet, carried by the forklift, or
- the "operator" – a person running the forklift.

This choice determines what type of tag should be used, and the location or mounting method for the reader.

What is the Purpose?

Will the tag's code be used –

- to grant access to a forklift at a door or gate, or
- to identify the forklift, or
- to know what load is being carried, or
- to relate a load type to a forklift, or
- to track the movements of the forklift, or
- to spot its current location, or
- to identify the person operating the forklift, or
- to generate records, or
- to prepare a report on activity?

This choice likewise determines what tag type and reader location is best, and also what PC program capability is needed.

Is the Forklift's Direction Important?

The application may require knowledge of the direction of the forklift at the reading location. If so, two readers are required on opposite sides of the lane (one for each direction). Or two tags are required on each forklift (if the two readers are on the same side of the lane).

Direction must be known if the application tracks the movement of the forklift or identifies its current location.

Will the Reader Be Beside or Above the Lane?

If the application is for gate or door control only –

- tags may be on top of the forklift or its load, and the reader mounted overhead, or –
- tags may be on a side of the forklift or its load, and the reader mounted beside the lane, or –
- cards may be held by the operator, who aims the card toward the reader at the reading location.

In either set-up, the reader and the tag must face each other without obstruction. The reader and the tag must be approximately parallel to each other at the reading location.

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Technical Reference

LR-2000 Reader – Application
Motorcycles and Other Small Vehicles

Change History

Version	Date	Author	Comments
1.0	24 February 2012	L. Hickcox	First release.

Use of tags on cars and trucks for vehicle identification and gate operation is well established. Applications for tags on smaller and open vehicles require special considerations. These are discussed below.

Vehicle Types

These suggestions can be used on motorcycles, motor scooters, motorbikes, bicycles, golf carts, small utility trucks, and small off-road vehicles. These vehicles generally have their credentials (encoded tags and cards) exposed to the weather.

Basic Rules

These products work well, in a great variety of applications, when the layout allows this –
(a) most of the credentials (that is, the encoded tags and cards) read at a "sweet spot" **distance** of 15 feet between the credentials and the reader, and
(b) the credentials are about **parallel** (that is, face to face) with the reader, and
(c) the credentials have uninterrupted **line of sight** with the reader, and
(d) the vehicles move at **speed** about 15 to 20 miles per hour, depending on the arrangement of reader and tags.

Tag Types

Tags that work best for hands-free applications are the MT-UHF bar-type tag, the VT-UHF sun-visor tag, and the HT-UHF hangtag.

MT-UHF tag may be attached permanently to the vehicle by screws, rivets or its own adhesive, or attached temporarily by wire or cable-ties. The tag must be on a flat surface 8 inches by 1 inch. The surface may be metal or any other material; or the tag may be held in air. The MT tag may perform best when it is oriented vertically ("portrait").

VT-UHF tag may be supported or clipped away from metal. The clip may be held in the fingers.

HT-UHF tag may be hooked on a cable or rod, or fastened at its hook, away from metal. The hook may be held in the user's fingers.

Self-adhesive tags (**WS-UHF** and **RV-UHF**) should not be exposed directly to weather. Therefore they usually can not be used on these vehicles. (For full read range, WS-UHF tags must be on windshield glass, not on any other material.)

Cards (either **CS-UHF** or **GR-UHF**) work well if they are carried in a pocket or pouch and, at the reader, held toward the reader by squeezing it between thumb and fingertip.

(continued)

Installation Types

These products offer a choice of installation types.

1. Reader **above** the vehicle lane – Reader mounted on a structure above the lane (long arm, beam, header, wall), as low as safety allows. Credentials at the front center of the vehicles, facing the reader at the "sweet spot". Read at 15 feet.
2. Reader at the **side** of the lane, **elevated** – Reader mounted on a pole or post or a wall, aimed at credentials on the front of vehicles as they approach the reader. Read at 15 feet.
3. Reader at the **side** of the vehicle lane, **low** – Reader at the same height as the credentials, aimed straight across the lane. Credentials parallel to the reader as the vehicle passes directly in front of the reader. Read at 4 feet to 12 feet.

Mixture of Full-Sized and Small Vehicles

When the gate is used for a mixture of vehicle sizes, such as passenger cars and light trucks with motorcycles and other small vehicles, the ideal solution is the **LR-2000HiLoMA** reader set. It consists of a set of antennas (Master Reader and Remote Antenna) that can be aimed individually at the location of tags for the two vehicle sizes, assuring good reads.

Getting Started

- To experiment and to confirm your ideas, use the **LR-2000KIT** Installation Kit. It has an EVAL reader that registers all tag reads, and a full set of tags and cards, and two informative test devices. The Kit is the way to get answers before committing a tag to the vehicle, or a reader to a particular mounting.
- Contact AWID's **Technical Support** for discussion and review. (408-825-1100, option 1)

Accessories

- (Installation Types 1 and 2) Mounting bracket with adjustable head, for aiming the reader at approaching credentials.
- (All installations) Installation Kit (required purchase by all installing companies.).

Reference

- LR-2000 product sheet and instructions.
- LR-2000HiLoMA product sheet and instructions.
- Credentials product sheet and instructions.
- "Effective RF Field" diagram.
- LR-2000KIT product sheet and guide for use.
- LR-2000 "Material List" and system planning Q&A.
- Protective Lexan housing line drawing.

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Technical Reference

LR-2000 Reader – Mounting Inside Protective Housing

Change History

Version	Date	Author	Comments
1.0	29 July 2011	L. Hickcox	First release.

*AWID's LR-2000 long-range reader is protected from direct rain and snow, and from hot sunlight, by installing the reader **inside** a plastic housing. This memo uses The Housing Company's Model PCH196 Lexan housing to describe popular methods of securing the reader inside the housing. Besides environmental protection, this housing offers space for mechanical assembly and cable junctions. Lexan plastic is ideal because it causes negligible reduction in RF field strength. AWID's Model LR-MB supports the housing well.*

A. Mounting the Reader Inside the Housing

Either of these 3 reader-mounting techniques may be used.

1. Reader attached inside the housing's door

Material: Velcro hook-and-loop fastener sets, roll or strips, 1 inch wide, self-adhesive.

(a) Cut 2 strips of the hook-and-loop fastener set, each strip 8 inches long. Orient the reader with the "AWID" logo at the upper left corner, so that it can be read normally. Peel the protective paper from the adhesive on one side of the strip sets. Press the strip horizontally at the upper and lower edges of the reader's front face.

(b) Peel the protective paper from the adhesive on the other side of the strips. Press the reader tightly to the inside of the housing's hinged door, away from the lock.

(c) Cut the white 10-pin connector from the reader's cable. Keep the wire pigtails as long as possible.

(d) Drill a clearance hole for the cable at a convenient location through the back or bottom of the Lexan housing. The first junction of the reader's integrated 10-conductor cable and the cable for power and data to the system may be either inside the housing or outside. Feed the cable though the housing's clearance hole. Provide strain relief for the cable inside the housing's wall.

(e) Connect **7** wires in the reader's cable – yellow to black to arm the reader's RF generator; red & black to the power supply's positive and negative DC; green & white & blue to the panel's reader port for Data-0, Data-1 and Data-Common; and drain (bare silver) to the shields on power and data cables. (To arm the RF generator remotely, use a relay to switch the yellow-to-black connection.)

(f) Apply sealant at the housing's hole to seal the cable.

2. Reader fastened inside the housing's back surface – *screws with locknuts*

Material: 2 machine screws, ¼"-20 X 1-3/4" long, hex head, rust-proof steel
4 nuts, ¼"-20, rust-proof steel
2 fender washers for ¼" screw, rust-proof steel

(a) Drill two clearance holes for ¼" screws near the center of the back surface of the housing. Measure the distance between the two capture-nuts in the aluminum plate behind the LR-2000 reader for the spacing between the two drilled holes.

(b) Cut the white 10-pin connector from the reader's cable. Keep the wire pigtails as long as possible.

(c) Drill a clearance hole for the cable at a convenient location through the back or bottom of the Lexan housing. The first junction of the reader's integrated 10-conductor cable and the cable for power and data to the system may be either inside the housing or outside. Feed the cable through the housing's clearance hole. Provide strain relief for the cable inside the housing's wall.

(d) Insert a machine screw through one of the slots in the LR-MB bracket's adjustable head, and then through the appropriate hole in the back of the housing.

(e) Inside the housing, slip a fender washer over the screw, and then thread 2 nuts on the screw to about the center.

(f) Repeat step (d) and (e) for the second screw, using the bracket's other slot and the housing's other hole.

(g) Using fingers only, thread the two screws into the reader's capture-nuts.

(h) Firmly tighten the two locknuts on each screw, one back against the fender washer inside the back of the housing, and one forward against the reader's aluminum plate.

(i) Connect **7** wires in the reader's cable as shown in step 1.(e) above.

(j) Apply sealant at the housing's hole to seal the cable.

3. Reader fastened inside the housing's back surface – *threaded spacers*

Material: 2 machine screws, ¼"-20 X 1" long, hex head, rust-proof steel
2 threaded studs, ¼"-20 X 1" long, rust-proof steel
2 threaded nipples or stand-offs, ¼"-20 X 1" long, hex cross-section, rust-proof steel
2 fender washers for ¼" screw, rust-proof steel

(a) Drill two clearance holes for ¼" screws near the center of the back surface of the housing. Measure the distance between the two capture-nuts in the aluminum plate behind the LR-2000 reader for the spacing between the two holes.

(b) Cut the white 10-pin connector from the reader's cable. Keep the wire pigtails as long as possible.

(c) Drill a clearance hole for the cable at a convenient location through the back or bottom of the Lexan housing. The first junction of the reader's integrated 10-conductor cable and the cable for power and data to the system may be either inside the housing or outside. Feed the cable through the housing's clearance hole. Provide strain relief for the cable inside the housing's wall.

(d) Using fingers only, screw the two threaded studs into the reader's capture-nuts.

(e) Screw the two threaded nipples or stand-offs on the two studs at the back of the reader's aluminum plate.

(f) Insert the two machine screws through the slots in the LR-MB bracket's adjustable head, and then through the holes in the back of the housing.

(g) Inside the housing, slip the fenders washer over the screws.

(h) Firmly tighten the two screws against the inside of the bracket's adjustable head.

(i) Connect **7** wires in the reader's cable as shown in step 1.(e) above.

(j) Apply sealant at the housing's hole to seal the cable.

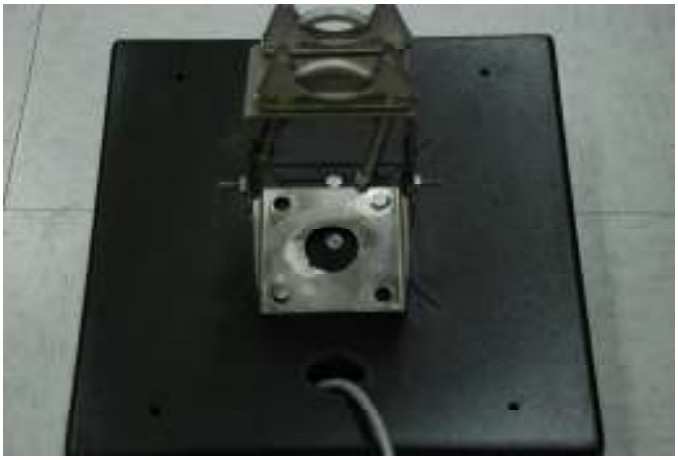




Note: The reader's power supply should *not* be installed inside the protective housing. To prevent possible RF interference, the power supply should be 12 feet or more of cable length, *and* 12 feet or more of distance (or metal-shielded), from the LR-2000.

B. Fastening the Housing to a Round Pole

1. If the reader requires pan-and-tilt adjustment



Material: Dual-U-bolt clamp for the pole's diameter
AWID's LR-MB Mounting Bracket
Required fasteners

(a) Fasten the protective housing, containing the LR-2000 reader mounted as in section A above, to the adjustable head of the LR-MB bracket.

(b) Fasten the U-bolt clamp's flat base to the LR-MB bracket's flat base, using suitable hardware and drilled holes.

(c) Insert the U-bolts into the clamp. Tighten the nuts to position and aim the reader in the proper direction. Set the bracket's adjustable head for aiming toward tags on vehicles at the reading distance.

2. If the reader does not require adjustment for tilt

Material: Dual-U-bolt clamp for the pole's diameter
Adapter plate customized for the installation
Required fasteners

(a) Prepare an adapter plate (metal or plastic or wood) with 2 clearance holes, spaced to match the capture-nuts in the reader's aluminum plate, and holes for fasteners to the base of the U-bolt clamp.

(b) Insert two ¼"-20 screws of suitable length to secure the reader's housing to the adapter plate.

(c) Insert fasteners to secure the U-bolt clamp to the adapter plate.

(d) Insert the U-bolts into the clamp. Tighten the nuts to position and aim the reader in the proper direction.

C. Fastening the Housing to a Flat Surface

1. If the reader requires pan-and-tilt adjustment

Material: AWID's LR-MB Mounting Bracket
Required fasteners

(a) Fasten the protective housing, containing the LR-2000 reader mounted as in section A above, to the adjustable head of the LR-MB bracket.

(b) Fasten the flat triangular base of the LR-MB bracket to the flat surface (square post, pedestal, gooseneck flange, cabinet, wall, etc.).

(c) Set the bracket's adjustable head for aiming toward tags on vehicles at the reading distance.

2. If the reader does not require pan-and-tilt adjustment

Material: Adapter plate customized for the installation
Required fasteners

(a) Prepare an adapter plate (metal or plastic or wood) with 2 clearance holes, spaced to match the capture-nuts in the reader's aluminum plate, and holes for fasteners to the flat surface.

(b) Insert two ¼"-20 screws of suitable length to secure the reader's housing to the adapter plate.

(c) Insert fasteners to secure the adapter plate to the flat surface.

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Memo

To: AWID's Customers Date: 18 March 2010

From: Leigh Hickcox, Technical Support Copies: ---

Subject: **Compatibility and Availability of AWID's UHF Long-Range Products**

In 2001 AWID introduced the LR-911 Long-Range Reader and its group of encoded credentials (2 vehicle-mounted tags) for automated vehicle identification and gate access control, with applications in parking facilities and residential communities, for example. These products operate in a UHF frequency band.

In 2008 AWID added to its UHF product line, introducing the LR-2000 Long-Range Reader and its family of credentials (5 vehicle-mounted tags, and 2 hand-held cards). These new products are for the same markets and applications. The new LR-2000 products use a different tag protocol from the earlier products, resulting in superior performance (such as longer reading distance in most installations), as well as a bigger selection of tags and cards for more applications. Security is enhanced by AWID's use of encryption in the digital communications between the LR-2000 reader and its credentials.

By adopting the different tag protocol, AWID's new LR-2000 products are not compatible with the earlier LR-911 products. The tags and cards specified for the LR-2000 reader are read only by the LR-2000. The tags for the LR-911 reader are read only by the LR-911.

AWID continues to provide both of these product groups.

- The LR-2000 reader and its credentials are offered for *all new* installations in which there is no need for compatibility with existing LR-911 readers or tags, that is, where an existing LR-911 installation is not being expanded by additional readers and tags.
- The LR-2000 reader and credentials may be installed to replace an existing LR-911 reader and tags. This assures the best possible performance from the application.
- The LR-911 reader and its tags continue to be available from AWID, but only when compatibility with an existing LR-911 installation is required.

Reference – AWID's documents:

Technical Reference ....."Matching AWID's Readers and Credentials"

Product Sheet ....."LR-2000 Reader"

Product Sheet ....."Credentials for LR-2000"

Product Sheet ....."LR-911 Reader"

Installation Instructions .."Tags for LR-911"

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Technical Reference

LR-2000 Reader Application – Preventing Cross-Lane Tag Reading by a Neighboring Reader

Change History

Version	Date	Author	Comments
1.0	13 July 2009	L. Hickcox	First release.

In some installations it is possible for a tag on a vehicle that is traveling in one lane to be read by a reader in a different lane. This may happen where there are parallel lanes with readers at the entrance to a parking facility, or where the tag in an exiting vehicle is detected by the reader at a neighboring entrance lane. To prevent unintentional reading by a neighboring reader, we offer the following suggestions. These options apply to the LR-911 long-range reader as well. See the diagram for the shape of the effective RF field.

Option 1 -- Spacing

Move the reader to a location farther from the tags on vehicles in a neighboring lane that cause false reads. Before re-mounting the reader, experiment to assure absence of cross-lane reading. A camera tripod is a convenient way to support the reader while testing at the site.

Option 2 -- Aiming

Aim the reader away from the tags on vehicles in a neighboring lane that cause false reads.

Option 3 -- Shielding

Install metal shielding to prevent false reads. Experiment with a large sheet of aluminum foil. Sheet metal formed as a shield may be effective. Or mount the reader in a shallow metal housing whose sides are 4 inches or more from the edges of the readers; remove the metal door. Use The Housing Company's Model PCH196 Lexan housing, lined inside with aluminum foil.

Option 4 -- Eliminating Reflection

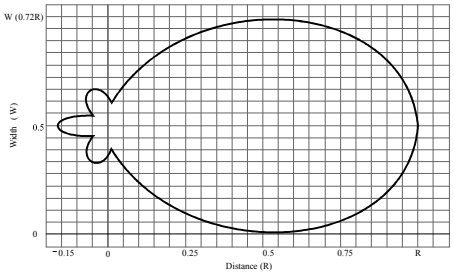
Metal (even rebar inside concrete) in the effective RF field in front of the reader may reflect RF to the tags on vehicles in a neighboring lane. To prevent reflection, either aim the reader away from the metal, or change the reader's mounting location, or relocate the tags in the vehicles.

Option 5 -- Reducing RF Power

Connect a PC to the reader using the RS-232 adapter cable in the LR-2000KIT or LR-911KIT Installation Kit. From www.awid.com/support, click on the link for "FTP website, log into the site, click on "Access Control" > "Downloads" > LR. Get the LR program; select "Save" or "Run". In the program, lower the RF Power Level by sliding the scale adjuster, or by entering the desired field reduction between 0 and 255. Reduce the reader's RF power level enough to eliminate false reads, but not so much as to reduce performance of the reader measurably for tags in its own lane.

Option 6 -- Substituting a Different Tag Type

Various vehicle tags have different RF field shapes, different field strength, and different locations in the vehicles. Cross-lane reading may be solved simply by using a different tag type in the vehicles, or by moving the tags to a location in the vehicles farther from the reader in the neighboring lane. Experiment using the tags in the LR-2000KIT Installation Kit.



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Technical Reference

LR-2000 Reader Application – Preventing RF Field Overlap in Neighboring Readers

Change History

Version	Date	Author	Comments
1.0	13 July 2009	L. Hickcox	First release.

In some installations, like parallel lanes of a parking facility, the RF fields of neighboring LR-2000 readers may overlap. This may reduce the read range of the readers. To maintain full rated read range, we offer the following suggestions. These options apply to the LR-911 long-range reader as well. See the diagram for the shape of the effective RF field.

Option 1 -- Spacing

Install the readers with enough distance between them so that the fields do not overlap. Experiment first, before mounting the readers, to assure absence of RF field overlap. Camera tripods are a convenient way to support readers while testing at the site.

Option 2 -- Aiming

Aim the neighboring readers apart somewhat to eliminate overlap of their RF fields. Test the read range of both readers while changing the aiming, and observe when the range becomes normal.

Option 3 -- Shielding

Install metal shielding between the readers to prevent field overlap. Experiment with large sheets of aluminum foil. Sheet metal formed as a shield may be effective. Or mount the readers in shallow metal housings whose sides are 4 inches or more from the edges of the readers; remove the metal door. Use The Housing Company's Model PCH196 Lexan housing, lined inside with aluminum foil.

Option 4 -- Eliminating Reflection

Metal (even rebar inside concrete) in the effective RF field in front of one reader may reflect RF to a neighboring reader. To prevent reflection, either aim the reader away from the metal, or change the mounting location of either reader.

Option 5 -- Reducing RF Power

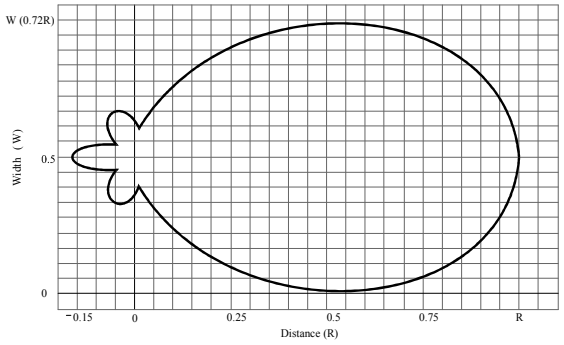
Connect a PC to the reader using the RS-232 adapter cable in the LR-2000KIT or LR-911KIT Installation Kit. From www.awid.com/support, click on the link for "FTP website, log into the site, click on "Access Control" > "Downloads" > LR. Get the LR program; select "Save" or "Run". In the program, lower the RF Power Level by sliding the scale adjuster, or by entering the desired field reduction between 0 and 255. Reduce the RF power level for both neighboring readers about the same amount, but not so much as to reduce performance of the readers measurably.

Option 6 -- Using LR-2000HiLoMA

LR-2000HiLoMA is a set of two units – a master reader and a remote antenna. Using the supplied coaxial connector, these two units may be mounted as much as 6 feet apart. The HiLo set is programmed with a duty cycle that allows only one unit to radiate its RF field ay any instant. Therefore the two units can not interfere with each other, and their RF field will never overlap. For an application where the two units may be within 6 feet of each other, this is an assured solution. (LR-911HiLoMA is also available.)

Notes: (a) To test for field overlap, remove power from one reader. Then check for full rated range with the other reader.

(b) Loss of read range because of overlapping RF fields is temporary. Read range recovers when overlap is removed.



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Technical Reference

UHF Long-Range Readers – Suppressing Multiple Reads, Etc.

In some applications, the host system may not be completely compatible with incoming data from the reader. This memo suggests improvements. These conditions do not indicate a problem with the reader – just the nature of the application.

A. Data Repetition: To Assure a *Single* Code Transmission for Each Vehicle

When AWID ships a long-range reader, it is programmed to repeat the code reading 3 times per second, as long as the tag or card remains in the reader's RF field. This may allow multiple code reads to be registered in the host system. The following methods prevent more than one read being stored in the database and being displayed in activity reports.

1. In the access control system's program, enable **timed anti-passback** (APB). Set a time (perhaps 5 seconds) between inputs for a repeated code. Be sure that timed APB actually blocks entry of a repeated code during the set time.

2. Use a **timed relay** to disarm the reader's RF field. Wire the timed relay's normally-closed contacts to break the connection of the reader's yellow wire to the black wire for the time (perhaps 5 seconds) that you set in the relay. The timed relay's operation is triggered by the panel's NO relay contacts when the gate motor operation starts.

3. Change the reader's **repetition rate** from the default 3 reads per second to one of the available slower rates. Download the Long-Range Reader Settings program from AWID's Web site (Note 1). Set a rate that assures that the vehicle carries its tag beyond the reader's RF field before the tag is read a second time. (Note 2.)

B. Data Repetition: To Reduce the Number of Reads for Each Tag

If the vehicle pauses at a slow gate or door *and* the tag remains in the reader's RF field, multiple reads may be transmitted into the system's controller. To have a smaller number of reads recorded by the system, use these methods.

1. Install the reader far enough* in front of the gate so that the vehicle carries its tag out of the reader's RF field, as the gate motion begins. The goal is for the driver to **keep the vehicle moving** slowly (up to about 15 miles per hour) through the RF field, toward the gate. (* . . . but not too far. Watch out for piggybacking by following vehicles.)

2. Change the reader's **repetition rate** from the default 3 reads per second to one of the available slower rates. Download the Long-Range Reader Settings program from AWID's Web site (Note 1). Set a rate that provides the desired smaller number of code reads to the host system for each vehicle. (Note 2.)

C. Data Processing Speed: To Space Out Repeated Inputs

If the host system can not process incoming code data at the default rate of 3 reads per second, it may be necessary to reduce the rate so that the system can see each input as a complete event, and to display and register each input separately.

1. Change the reader's **repetition rate** from the default 3 reads per second to one of the available slower rates. Download the Long-Range Reader Settings program from AWID's Web site (Note 1). Set a rate that lets the host system see each code input separately, with enough time to process the code correctly. (Note 2.)

D. Data Corruption: To Maintain Clean Data

The host system may fail to accept input if data from the reader are corrupted. Or the system may accept the corrupted code but fail to grant access. Causes of corrupted data are (a) electrical noise causing extra pulses or damaging valid pulses in the data stream from the reader, and (b) cross-talk in the Wiegand data lines if the cable has twisted-pairs.

A system that counts and displays the number of bits in the incoming code helps to diagnose the problem.

- If the number of bits is correct, and the site code and ID number are consistent but wrong, check the Wiegand data lines (green and white). They may be reversed.

(continued)

- If the number of bits in repeated code inputs is consistently wrong (always the same *number* of bits), the tag or card may have a format (number of bits) that is different from the format that is programmed into the system.
- If the number of bits in repeated code inputs is randomly *higher* than the number of bits in the tag's code, a noise source may be injecting pulses in the data stream.
- If the number of bits in repeated code inputs is randomly *lower* than the number of bits in the tag's code, there may be a bad wire junction that intermittently fails to transmit one or more bits in the data stream.

Corrections include …

1. Use tags and cards with the **correct code format** (number of bits).
2. Program the host system for the **identical code format** with which the tags or cards are encoded.
3. Review **AWID's specifications** for cables, power and data wire connections, drain wire connections (do not ground), grounding metal conduit, and grounding the metal pole or surface to which the reader is fastened, etc. (Note 3.)
4. **Separate the cables** for switching door locks, gate operators, motors, etc. from the long-range reader's cable.

E. Data Collision: To Read Each Tag Separately

AWID's long-range readers read codes from one or two tags at a time. If more than two tags are present, the transmitted codes may collide in the reader. The reader then does not transmit any data to the system. To avoid data collision --

1. Have only **one or two tags** in the reader's RF field at any time. See section F (below) for ways to do this.
2. Do NOT connect **readers in parallel** for data input to the system's controller. Each reader needs its own input port.

F. Reading Tags on Several Cars in Line: To Read Only the Closest Tag

When there is a string of vehicles waiting at a gate, you can read only the tag on the first car by these techniques.

1. Install the reader about a **vehicle-length** in front of the gate, but no more than this.
2. Install the reader about **2 feet higher** than the typical height of vehicle tags. Aim the reader toward the nearest tag.
3. **Tilt the reader** down even more, to shorten the maximum distance at which the reader can read a tag.
4. Use the LRRSettings program (see Note 1) to **reduce the RF field** from the reader. The entire field gets smaller.

G. RF Field Overlap: To Separate RF Fields of Two Readers

If the RF fields of two neighboring readers overlap, their fields can interact with each other. Read range will be reduced. Technical Reference "Preventing RF Field Overlap" offers six suggestions. An easy solution is to reduce the reader's RF field strength. If two readers must be close together, consider using the LR-2000HiLo set with two antennas.

H. Tag Cross-Talk: To Assure Tag Reading by a Single Reader

If two readers are so close that they both read a tag, there are ways to assure that only the correct reader sees the tag. Technical Reference "Preventing Cross-Lane Tag Reading" offers six suggestions. Try reducing the RF field strength.

Notes

1. Path for "**Long-Range Reader Settings**" program on AWID's Web site = www.awid.com > Support tab > Downloads > Access Control > Software Tool > LR > LRReaderSettings>
2. For any setting of the **read repetition rate** in the reader, the next tag that is presented to the reader is read immediately, and its code is transmitted to the host system with no delay. Repeated reads for that same tag will be at the programmed read repetition rate.
3. The **specifications** for the DC power supply, cables, wire connections, shield connections, and grounding are in the Material List, the product sheet, and the installation instructions for the long-range UHF reader models.

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Technical Reference [*Draft*]

SUPPRESSING RADIO FREQUENCY INTERFERENCE

[Introduction, brief]

o Tweak the aiming of the reader. A small change in aiming might not affect the ability of the vehicle tags and the reader to communicate with each other, but could cure a problem 2-1/2 miles away (if that is the problem).

o Move the reader to the correct side of the lane. This will necessarily change the aiming of the reader.

o Experiment with shielding around the reader. Try a hemisphere of aluminum foil at the sides and the rear of the reader, but leave the front of the reader open.

o Check the cable running from the reader to the controller. Does it meet our specifications completely?

o Check the wiring of the reader. Does it follow our wiring exactly?

o Check the grounding of the reader carefully. We have three "grounds" that are entirely independent from each other (black, blue and drain wires). None of these should be connected to a chassis ground or an earth ground.

o Check the power supply's wiring. The power supply must be connected to nothing else in the system except perhaps a second LR-911 reader.

o Ask the ISP people to identify the precise RF frequency at which the interference occurs, and the time frequency (continuous, or a pulse every *n* seconds, or what?).

o Check the access control system to be sure that it isn't contributing to propagation of the interfering RF. For example, disconnect the LR-911 reader from the system, power it by a backup 12 volt battery, and use the test unit that is a component of our LRIN Installation Test Kit, with the test tags that can be held by hand. This will isolate the problem to the reader, if that is the cause, and not to the system and cabling.

o Install ferrite doughnuts on all of the cables between the reader and the controller, to block surface-effect RF noise.

o Use the reader's yellow wire to arm the reader only when the vehicle is present with its tag at the reader. The sensor might be a light-beam type, or infrared (as you suggested), or a ground loop, or a pressure pad, or whatever. As you said, all that you need is a contact to ground the yellow wire when the reader is to transmit RF, and otherwise to float the yellow wire.

[Attachments: FCC compliance statement – attach from Installation sheets or MPR-2010AR manual.
LR-911 output characteristics – TechRef
LR-911 Instructions Part 2 – wiring diagrams etc.]

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Technical Reference

Long-Range Readers -- Quick Trouble-Shooting Guide

Change History

Version	Date	Author	Comments
1.0	21 April 2009	L. Hickcox	First release.

These "trouble-shooting" topics may help you before and after you install the LR-2000 and LR-911 long-range readers for automated vehicle identification. The topics are listed in the order that service problems are likely to occur. You may use these notes as a checklist. Please suggest other ideas to AWID's Technical Support.

TOOLS AT SITE (REQUIRED)

☐ AWID's Installation Kit – For LR-2000 reader, use LR-2000KIT. For LR-911 reader, use LR-911KIT.

☐ Multimeter
DC Volts: ranges 0-20 V and 0-200 V. DC Amperes: ranges 0-1 A and 0-10 A.
AC Volts: ranges 0-20 V and 0-200 V. Resistance: ranges 0-100 Ω and 0-1000k Ω . . . Or equivalent.

☐ Hand tools – Standard set for installations.

☐ Back-up battery – Typical alarm-system battery = 12 volts, 7.5 ampere-hours, fully charged.

☐ Instructions – Full Installation & Operation Manual for LR-2000 or LR-911 reader. Tags Installation sheet.

TEST STEPS

☐ **1. RF Signal Detector (RF-SD from LR-2000 Installation Kit)**

Purpose: (a) To detect radiation in a broad spectrum (nominal 50 MHz to 3 GHz) from other sources in the neighborhood when the reader is *not* generating its own UHF radiation. (Do a hand-held sweep of the area.)
(b) To prove that the reader itself *is* generating its own UHF radiation, even if the Installation Kit's test unit and the access control system do not indicate code input from the reader. (Hold the RF-SD near the reader.)

Start: Test the RF-SD Detector – Is its LED on? Does it react to a cell phone when transmitting your voice?

Power: The slide-switch for the RF-SD is on the side, "1" for ON. Be sure to switch it OFF ("0") when the RF-SD is not in use, to preserve battery life.

Don't forget: (a) The RF-SD measures the reader's transmission to about 50 feet in front of the reader.
(b) If the RF-SD detects radiation when the detector is held more than ~50 feet from the reader, the source is probably a communications antenna in the neighborhood (perhaps many blocks away).
(c) This low-level radiation from a distant antenna usually has no effect upon the LR-2000 or LR-911 reader's performance. Therefore low-level external radiation can usually be ignored.
(d) Radiation from neighboring sources that could affect the LR-2000 and LR-911 readers will always be detected by the RF-SD. Distinguish between the reader's UHF transmission and neighboring sources by shielding the reader (with aluminum foil, for example), or by moving the reader to an RFI-free location.

Instructions: This is it. It's this simple … and valuable.

Evaluation: (a) Be sure that radiation from surrounding sources is not interfering with the reader.
(b) Be sure that the reader is radiating its UHF field out to about 50 feet in front of the reader. Next tests …

☐ **2. Test Unit (SP-6820-LR from the Installation Kit)**

Purpose: (a) To indicate proper performance of the reader and its tags, isolated from the rest of the system.
(b) To give you full confidence that AWID's products are working perfectly.
(c) To show that the set-up and aiming of the installed reader and tags are correct.

Start: Connect the three spring clips of the Kit's test unit to the corresponding wires on the reader, preferably with all other connections to the power supply and to the system's controller disconnected at the reader.

Power: Use the Kit's plug-in DC power module, or (better) use your back-up battery. Measure voltages.

Don't forget: (a) To generate RF, connect the reader's yellow wire to the 3 black/negative wires.
(b) The SP-6820-LR test unit is a visual and audible indicator only. Hold the test tag in front of the LR-2000 or LR-911 reader, but watch the test unit for indication of good reads by the reader.
(c) Some background radiation is common. But only an AWID tag will cause the reader to register a read.

Instructions: Use the "Quick Installation Guide" that AWID supplied with the Installation Kit.

Evaluation: Expect an easy 10 feet or more for the LR-2000 reader with hand-held test tags. Expect 8 feet or more for the LR-911 reader with hand-held test tags. (The WS windshield-type tag must be permanently mounted on a piece of windshield glass to give its rated reading distance.) Next tests …

☐ **3. Cable**

Purpose: To check that AWID's specifications for cable have been met completely. This is a necessary step.

Start: Identify the cables that are in place. Review AWID's cable specifications. For *any* length of power cable, it must be 18 gauge or larger. Data cable (if separate from power cable) may be 22 gauge or larger. Power and data may be combined in a single 18 gauge cable. *All cable must be overall 100% shielded*.
Cable should have bunched wires, not twisted pairs. (If they are twisted pairs, separate the 3 data wires into different pairs.) If existing power cable is only 22 gauge, use spare conductors in that cable to double up the wires for both positive and negative DC; or pull new cable that meets the specs. Use really good cable.

Limits: The Wiegand protocol limits cable length to 500 feet. You may cheat on longer runs and be lucky. A safer solution is to use Cypress Computer Systems' Wiegand drivers or radio links or protocol converters.

Don't forget: The reader may work OK for a while using non-spec cable. Eventually it may cause trouble.

Instructions: Read the online Manual (complete version) for the LR-2000 or LR-911 reader. See the specs.

Evaluation: Cable is not just a supply item. It is a vital participant in the good reader package. It assures unimpeded current flow to the reader, and clean data to the controller. Next tests …

☐ **4. Electric Power**

Purpose: To know that a suitable power source is being used, and that it is connected correctly.

Start: Voltage-drop tests –
(a) Disconnect cable from power supply. Measure voltage at power supply when *nothing* is connected.
(b) Connect cable alone (without reader) to the power supply. Measure voltage at the power supply.
(c) Go to the reader-end of the cable (without reader). Measure voltage at the reader-end of the cable.
(d) Connect the reader to the cable. Measure voltage across the reader's black and red wires.

If voltage drop in any of these steps is more than a few tenths of a volt – even if the 18 gauge cable is 500 feet long – there is a problem to be corrected. Call AWID's Technical Support.

Proof: Substitution test –
(a) Disconnect the reader's red and black wires from the cable.
(b) Clip a fully charged back-up battery (see page 1, "Tools") to the reader's black and red wires.

(c) Repeat the basic tests in step 2 (page 2), using the Installation Kit.
If you use the PS12-3.3A DC power module instead of a battery for this test, place the reader at its full DC cable length from the reader – at least 6 feet or 8 feet between the power module and the reader.

Don't forget: (a) Connect the reader's yellow wire to the black wire for all tests that require RF generation. (b) There must be a separate, dedicated power supply for each reader – one reader per power supply, and nothing else connected to each power supply except its reader.

Instructions: Use the "Quick Installation Guide" for the LR-2000KIT or LR-911KIT Installation Kit.

Evaluation: Having correct power is vital to the reader. If necessary, change the power supply and the power cable. Be sure that the cable is shielded, and that its shield is drained to the reader's drain wire, but *not grounded.* Next tests …

☐ **5. Wiring**

Purpose: To check on accuracy of the reader's wiring to the power supply, and to the controller's data input.

Start: Break out the wiring diagram in the reader's installation instructions. This is vital. Wiring the LR-2000 or LR-911 reader is *not* the same as wiring the familiar proximity readers.

Checks: It's really easy – 2 wires to the power supply, 3 wires to the controller, 2 wires interconnected right at the reader, and drain wire connections to cable shields. But *no* ground connections anywhere. That's all!

Don't forget: There is only one way to wire the reader that is correct. Use it!

Instructions: Start with the Quick Installation Guide that comes with the reader. See Figure 3. Download the full Installation & Operation Manual for your reader, from AWID's Web site or Technical Support.

Evaluation: Correct wiring makes the reader work. Incorrect wiring may work for a while, and then cause poor performance. The easy solution is to do exactly as the Manual's instructions say. Next tests …

☐ **6. Tag Mounting**

Purpose: To assure that the tags are located properly for the layout, and that the reader is aimed well.

Start: First test the installation using the hand-held test tags in the Installation Kit. Then hand-test the customer's tags inside or outside the vehicles. Finally adhere or fasten the tags in their permanent location.

Saving tags: You do not need to use the windshield tag's permanent adhesive, or otherwise commit the tag to a particular location, until you have tested the tag inside or outside the vehicle, using temporary techniques. This lets you move the tag around and change its orientation (horizontal or vertical) before the final decision. Windshield and Rear-View Mirror tags are for one-time-only application; there is no second chance.

Don't forget: Tags need some experimentation. A small percentage of vehicles may not work with the tag that you select for inside the vehicles. The MT tag is the usual back-up in this case. When you visit the site, check that all vehicles have a tag on the vehicle, and check that all tags are mounted correctly.

Instructions: See the instructions for mounting tags in the reader's full Manual, and in the 2-page Installation Instructions for the appropriate tags.

Evaluation: If you are letting your client install the tags, please give the Property Manager a set of Instructions for the tag types being used. Copy them from the reader Manual, or write your own. Next …

☐ **7. Driving**

Purpose: To help the drivers achieve reliable tag reading every time.

Start: The drivers need instructions for the new system. The Property Manager should give suggestions for driving to all drivers when the tags are distributed or installed.

Discipline: Drivers who expect the gate-control tags to work like their high-speed toll-gate tags need to be reminded that these are different products, and their driving technique needs to be different.

Don't forget: Instructions for the drivers are a part of the complete installation. Having the drivers understand their tag and the reader leads to good performance of the system.

Instructions: Use the "Guidelines for the Installation" in the full LR-2000 or LR-911 Installation Manual. The key factors are – (a) Drive in a single lane close to the reader.
(b) When possible, drive in a straight line as the tag passes though the reading zone.
(c) Drive at about 5 mph through the reading zone (don't stop unless necessary).
(d) Observe lane markings, signs, speed bumps, etc.

Evaluation: The drivers are an important component of the successful system. It is easy to gain their cooperation, because they want the gate to open as much as you do. Next item …

☐ **8. Instructions for the Property Manager**

Purpose: To provide the system's administrator with all information that results in a satisfied customer.

Start: Decide on the amount and kind of instructions that the system's administrator needs.

Preparation: Make the Property Manager a partner to your work. There must be no surprises when the system's administrator takes over the system.

Don't forget: A satisfied customer starts with a customer who knows the system and is comfortable with it from Day One.

Instructions: Necessary contents are – (a) Instructions for the drivers.
(b) Instructions for the person who mounts the tag in or on the vehicle (ideally this is a trained technical representative of the Property Manager).
(c) Your contact information, so that the customer can reach you easily.
(d) Information on how your customer can order additional tags – including the products' part numbers, and the three vital pieces of code data (the code format name, the facility code or site code, and the tags' range of ID numbers).
Please contact AWID's Technical Support for suggestions and documents.

Evaluation: Good service for your customer includes occasional follow-up, to see what questions have accumulated. The best result is a compliment from the Property Manager. Finally …

☐ **Summary**

- You need AWID's instructions for the LR-2000 or LR-911 reader – the full Manual, not the Quick Guide.
- You need to check the specifications for cables and power supplies, and the layout for various applications.
- You need to study the wiring diagram carefully, and follow the wiring faithfully.
- You need to contact AWID's Technical Support for Access Control as soon as a question arises.
- You need to give your client the tag-mounting instructions and good driving suggestions from the Manual.
- AWID invites you to suggest other tests that help you in your installations. Please contact Technical Support.

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Technical Reference

LR-911 System Troubleshooting

Change History

Version	Date	Author	Comments
1.0	4 Aug 2005	LHH	First release.
1.1	7 Jan 2006	LHH	additions
1.2	7 Nov 2007	LHH	

Tools

Required:
- Digital multimeter
- AWID's LRIN Installation Kit
- Common hand tools

Recommended:
- Oscilloscope, dual-trace
- Spectrum analyzer

General Ideas

__ Do not "button up" the system until it has been thoroughly tested, and all components are working perfectly.
- Do not cut and trim wires and cables too short, in case changes are necessary.
- Keep all wiring terminations accessible for measurements, and for wiring changes if necessary.

__ Identify what the system is doing wrong.
- *Isolate* the components of the system – the reader, the panel, the power supply, the cable.
- Consider how each component works by itself. Test and replace the components one-by-one, and decide exactly where the problem resides.

__ Keep the LRIN Installation Kit with you. The components of this Kit are *absolutely necessary* for effective testing and troubleshooting, as well as for correct tag location and reader aiming.
- If the LRIN kit is not available, **order one** before starting the troubleshooting.

Power

__ Check the power supply's specifications:
- Voltage, between 7 volts and 15 volts DC.
- Current capacity for a 12 volt supply, at least 1.5 ampere for each LR-911 reader.
- Linear (that is, not a switching supply). Avoid Altronix supplies, which are switching.
- Regulated.

__ Measure voltage drop between the power supply and the reader:
- Measure voltage at the power supply with nothing connected to the supply.
- Measure voltage at the reader when it is wired to the power supply.
- The difference between these 2 readings is a combination of power supply regulation, and voltage drop in the cable. This should not exceed a few tenths of a volt.

__ Disconnect other readers and other devices from the LR-911 reader's power supply:
- Observe change in the problem LR-911 reader's performance when only that reader is connected.

__ Substitute a back-up battery in place of the system's DC power supply.
- Disconnect the reader from the independent power supply.
- Replace the power supply temporarily with a back-up battery (typically 12 volts, 7.5 ampere-hours), fully charged. This will power the LR-911 reader for hours.

__ If the reader does not read any tags under any circumstances, cycle the DC power to the reader off and (after a few seconds) on again.
- If the reader now reads tags normally, contact AWID's Technical Support for reprogramming of your reader at the Morgan Hill, CA facility.

Cable

__ Check the specification of the cable between the reader and the panel, and between the reader and the power supply. It should be --

- Stranded wires, color-coded, not twisted pairs, overall 100% shielded, insulated with plastic sheath, high quality. Use 22 gauge wires up to about 250 feet, 18 gauge for longer runs. Use 6 conductors if both data and power are carried in the cable, 4 conductors if power is from a local source or a separate cable.
- Maximum length for Wiegand interface (using the Data-0 and Data-1 lines) is 500 feet. Cheating with longer runs may work, but be prepared to use cable-extender devices, for example, Wiegand-to-current-loop converters.
- Maximum length for RS-232 serial interface is 30 feet. Cheating up to 50 feet may work in quiet environment using top-quality cable and technique.

__ If existing cable is twisted-pair (rather than "parallel" wires), do not run the reader's Data-0 (green) and Data-1 (white) through the same twisted pair in the cable.

- Split the 2 data lines so that each is in a different twisted pair.
- It is OK to pair DC power positive with one of the data lines, and the power negative with the other data line.

__ Check the cable for junctions and splices.

- Be certain that they are solid, clean, dry, insulated, grounded and shielded.
- Do not let the cable shield touch metal conduit.
- Check metal conduit's ground.

__ If a problem in the cable in conduit between the reader and the panel is suspected, disconnect that cable, and run a temporary cable on the surface.

- If the reader now works normally, pull new cable through the conduit, with no splices or junctions.

__ If cable in a long run (more than 250 feet, to 500 ft, for the Wiegand interface) has 22 gauge wires, double up the 2 power wires (positive and ground), tying unused spare wires in parallel with the power wires, to prevent voltage drop in the cable.

Wiring

__ **Wiring for an LR-911 reader is *not* the same as wiring for a proximity reader.** They both use Data-0 and Data-1 lines for Wiegand interface, but all other wires are *different*.

__ Study the wiring diagram in LR-911 Instructions, Part 2 for Installation – page 8, Figure 2:
- Compare the actual wiring with this wiring diagram.

__ Be certain that there is no connection between the low-voltage side of the reader's power supply and the host system's panel – not even a ground connection.

__ *Never* connect 2 readers in parallel on 1 reader input port. Always use a separate port for every reader.

__ To identify a problem in the cable, wire the LR-911 reader directly to the panel's reader input port.
- Connect the reader's 3 data wires directly to the panel's reader input port – green to Data-0, white to Data-1, and blue to Data Common on the *same port*. If there is no terminal labeled "Data Common" on that port, connect the blue wire to the electrical ground terminal on that port.
- Use a local DC power supply that meets AWID's specifications fully.
- Observe operation of the reader, and compare it with operation at the original location.

__ Check the unused wires on the reader:
- The unused wires must not touch each other or anything else. Tape them off singly.
- The violet and brown wires are never used. They may be permanently taped or capped.
- The orange wire is used by the SP-6820-LR test unit (part of the LRIN Installation Kit). Keep this wire available for testing for the life of the system.

Grounding

__ The LR-911 reader has 3 "grounds" or negatives – *black* wire for power supply negative, *blue* wire for data common, and *drain* wire for shield grounding.
- These 3 wires *must* be wired correctly as shown in the Instructions Part 2, Figure 2.
- These 3 wires must *not* be wired to each other. They must be kept separated.
- The reader's *yellow* wire must be connected to ground to arm the reader, so that it can read tags and transmit data.

__ The power supply's DC negative and the panel's electrical ground must be kept separate.
- Do not wire these two negatives together. Keep the power supply's secondary (DC) side floating.
- The panel and the LR-911 reader must be powered with different DC power sources.

__ Check the reader's drain wire (clear insulation over copper stranded wire).
- It must be tied to the shield of the cable between the reader and the panel – **but** that shield must not be grounded at either the panel end or the reader end.

__ Measure voltage between earth ground and the panel's electrical ground.
- Voltage should not exceed a few tenths of a volt in AC or DC.

- If it does, have a qualified "high-voltage" electrician check the 3-wire grounded power line and receptacle that feeds the DC power supply for both the panel and the reader.
- Be sure that the electrical ground is not floating, and that the two AC wires are not reversed at a receptacle.

Isolation

__ Disconnect everything from the reader, except power. Use a backup battery (12 volts, 7.5 ampere-hours, charged) instead of the DC power supply. Test with the test unit and test tag from AWID's LRIN Installation Kit.
- Observe the reader's performance by itself. Map the reader's effective field by moving the tag slowly, side to side, gradually farther from the reader. See the maximum width of the field, and the farthest point where the tag reads (this is the reader's rated read range).
- Reconnect the rest of the system one component at a time. Observe results at each step. What is it that makes the problem re-appear?

__ Disconnect other devices near the problem reader. Observe the LR-911 reader by itself.
- When the LR-911 reader is connected to the system's panel, disconnect other readers that are connected to that panel.

Replacements and Substitutions

__ Try a different reader in place of the problem reader:
- Is there a spare LR-911 reader in your truck or at your shop? If so, use it in place of the original reader.
- Does another LR-911 reader that is installed at the site work correctly? If so, interchange the 2 readers, and observe if the problem moves with the reader or stays at the original location?
- Do you have a different kind of reader, like a proximity reader and a compatible card or tag? If so, wire it into the panel in place of the LR-911 reader.

__ Do all tags give the same results?
- Try one of more extra tags, either MT or GMWS (the windshield tag on windshield glass), and compare results.

Environment

__ Disconnect or power-down all other equipment in the reader's vicinity that might generate RF signals or RF noise:
- Look for communications antennas, PC monitors, arc-type lights (including fluorescent), heavy electrical equipment (elevator motors, air conditioners, etc.), RF-type telephone access panels, other RF-type readers (even 125 kHz proximity readers), etc.

__ If the reader's cable to the system has a junction inside the gate-motor housing, try removing power from the gate motor for the reader performance tests.

__ Shield the reader from possible RF noise sources:
- Try forming a large sheet of aluminum foil around the reader's rear and edges into a half-sphere to block environmental RF interference. Leave the aluminum foil in front of the reader open so that the reader can communicate with the WS or MT tag.

__ Remove power from all other LR-911 readers that are less than 12 feet from the problem reader if they are aimed parallel (as in neighboring lanes at the gates), or less than 30 feet from the problem reader if they are aimed head-on toward the problem reader.
- Does the problem go away? Does the reader operate normally?

__ To see how the reader performs when it is removed from possible RF interference, do the "greenfield" test.
- Take the LR-911 reader, a battery (or even use your truck's battery), a tag, and the test unit from the Installation Kit, and carry them to a remote site where interfering devices are very unlikely. Test the reader's performance under these new conditions.

Host System

__ Observe messages on the PC monitor while the access control program is running.
- If there is no message, there may be no data input from the reader to the panel, or from the reader input module to the controller.
- If there is no message, there may be input data but not in the format for which the system is programmed. For example, induced noise may add bits to the bit stream from the reader (commonly 26 bits).
- If the message indicates bit-count error, or incorrect format, or parity error, or facility code error, or non-valid identification number – find the source of the error. It may be improper programming of the host system, or of the LR-911's tags.
- Watch the "Access denied: …" message. The listed reason for denying access may be very useful.

__ Program the host system to configure the data input from the readers.
- Enter the bit format of the tags (usually "26-bit Wiegand standard"), the tags' facility code or site code, and (in the cardholders database) the ID number for the tag.
- Program your own test tag as a top-level supervisor, with top priority level, access to all doors or gates, for all days and times.

__ If the tag's code data shown on the PC monitor are different from the code that is printed on the tag's label –

- The *same* wrong code for every read indicates that the tag is incorrectly programmed. Try a different tag to see if it reads correct code.
- A randomly *different* code for every tag read indicates induced noise, intermittent wiring connection, or poor grounding. Check for cable and wiring problems.

Testing Techniques and Tools

__ Digital multimeter (DMM): Absolutely necessary for voltage checks, and perhaps for current measurements.

__ Oscilloscope: Often useful, for observing the digital data output at the reader and input at the panel, and for analyzing the pulse shape.

__ Test tags: Test them on a reader that is known to work well, to be sure that they work at full rating.

Reference

LR-911 Instructions Part 2, "Installing the Products" (14 pages – this is "the bible")

Technical Reference, "LR-911 – Troubleshooting Basics" (a simple 4-step approach on 1 page)

AWID's Technical Support

- Call for technical support at AWID, Phone 1-800-369-5533 in the United States, or 1-408-825-1100 from anywhere.
- Contact us with the web: www.awid.com/support

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Technical Reference
Long-Range UHF Readers
Pre-Installation Testing – Evaluating Site Conditions

This memo contains a rigorous (but not difficult) approach for testing the installation of an access control system, using AWID's long-range UHF readers. The procedure starts before *the products are brought to the site. This applies to the LR-2000, LR-2200, LR-3000 and LR-911 reader models.*

1. Testing the "EVAL" Reader – Away from the Site

Products: LR-2000KIT Installation Kit. Backup battery (12 volts, 7.5 ampere-hours, fully charged).

Purpose: Know how to set up a reader and test unit for product performance tests.

Procedure: (a) Find a location that has no spurious background radiation – perhaps your own shop, or inside a truck. Use the RF-SD "ProHunter" signal detector (in the Kit) to identify a place where the ProHunter has no "chirping" or LED flashing. **TIPS**: Be sure that all UHF readers have their power off when testing for background radiation. Avoid sources of RF like arc-lamp and fluorescent lighting, radio transmitters, pre-collision warning systems on cars, etc.

(b) Stand the LR-2000EVAL reader (from the Kit) so that there is clear space (20 feet or more) in front of it. Connect the backup battery and the SP-6820-LR test unit to the reader's spring clips, using the wiring diagram in the Kit's laminated instructions. **TIPS**: Use a camera tripod to support the reader, adjusted to full height. The ¼"-20 screw in the camera pad matches the long-range reader. **OPTION**: If necessary, use the PS-123.3A plug-in DC power module from the Installation Kit. The *battery* provides continuous and clean DC, with plenty of current, and power for 8 hours.

(c) Holding one of the 7 test tags and cards from the Kit, observe that the reader reads these credentials at 20 feet or more. **TIPS**: Have just one tag near the reader at any time. Place all other tags 30 feet behind the reader. When testing the windshield tag, use the WS-UHF tag that is adhered to the small piece of windshield glass. Or press a loose WS-UHF tag against the windshield glass, using a block of plastic foam to flatten the tag against the glass.

2. Testing the Reader to be Installed – Away from the Site

Products: Long-range reader that will be installed. LR-2000KIT Installation Kit. Backup battery.

Purpose: Know that the reader that will be installed at the site performs to ratings. Steps #1 and #2 are *vital* to set a benchmark for performance of the products – to give full confidence that the AWID products are working normally.

Procedure: (a) In the set-up for Step #1, substitute the reader that will be installed at the site, in place of the EVAL reader from the Kit.

(b) Observe that the reader to be installed reads the Kit's 7 credentials at 20 feet or more. See **TIPS** in Step #1 (c).

(c) If any of these tests fail, contact AWID's Technical Support, to identify and correct the problem.

3. Checking the Site for Spurious Background Radiation

Products: LR-2000KIT Installation Kit. Backup battery.

Purpose: Know whether there is radiation from other sources at the site that might interfere with the long-range reader's performance.

Procedure: (a) At the installation site, repeat the ProHunter test of Step #1(a). Walk around the area and watch for "hot spots" and "dead spots" of RF. If possible, select a location for the long-range reader that has no RF indicated on the ProHunter. **TIP**: Detecting spurious RF does not necessarily lead to interference with the long-range reader. The reader may work perfectly well in the presence of most RF from neighboring sources.

(b) Repeat this test using all 7 of the Kit's tags and cards – one at a time). If the read ranges for different credentials are widely different (for example, a 2-to-1 ratio), there may be external RF that will affect the read range of these credentials.

4. Testing the Reader to be Installed – At the Site

Products: Long-range reader that will be installed. LR-2000KIT Installation Kit. Backup battery.

Purpose: Know that the reader that will be installed performs at the site to published ratings.

Procedure: (a) Repeat the set-up and connections from Step #2, using the reader that will be installed and the power supply and the test unit from the Kit. **OPTION**: Use the DC power module from the Kit, instead of the battery.

(b) Observe this reader reading the Kit's tags and cards, held in fingertips, at 20 feet or more.

(c) Map the field in which the hand-held tags are read, indicated by the test unit's beep and LED flashing. Reproduce the Effective RF Field diagram with maximum range "R" = 25-30 feet, and maximum width "W" at 1/2 "R" = about 12 feet.

5. Mounting the Reader

Products: Long-range reader to install. LR-MB Mounting Bracket. Protective housing. LR-2000KIT Installation Kit.

Purpose: Know that the reader performs as well when it is fastened physically at the site.

Procedure: (a) Fasten the reader to its mounting bracket, using the reader's protective housing when it is required.

(b) Repeat the performance tests, observing reading distance and RF field size when the reader is on its mounting.

6. Connecting the Power Supply

Products: DC power supply for this reader. Mounted reader (and housing). LR-2000KIT Installation Kit. Power cable.

Purpose: Know that the reader performs as well when the installation's power supply is used to power the reader.

Procedure: (a) Select a location for the power supply. Install the power supply 12 feet of cable length *and* 12 feet of physical distance ***or more*** away from the reader, to avoid RF feedback (conduction or radiation) from the power supply to the reader. **SEE** Technical Reference "Planning, Material List" or Manual for specifications on power supply and cable.

(b) If the power supply is near the control panel, the cable for power and data may be combined. If the power supply is at a remote location or closer to the reader, separate cables may be better. *Both cables must be overall-shielded.*

7. Connecting the Data Lines

Products: Mounted and powered reader. Data cable. Compatible tag or card.

Purpose: Know that the reader communicates data to the host system.

Procedure: (a) **SEE** Technical Reference "Planning, Material List" or Manual for cable specifications and connections.

(b) Observe the means provided by the host system to know that there was data input to the panel. This may be an LED on the board, or a message on the system's PC display, or even a beep.

8. Programming a Test Tag's Code

Products: Complete system. Test tag or card.

Purpose: Know that the installer's test tag grants access or registers correct tag data in the system.

Procedure: (a) The Installation Kit's tags and cards use the 26-bit-STD industry-standard format. In the system, select a reader input for this format, and program the facility or site code (usually 001) as printed on that tag or card, and the ID number (perhaps 00001).

(b) Look for the system's indication of correct code reading and programming. This may be the "Access granted" message, or display of the credentials code on the screen, or triggering the panel's relay contacts for gate motor operation or door unlocking.

9. Programming a User's Tag

Products: Complete system. Customer's test tag or card.

Purpose: Know that the users' credentials grant access or register correct data in the system.

Procedure: In the system, select a reader input for the code format that AWID programmed into those tags or cards. This is usually 26-bit-STD, the industry-standard format. Program the facility or site code for the users' series of credentials, and the range of ID numbers. ID numbers are usually sequentially numbered and stacked as shipped.

10. Attaching a User's Tag to a Vehicle

Products: Complete system. Customer's supply of tags or cards.

Purpose: Know that the system can have the full range of codes entered in the system, and that each tag reads correctly.

Procedure: **SEE** Instructions sheet, Manual, or Technical Reference issues for instructions on attaching or holding the credentials.

References:

- "Installation & Operation Manual" for the long-range UHF reader model.
- Product sheets for the reader model and compatible credentials.
- Technical Reference issues for AWID's products. See especially "Planning, Material List" for the reader model.
- Instructions for the credentials used with this reader model.
- Diagram for "Effective RF Field" from these long-range readers.

All of these documents are available on AWID's Web site, www.awid.com. On the home page, click on the tab "Support", then use the path Downloads > Access Control > type of documents > "UHF Products" > document by model number for "Readers, UHF" or "Credentials, UHF"

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Technical Reference

Long-Range UHF Readers – Trouble-Shooting

DC Power, Isolation & Substitution Tests

*These tests for AWID's long-range UHF readers show the procedure for identifying a problem in **DC power**, either applied to the reader or generated by the reader's internal DC power supply – or an **environmental effect** on the reader. These notes apply to UHF reader models LR-2000, LR-2200, LR-3000 and LR-911.*

TOOLS These tools are useful at the site –

- AWID's Installation Kit for the long-range reader model . . . This is a required purchase by every installing dealer.
- Digital multimeter, including a DC amperes scale . . . An analog multimeter may be used.
- Back-up battery -- 12 volts, 7.5 ampere-hours, well charged . . . Substitute for the reader's DC power supply.
- Proximity reader and compatible card . . . Substitute for the long-range reader at the controller's reader port.
- Test tag from the customer's application system . . . Program its code into the host system as a Master tag.

TESTS These tests may be used to isolate and identify the cause of . . .
(a) reader failure or (b) intermittent reading or (c) resettable operation after "lock-up" –

A. 5-point voltage checks for cause of voltage drop (see steps below)
B. Series current in the reader
C. Isolation tests of the reader's performance
D. Wiegand data line voltage
E. System component tests

PREPARATION

- The only wires of the long-range reader that are never used are violet and brown. Insulate these two wires permanently from each other and from everything else (like the cable's shield).
- For "isolation" tests, have all other wires accessible, spread out so that they can touch nothing.

A. 5-POINT VOLTAGE-DROP TESTS

The 5 steps in the test for cause of voltage drop are –

1. Disconnect the DC power supply's DC output (positive and negative) completely.
   Measure DC voltage on the positive and negative terminals of the power supply, no-load.
2. Disconnect the DC power cable from the reader, but connect its other end to the DC power supply.
   Measure voltage on the power supply's DC terminals.
3. Move the voltmeter to the other end of the DC power cable. Have the cable still disconnected from the reader.
   Measure voltage on the power cable's loose red and black wires near the reader.
4. Connect the reader's yellow to the reader's black wires (to arm the reader for RF generation).
   Connect the DC power cable to the reader's red and black wires. Measure voltage on the red and black wires.
5. Leave all connections as in step 4.
   Return to the DC power supply, and measure voltage on the positive and negative terminals.

These voltage measurements can identify a problem in the DC power supply, or in the wiring connections, or in the cable between the reader and the power supply, or in the reader itself.
Typical voltage drop from the connected power supply (step 5) and the reader (step 4) is about 0.4 volt.

B. SERIES CURRENT IN THE READER

To measure the current drawn by the reader from the DC power source –

1. At the reader, have the reader's yellow wire (the RF arming circuit) connected to the reader's black wire.
2. Other wiring may be as in a normal installation, or disconnected.
3. At the reader, disconnect the reader's red wire from the power cable.
4. Set the multimeter to DC Current, for a range of 1 or 5 or 10 amperes.
5. Hold the multimeter's probes on these two red wires – red probe on the cable's positive DC wire, and black probe on the reader's red wire.
6. Normal current when no tag is near the reader is about 450 milliamperes (less than 0.5 ampere). When a tag is present, current may be slightly higher and fluctuation quickly (3 times per second, if the meter reacts quickly to changes in current).

   Higher or lower current could indicate a problem inside the reader. Higher than normal current could be the cause of excess voltage drop between the power supply and the reader (see section A.).

C. ISOLATION TESTS FOR THE LONG-RANGE READER

To see the reader operating completely separated from the rest of the installation –

1. Disconnect *all* wires of the long-range reader, except the yellow wire (it remains shorted to the reader's black wire).
2. Substitute a back-up battery (12 volts, 7.5 ampere-hours, well charged), clipped to the reader's black (negative) and red (positive) wires.
3. Connect the Test Unit (part no. SP-6820-LR) from the Installation Kit to the reader's black, red and orange wires.
4. Hold the test tag in front of the reader. The test unit beeps and its LED changes color for every reading event – 3 reads per second for a new reader. A test tag held in the fingertips should read to about 20 feet in front of the reader (for LR-3000, to 25 feet; for LR-911, to 9 feet).
5. If necessary, remove the reader from its mounting, and carry it to a remote location, distant from the installation site. This removes the reader from possible RF interference from other devices and antennas near the installation. For this "**green field**" testing use the reader, the battery, and the Kit (test unit and test tag).

   Isolation Tests indicate if the long-range reader is able to work independent of everything else in the application system. For more detailed testing with the Installation Kit, see its Quick Installation Guide (provided in the Kit).

D. WIEGAND DATA LINES VOLTAGE TESTS

The Isolation Tests (above) use the reader's RS-232 Transmit Data (orange) wire to indicate reading. To test the possibility that the reader's Wiegand data drivers have been damaged, follow these steps –

1. Isolate the reader as in steps C.1 and C.2, above.
2. Measure the voltage on the reader's black and red wires. Confirm that the voltage is close to the battery's voltage when nothing is connected to the battery (perhaps 0.5 volt less).
3. Move *all* tags and cards for the long-range reader at least 30 feet *behind* the reader, so that no tag can be read by the reader.

(continued)

4. Measure DC voltage between the reader's black and *green* wires (Wiegand Data-0). It should read about +4.96 volts, varying randomly only about 0.01 volt. (Meter's black probe to black wire, and red probe to green wire.)
5. Measure DC voltage between the reader's black and *white* wires (Data-1). It also should read about +4.96 volts, with the same slight variation. (Meter's black probe to black wire, and red probe to white wire.)
6. If these voltages are correct, bring a single test tag from the Installation Kit, or from the customer's tags, in front of the reader, within a foot or two. It may be convenient to tape the test tag to the face of the reader.
7. Repeat the voltage measurements of steps 4 and 5. The voltages should be similar to steps 4 and 5, but (a) the voltage should be slightly lower, and (b) it should vary in a range of about +4.88 to 4.94 volts. By careful observation, the variation may be seen to occur 3 times per second (the read repetition rate of a new reader).

   Failure of these voltage checks indicates damage to the reader and need for repair by AWID. If the reader tests normal, the problem is elsewhere in the system.

E. SYSTEM COMPONENT TESTS

When the DC power tests normal in the procedures described above, the following items, related to the installation rather than the reader, should be checked –

1. **Cable** between the reader and its power supply, and between the reader and the system's controller panel – AWID's specifications for the cable must be observed.
2. **Wiring connections** – 7 of the reader's wires must be used (yellow, black, red, green, white, blue and drain). The orange wire must be accessible for the Installation Kit's Test Unit. Only violet and brown wires are never used.
3. **Reader** mounting, location, aiming – Follow AWID's recommendations in the installation instructions.
4. **Tags** location and attachment – Follow AWID's instructions.
5. **Driving** conditions – In the reader's Manual, observe Section 3.2 carefully.
6. Host **system** -- Substitute a proximity reader and a compatible card, in place of the long-range reader, into the host system's controller (the panel's reader input port).

   For guidance on these tests, see the Reference documents listed below, and contact AWID's Technical Support.

NOTES

1. Never have more than 1 UHF tag or card present in the reader's RF field. Store other tags 30 feet behind the reader.

REFERENCE

- Manual for the long-range reader model – Section 11, "Trouble-Shooting" (pages 16-20)
- Technical Reference: "Long-Range UHF Readers – Pre-Installation Testing; Evaluating Site Conditions"
- Technical Reference: "Trouble-Shooting Quick Guide"
- Technical Reference: "Trouble-Shooting the System"
- Quick Installation Guide for the Installation Kit
- Technical Reference "Material List" for the reader model (specifications and sources)
- Diagram for "Effective RF Field"

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Technical Reference

LR-2000HiLoMA Long-Range Reader Set

APPLICATION: Mixed Trucks and Cars at Same Gate

*An advantage of the **LR-2000HiLoMA** reader set is the ability to have two long-range readers close together, aimed at different locations of the vehicle tags. This allows a mixture of big trucks and buses, and also passenger cars of all sizes, at the same gate. There is a single interface from the LR-2000HiLoMA to the controller panel. The features and options for this application are described below.*

Product Description

The LR-2000HiLoMA reader set consists of two similar units – a master reader and a remote antenna. The housings are the same as the standard LR-2000, except that a brass mini-coaxial connector has been added on one edge of both units. The LR-2000HiLoMA set includes a 6-foot-long coaxial cable that allows the two units to communicate with each other. Both units contain an antenna and an aluminum reflector plate, in an ABS plastic housing. Only the master reader has the integrated cable that connects DC power from an external power supply, and transmits code data to the host system.

The DC power specification is the same as for the standard LR-2000 long-range reader. The data interface to the host system is the same also – only a single reader input port is required at the host panel.

Function

The LR-2000HiLoMA reader set gives the installer a means of (a) spreading out the effective RF field in the same direction from the units, to enlarge the size of the field either horizontally or vertically – or of (b) creating two separated RF fields. The HiLo feature does not make the effective field *longer*, so the maximum read range or the guaranteed reading distance remains the same as with a standard LR-2000 reader.

Applications

The LR-2000HiLoMA reader set with the RF field **spread horizontally** is used where the vehicles turn as they approach or drive through the tag-reading zone near the reader, or where the roadway is wider than the usual single lane. This is common if the reader is at a driveway where vehicles turn from a through street, or if there is a curve in the lane at the tag-reading zone.

With the RF field **spread vertically**, tags on vehicles at a change in grade on the lane at the tag-reading zone can be read with assurance. This arrangement also applies to vehicles of different sizes in which the tags may be at different heights above the lane surface.

The two units of the LR-2000HiLoMA reader set can even be facing in **opposite directions** at a set of IN and OUT gates, for example, with the two reader units mounted back-to-back at the same height on the same pole. The master reader may be aimed at tags in entering vehicles, and the remote antenna may be aimed 180° away at tags in exiting vehicles. This application is practical if the system does not need to know whether the vehicle was entering or exiting the facility – only that it was an authorized vehicle with a valid tag code.

A special case occurs when the vehicles are of great diversity – say, passenger vehicles, and vans or pickups, and semi-trailer trucks or buses. In this case, the best results may come from use of different tag types on small and big vehicles. The LR-2000HiLoMA's units should be at different heights on a single pole, and the units aimed in different directions. Here are the details . . .

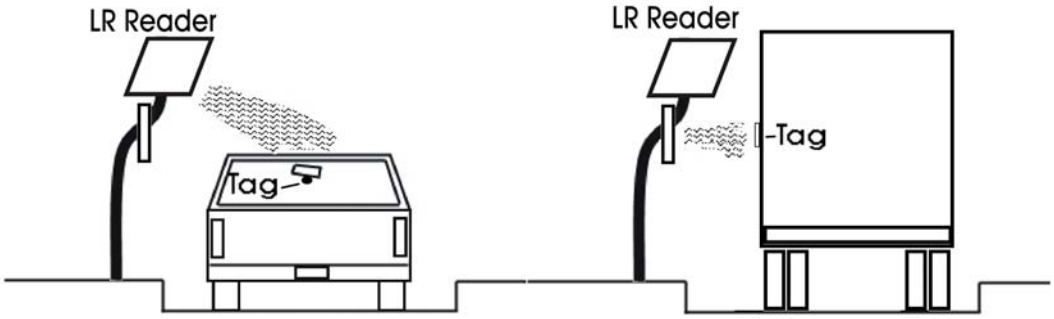
Mixing Passenger Cars and Big Trucks or Buses

A popular solution for this mix of vehicles is the LR-2000HiLoMA reader set with the two units mounted on LR-MB mounting brackets fastened to a single square pole or post at either side of the vehicle lane, close to the edge of the vehicle lane.

For the passenger cars (including sedans, vans, SUVs and pickup trucks), mount the reader so that it is about 7 feet above the lane's surface. Attach the selected vehicle tag (like the **WS-UHF** on the windshield) according to AWID's instructions, on the same side of the car as the reader. Aim the reader at the location of tags on the windshields when the distance between the reader's front face and the tags' locations on cars approaching the reader is 10 feet.

For the big trucks and buses, mount the reader so that it is about 4-1/2 feet above the lane's surface. Attach the **MT-UHF** tag with vertical orientation on the side of the truck, on a flat surface that is about 4-1/2 feet above the lane, on the same side of the truck or bus as the reader. Aim the reader's RF field horizontally across the lane, perpendicular to the path of the vehicles. The ideal distance between the reader's front face and the tag, when the tag is just opposite the reader, is between 4 feet and 10 feet.

It does not matter whether the LR-2000HiLoMA master reader or remote antenna is at the high or low position on the pole. It is usually best to have the master reader low (for the big trucks and buses), to keep the cable run from underground conduit shorter. Then the high remote antenna (for the passenger cars) is connected by the coaxial cable to the low master reader. Using the LR-MB mounting brackets, the two brackets may be as much as 4 feet apart vertically.



Alternative Plan

It is possible to use tags inside all of the vehicles for this mix of small and large vehicles. For example, if the **WS-UHF** windshield tags are used in both passenger cars and big trucks or buses, the LR-2000HiLoMA set's master reader may be at the 7 foot high bracket location to read tags inside the cars, and the remote antenna may be at a higher position, perhaps around 9 feet above the lane, to read tags inside the trucks or buses. In this case, both readers will be aimed at the location of their respective tags when the tags are at the typical 10 foot reading distance from the reader's front face. The goal is to have the tags and the face of the reader about parallel to each other when the tags are at the typical reading distance.

Site Layout

Other factors relating to the installation, as described in AWID's LR-2000 Installation & Owners Manual and Technical Reference issues, should be considered in all applications. These include . . .

- Location of the readers relative to the gate.
- Specifications for power supply and cables and wiring.
- Plastic enclosure for both of the reader units if they are mounted outdoors and exposed directly to precipitation, or exposed to bright sunlight in a location with high ambient temperature.
- Selection of 5 vehicle-mounted tags and 2 hand-held cards that work with the LR-2000 reader.
- Use of the LR-2000KIT Installation Kit.
- Vehicle path and speed.

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Technical Reference

Long-Range Readers – Questions for System Planning

Change History

Version	Date	Author	Comments
1.0	23 May 2011	L. Hickcox	First release.

When you plan a system using AWID's long-range readers, it may help to have an organized method to cover the items that contribute to a good solution. The questions below provide a check list for the most important points.

Overview

- Is the application for motor vehicles (cars, trucks, trailers, loads), or for wheelchairs and gurneys, or for people carrying tags? -- *For* vehicles*, see questions below. For* wheelchairs *and* gurneys*, see AWID's Technical Reference on ADA applications. For* people*, see AWID's UA-612 wall-mounted UHF reader, and discussion of the LR-2000 reader at doorways.*
- Is the purpose of the installation to identify vehicles or to identify individual people? – or a combination of vehicles and people? -- *Any of AWID's UHF readers may fit the application. But for people, use the 2 hand-held cards (not tags).*
- Is the purpose to operate a gate or door (access control), or to track movement or identify location of vehicles and/or people (mustering)? -- *This information helps to focus on the related questions.*
- Do vehicles pass in one direction or both directions in the lane? – and through the gate? -- *This tells us if 1 or 2 readers are needed at the gate, and where the readers and tags must be located.*

Tag Technology -- *These questions indicate whether the technology should be active-tag or passive-tag.*

- How fast will vehicles move through the tag-reading location (the "sweet spot") and through the gate area?
- Is there a gate (to slow or stop the approaching vehicles)?
- How far from the reader must the vehicles' tags be read?
- How wide is the lane in which vehicles will pass through the tag-reading location and the gate?
- Are the vehicles driving in well defined lanes? – or in a large open space for maneuvering?
- Are the size and visibility of the tag important? Is limited life of a tag's battery a factor?
- Are the size and visibility of the antenna array important. Is a single small unit for antenna and reader a factor?
- What is the customer's budget for the installation?

Reader Type -- *These questions indicate which distinct model of the LR-2000 reader family is recommended.*

- In what country will the reader be installed? – *Installation in the European Community requires the* LR-2200 *reader.*
- What are the types of vehicles that will be tagged? – passenger cars (including sports cars, sedans, vans, pickups and SUVs), delivery trucks, utility trucks, tractor-trailers, off-highway machines? -- *Different vehicles require different reader locations.*
- Are all vehicles the same type? – or is there a mixture of vehicle types? -- *This may require LR-2000HiLoMA reader set.*
- Will both vehicle tags and hand-held cards be used? -- *LR-2000HiLoMA reader set is convenient for mixed tags and cards.*
- Will trucks be tagged? – permanently or temporarily? – or will the gate be opened manually (that is, by a guard pressing a switch)? -- *Trucks may need a separate reader (in the HiLo set), unless the driver can reach the lower reader used by cars.*
- How wide is the lane in which vehicles will approach the tag-reading location (the "sweet spot")? -- *The HiLo reader set can be aimed horizontally to cover a wider area.*
- Do vehicles approach the gate in a straight line through the tag-reading location ("sweet spot")? – or is the lane curved (like a turn from a through-street into a driveway)? -- *The HiLo's 2 units can be spread apart to read cars from different angles.*
- Is the lane's grade constant at the "sweet spot"? Or is there a change in grade, like the top or bottom of a ramp? -- *The HiLo set is ideal when the reader's RF field must be spread out vertically to cover tags at different heights in the vehicles.*

Reader Location -- *These questions indicate where the reader may be mounted most conveniently.*

- Is there a structure above the lane to mount the reader? – like a horizontal beam, or a header above the doorway, or a ceiling?
- Is there a wall at the side of the lane?
- For a vehicle entrance into a structure, is the opening in a wall that extends to the left and/or right of the opening?
- Is there an existing pole, post or pedestal on one side of the lane at the "sweet spot"?
- If the reader will be at the side of the lane, can the reader be at the left (driver's) side? -- *This is more comfortable for the driver and more natural. It is easier for the driver to align the driving path with the left edge of the lane.*
- Can a side-mounted reader be near the edge of the lane? -- *To read best, the car's tag and the reader should face each other.*
- Is there room to install the reader a vehicle-length before the gate or door? -- *This lets the car keep moving up to the gate.*
- How fast do vehicles go in the tag-reading location? -- *Can drivers be trained (persuaded) to drive no more than 15 m.p.h.?*
- Will vehicles stop while waiting for the gate or door to open? -- *This depends upon gate operation speed, and distance between the reader and the gate.*

Reader Mounting

- Will the reader by mounted flat against a wall (non-adjustable), or on an adjustable bracket? -- *This depends upon the application and the vehicle types – see AWID's Technical Reference, "Application – Mixed Cars and Trucks".*
- Can the post have a square cross-section, rather than circular -- *AWID's LR-MB bracket mounts most easily on a flat surface.*

Protective Housing -- *AWID requires a Lexan housing for long-range readers in certain conditions.*

- Will the reader be mounted outdoors *and* exposed directly to weather (rain or snow)? -- *The housing protects against water condensation inside the reader. Lexan plastic assures minimal reduction in RF field strength through the housing's door.*
- Will the reader be exposed to bright sunlight in a hot environment? -- *The housing keeps the reader at ambient temperature.*
- Are aesthetics or vandalism an issue at the site? -- *The Lexan housing removes the reader from view or unauthorized access.*

Credential Type (Tag or Card)

- Are credentials to be permanently attached to the vehicles, or to be portable for use in different vehicles at different times?
- Are credentials to be always present in vehicles, or for temporary or occasional use?
- Are credentials to be attached to the vehicle during reading, or held between fingertips?
- Are credentials to be inside or outside vehicles? -- *Here are the characteristics of each UHF tag and card type.*

WS-UHF .. permanent, adhered to windshield, inside vehicle (destroyed if peeled off) – for reader at side of lane or overhead.

RV-UHF .. permanent, adhered to shell of rear-view mirror, inside vehicle (destroyed if peeled off) – for reader overhead.

VT-UHF .. portable, clipped in place, inside vehicle – for reader at side of lane or overhead.

HT-UHF .. portable, hung inside vehicle or hand-held – for reader overhead if on rear-view mirror post, or in any location if held in fingertips.

MT-UHF .. permanent or portable or temporary, fastened or adhered or hand-held, inside or outside vehicle – for reader in any location.

CS-UHF ... portable or temporary, hand-held inside or outside vehicle – for reader in any location.

GR-UHF .. portable or temporary, hand-held inside or outside vehicle – for reader in any location.

Tag Location on Vehicles

- Will the installer test for best tag location and orientation? -- *AWID's Installation Kit makes tag testing quick and simple at the site. Most vehicles need no individual testing; a few cars may call for individual trials with different tags types.*

DC Power Supply

- Will the power supply be located near the reader, or near the controller's panel? -- *In all cases the power supply is separate and dedicated to each individual reader. There is no wiring between the power supply and the controller panel.*
- Will the power supply be installed inside a metal enclosure (like the gate motor housing or a cabinet)? -- *Almost all power supplies use switching technology, which generates spurious RF. The metal cabinet may block this RF from the reader.*
- Will the straight-line distance between the power supply and the reader, and also the length of the cable connecting them, be 12 feet or *more*? -- *In this 12 foot distance, spurious RF from the power supply should be reduced to a very small amount.*
- Is there a 120 VAC grounded 3-pin receptacle available where the power supply will be installed? -- *It is OK to use a plug-in DC module if its specifications meet AWID's requirements. If there is no AC receptacle, the power supply must be wired to an AC power source.*
- Does the DC power supply include a back-up battery? -- *Battery-backup is ideal for reliable reader operation.*
- Will the installer provide specified power supplies? -- *AWID advises on manufacturers and models for best performance.*

Cable

- Will the power supply be located near the reader, or near the controller's panel? -- *If the power supply is near the panel, a single cable may be used (18/6 overall-shielded). If the power supply is not near the panel, separate cables may be needed (for power, 18/2; for Wiegand data, 22/4 – both* overall-shielded!*).*
- Will the cable be bunched wires or twisted-pair? -- *If twisted-pair, special Wiegand wiring prevents cross-talk on data lines.*
- Will the cables be run in metal conduit, or in trays, or direct-burial, or … ? -- *Besides cable shielding, physical separation from other cables with potentially noisy control lines or power lines is advised.*
- Will the installer provide specified cables? -- *AWID advises on specifications for best performance.*

Related Products

- Will doors for people in buildings have access control using the same UHF cards as in vehicles? Does the customer want to use a single card for both applications? -- *AWID's small UA-612 UHF reader uses the same cards as the long-range reader.*
- Will the proposed system have a combination of UHF readers – LR-2000, LR-2000HiLoMA and UA-612? -- *These compatible products can be used together in a system for access control or gate control, using the same UHF tags or cards.*

Maximum RFID

UHF CREDENTIALS for HOLDING BY HAND with LR-2000-3000 & X-SERIES READERS

CS-UHF-0-0 Clamshell Card

- Rugged card with slot — long life in rough usage
- Held by clamping edges between thumb and fingertips
- Hands-free identification — completely portable
- Convenient — carry loose or on strap or in pocket



GR-UHF-0-0 Graphics-Quality Card

- High-quality card for direct photo ID badge printing
- Slim card with smooth finish for user data, bar code, company logo
- May be slot-punched for portrait or landscape
- Best for carrying in wallet or pouch, or for multiple technologies



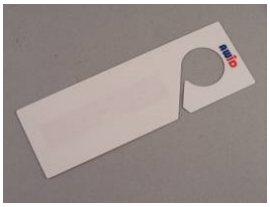
KT-UHF-0-0 Keytag

- Right-sized tag for easy carrying and holding — waterproof for pools
- Hangs on keyring, keychain, strap or hook
- Good range with small size — reads hanging below keys
- Tag always accessible with keys — always ready to read



HT-UHF-0-0 Hangtag

- Hook in end of tag makes it easy to hold or hang
- Just squeeze the hook between thumb and fingertip
- Extended size makes Hangtag easy to use, hard to lose
- Dual purpose tag — hangs inside vehicles, and goes with you



Maximum RFID

NOTE: For UHF **vehicle-mounted** tags, see product sheet "UHF Vehicle-Mounted Credentials". For credentials **held by hand**, see below.

Reading Distances – Up to These Distances in Practical Applications

Card or Tag - Held in Fingers	LR-2000, LR-2200, LR-	X-Series Readers	UA-612 Reader
CS-UHF-0-0 Clamshell Card	20 feet (6.1 meters)	6 inches (15 cm)	12 inches (30 cm)
GR-UHF-0-0 Graphics Card	15 feet (4.5 meters)	6 inches (15 cm)	12 inches (30 cm)
KT-UHF-0-0 Keytag	12 feet (3.6 meters)	6 inches (15 cm)	12 inches (30 cm)
HT-UHF-0-0 Hangtag	10 feet (3.0 meters)	6 inches (15 cm)	12 inches (30 cm)

Reader Selection For use with all AWID UHF reader models, both long-range and near-field.

Technology in Tags and Cards

- UHF communications: Bi-directional between UHF readers and credentials.
- Excitation frequency: 865-868 MHz for the LR-2200 reader; 902-928 MHz for other UHF readers.
- Read repetition rate: Set in the readers. For "LR" readers, rep rate is 3 reads per second (field-programmable to slower rates).

Encoding for Tags and Cards

- Code format type – Wiegand. • Open code formats – 26-bit-STD and 37-bit-AWID. • For a custom format, call AWID.

Information Required in Purchase Order (*Include leading zeros in facility code and ID numbers.*)

• Quantity. • AWID's part no. • Code format (example: 26-bit-STD). • Facility or site code. • Start ID number sequence.

Environmental Conditions

- Operating temperature: -31° F to +150° F (-35° C to +65° C).
- Operating humidity: 0% to 95% non-condensing.
- Exposure to weather: All tags accept exposure to bright sunlight. They may be used in rain, snow, and car washes.

Size of Tags and Cards (Approximate)

Card or Tag	Width	Height	Thickness	Notes
CS-UHF-0-0 Card	3-3/8 inches	2-1/8 inches	0.065 inch	Rugged card. Slot for clip-strap.
GR-UHF-0-0 Card	3-3/8 inches	2-1/8 inches	0.033 inch	For photo ID badge printing.
KT-UHF-0-0 Tag	1-3/4 inches	1-1/16 inches	3/16 inch	Slot in metal tab for key ring or chain.
HT-UHF-0-0 Tag	2-1/4 inches	6-1/2 inches	1/32 inch	Present to reader with fingers at hook.

Slots and Holes

- GR-UHF cards may be punched with a slot for either portrait or landscape. *See instructions sheet in carton for locations of slot.*
- CS-UHF, KT-UHF and HT-UHF must have no slots or holes, punched or drilled, anywhere on the credential.

Applications

- For identification and access of vehicles at gates and doors for parking facilities, gated communities, etc.
- For identification of drivers and passengers in vehicles when the hand-held card or tag is presented to the reader at the gate.
- For physical access of people at doors in buildings, or at turnstiles, using the same credential as for gate access of vehicles.

Custom Graphics

- For CS-UHF and HT-UHF only. • For quotation, send original artwork to AWID. • A local printer may be able to print graphics.

Literature for UHF Credentials

- Before installing any tag, read AWID's "Installation Instructions" sheet for that tag type.
- Visit AWID's Web site www.AWID.com to download all literature.

Options and Accessories

- LR-TEK LR Reader Tech Kit: *Required* -- a one-time purchase for every installing dealer.

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http://www.awid.com

Maximum RFID

UHF CREDENTIALS for VEHICLE MOUNTING with LR-2000, LR-2200 & LR-3000 READERS

WS-UHF-0-0 Windshield Tag



- Self-adhesive — tag adheres permanently inside windshield glass
- Tag is destroyed if it is ripped off windshield after adhesive cures
- Hands-free identification — out of driver's line of sight
- Secure tag — for one-time use — slits give evidence of tampering

RV-UHF-0-0 Rearview Mirror Tag



- Tag adheres permanently on shell of rear-view mirror
- Self-adhesive — tag is destroyed if it is pulled off after curing
- Hands-free identification — low visibility — black side faces reader
- Secure tag permanently attached inside or outside the vehicle

MT-UHF-0-0 Metal-Mount Tag



- Bar-type tag — variety of locations and fastenings — reads on metal
- Self-adhesive — also held by screws, rivets, cable ties . . .
- Use inside or outside, on front or side or top of vehicles
- For big trucks, buses, forklifts, containers, golf carts, wheelchairs . . .

SV-UHF-0-0 Sideview Mirror Tag



- Tag adheres permanently on edge of mirror shell
- Self-adhesive — tag is disabled if pulled off after adhesive cures
- Hands-free — small, thin, simple, out of sight under mirror
- Secure tag — flexible use in other outside locations

PT-UHF-0-0 Portable Tag



- Tag installs like a toll highway tag on windshield behind mirror
- Hook-and-loop adhesive strip holds tag firmly in reading position
- Hands-free use inside vehicles — move tag easily to other vehicles
- For readers installed above the traffic lane or at either side

VT-UHF-0-0 Sunvisor Tag



- Hand-held — tag can be held by fingertips on clip — or . . .
- Hands-free — tag clips to sunvisor — easily moved to other vehicles
- Clip holds tag facing reader through windshield when visor is down
- Lower visor to read tag — tag is out of sight when not reading

HT-UHF-0-0 Hangtag



- Tag hooks on rearview mirror's post — easily moved or carried
- Hook lets tag hang free — to read, driver can turn tag by fingers
- Hands-free identification — also portable like a card — hold to read
- Visible through windshield for printed or laminated identification

ST-UHF-0-0 Supertag



- Large tag with superior read range in tough assignments
- Attaches by double-side adhesive tape, screws, rivets, cable ties . . .
- Permanent or temporary mounting — for rugged use and bad weather
- Perfect in industrial and commercial applications — inside or outside

Maximum RFID

NOTE: For UHF credentials **held by hand**, see product sheet "UHF Credentials for Holding by Hand". For **vehicle-mounted** tags, see below.

Reading Distances – Up to These Distances in Practical Applications

Tag . . . Conditions	LR-2000, LR-2200, LR-3000	X-Series Readers	UA-612 Reader
WS-UHF-0-0 on windshield	25 feet (7.6 meters)	(Not applicable)	(Not applicable)
RV-UHF-0-0 on mirror shell	20 feet (6.1 meters)	(Not applicable)	(Not applicable)
MT-UHF-0-0 on metal surface	15 feet (4.6 meters)	(Not applicable)	(Not applicable)
SV-UHF-0-0 on sideview mirror	25 feet (7.6 meters)	(Not applicable)	(Not applicable)
PT-UHF-0-0 on windshield	15 feet (4.6 meters)	(Not applicable)	(Not applicable)
VT-UHF-0-0 clipped on visor	15 feet (4.6 meters)	(Not applicable)	(Not applicable)
HT-UHF-0-0 hanging on mirror	10 feet (3.0 meters)	6 inches (15 cm)	12 inches (30 cm)
ST-UHF-0-0 fastened on metal	35 feet (10.7 meters)	(Not applicable)	(Not applicable)

Reader Selection With vehicle-mounted tags, use LR-2000, LR-2200, LR-3000, and their "HiLo" variations.

Technology in Tags

- UHF communications: Bi-directional between UHF readers and credentials.
- Excitation frequency: 865-868 MHz for the LR-2200 reader; 902-928 MHz for other UHF readers.
- Read repetition rate: Set in the readers. For "LR" readers, rep rate is 3 reads per second (field-programmable to slower rates).

Encoding for Tags

- Code format type – Wiegand. • Open code formats – 26-bit-STD and 37-bit-AWI. • For a custom format, call AWID.

Information Required in Purchase Order *(Include leading zeros in facility code and ID numbers.)*

- Quantity. • AWID's part no. • Code format (example: 26-bit-STD). • Facility or site code. • Start ID number sequence.

Environmental Conditions

- Operating temperature: -31° F to +150° F (-35° C to +65° C).
- Operating humidity: 0% to 95% non-condensing.
- Exposure to weather: All tags accept exposure to bright sunlight. "Outside" tags are for use in rain, snow, and car washes.

Size of Tags and Cards (Approximate)

Tag	Width	Height	Thickness	Notes
WS-UHF-0-0	4 inches	1 inch	<1/32 inch	Peel-off sheet covers adhesive.
RV-UHF-0-0	4-3/16 inches	1-1/8 inches	<1/32 inch	Peel-off sheet covers adhesive.
MT-UHF-0-0	8 inches	15/16 inch	1/4 inch	Self-adhesive. 2 holes for fasteners.
SV-UHF-0-0	4-3/8 inches	1/2 inch	<1/32 inch	Peel-off sheet covers adhesive.
PT-UHF-0-0	3-1/8 inches	1-5/8 inches	3/8 inch	Peel-off sheet covers adhesive strip.
VT-UHF-0-0	4-1/2 inches	2-3/8 inches	1/32 inch	Includes U-clip for sunvisor.
HT-UHF-0-0	2-1/4 inches	6-1/2 inches	1/32 inch	With hook to hang on mirror.
ST-UHF-0-0	5-1/2 inches	7-3/4 inches	3/4 inch	Flat back. 4 holes for fasteners.

Slots and Holes

- WS-UHF, RV-UHF, SV-UHF, PT-UHF, HT-UHF: Must have no slots or holes, punched or drilled.
- VT-UHF: Contains a slot for the sunvisor clip (supplied with the tag).
- MT-UHF, ST-UHF: Contains holes at the ends for screws, rivets, cable ties. Must not be punched or drilled.

Applications

- Use tags on cars, trucks, buses, fire trucks, forklifts, motorcycles, golf carts, transit vehicles, wheel chairs, gurneys, rail cars, etc.
- For **security**, WS-UHF and RV-UHF tags tear when they are ripped from their cured adhesive. SV-UHF tag is for one-time use only.
- For user **convenience**, all other tags may be moved easily from one vehicle to another vehicle.
- Tag type and mounting location must be **consistent** for all readers in a particular installation.
- If used with a "**HiLo**" reader (dual antennas), credentials may be different types, in different locations, on different vehicle types.

Custom Graphics

- For quotation, send original artwork to AWID. • A local printer may be able to print graphics. • *Not* for ST-UHF tag.

Literature for UHF Credentials

- Before installing any tag, read AWID's "Installation Instructions" sheet for that tag type.
- Visit AWID's Web site www.AWID.com to download all literature.

Options and Accessories

- LR-TEK LR Reader Tech Kit: *Required* -- a one-time purchase for every installing dealer.

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XR-3600™
UHF Card Reader

AWID's XR-3600 UHF Mullion-Mounting Reader is the link between card access by people at doors in buildings, and vehicle access at gates for parking. The XR-3600 reads the same UHF hand-held cards and tags that drivers use for vehicle identification and gate control at a parking facility. These cards and tagsare compatible with AWID's LR-2000, LR-2200 and LR-3000 long-range readers and their "HiLo" sets. The enclosure is a striking, deep black design.

Installation The XR-3600 reader fits perfectly on a door frame or window mullion, a wall, or other surface, using two screws (supplied). With simultaneous Wiegand and RS-232 data output, the XR-3600 reader can be interfaced for a wide variety of access control, special system control, and cardholder identification applications.



Features The reader's 2-color LED and beeper are controlled by the reader itself. No external wiring is required for this feedback.

The XR-3600 is *self-testing*, using its LED and beeper as indicators. It needs no interface to a controller to show that it is performing correctly. The reader can be demonstrated with nothing more than a DC power source (even a battery) and a card or tag.

Operation The XR-3600 reader operates in "repeat read" mode. While a card or tag is held in the reader's read range, it transmits the card's code twice every second. Repeated LED and beeper signals alert the user to remove the card from the reader.

Environment The XR-3600 may be installed indoors or outdoors. It may be exposed directly to rain, snow, lawn sprinklers, etc.Consisting of a one-piece sealed unit, the XR-3600 is strong and secure. Mounting screws are out of sight under push-in plugs.Electronic circuits are protected from moisture.

Credentials The hand-held cards and tags for the XR-3600 are the same as the credentials that AWID offers for its UHF long-range readers in gate applications for vehicle access. Encoding in the cards and tags has the same format and data fields as in AWID's credentials for all other reader types.

The XR-3600 serves separately as an enrolling reader for UHF vehicle tags into a gate-operating system.

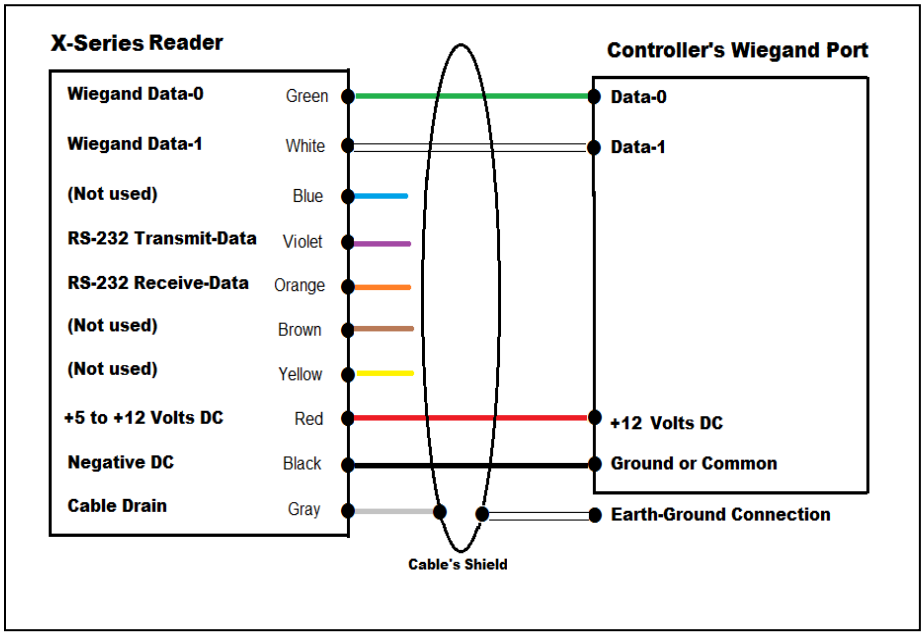
The XR-3600 reader's read range is up to 6 inches. (Mounting the XR-3600 directly on metal slightly reduces the read range.) Presenting any AWID UHF card or tag to the reader causes the beeper to sound and the LED to change color momentarily.

FEATURES

- People access using UHF cards …
  Same cards for vehicles and people
- Quick access at busy entrances …
  Read range up to 6 inches
- Easy mounting …
  Fastens on door/window mullion or wall
- Easy wiring for power and data …
  Connects like a proximity reader
- Combines car and people access …
  Interfaces to common access control
- Reader needs no programming …
  XR-3600 reads all AWID UHF cards
- Compatible with access systems …
  Standard code formats & interfaces
- Visible and audible feedback …
  Reads indicated by LED and beeper
- Great appearance in all locations …
  Attractive enclosure, small size

XR-3600™

UHF Card Reader



ACCESSORIES AND SUPPLIES

- Mounting hardware–2 self-tapping screws are supplied with the XR-3600 reader.
- Power supply–The XR-3600 reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage and current on the "+DC Power" and "Ground" terminals. An external DC power supply (nominal +12 volts, 1 ampere, linear-rated, regulated output) may be used. Ask AWID about specifications.
- Cable for power and data – A single cable interfacing the reader to the panel should be 22 gauge, 4 conductors, **overall shielded**, stranded wires, color-coded, not twisted pairs. Using Wiegand interface, cable may be up to 500 feet long for power and data.
- Installation Sheet - Download full instructions from AWID's Web site www.awid.com.

CREDENTIAL OPTIONS

- Hand-held cards and tags – Clamshell and graphics UHF cards, and keytag (use also for LR-2000, LR-2200 and LR-3000 readers). Ask AWID about selection and instructions.
- All credentials must be AWID's products that are specified for this reader model.

OPERATING CHARACTERISTICS

Reading Distance:
On wall or metal – up to 6 inches

Frequency Band:
902 to 928 MHz
Frequency-hopping technology

Power Supply:
+5 to +12 volts DC supply; rated 1.0 ampere or more; linear type; regulated DC output (Panel's power terminals are OK.)

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Programmed in AWID's UHF credentials
Reads 26-bit to 50-bit codes

Cable (for Wiegand Interface):
22 gauge, 4wires, stranded, color-coded
Overall shielded for both*power and data*
Up to 500 feet long for Wiegand interface

PHYSICAL CHARACTERISTICS

Dimensions:
1.9 x 4.8 X 0.7 inch (4.8 x 12.2 x 1.8 cm)

Weight:
4 ounces (113grams)

Material (Color):
ABS 1-part sealed enclosure (black)

Cable (Integrated with Reader):
10 conductors, 18 inches long
Overall shielded, gray plastic jacket

Mounting (Supplied by Installer):
On mullion,wall or other surface

ENVIRONMENT

Operating Temperature:
-31°Fto+150°F (-35°C to+65°C)

Operating Humidity:
0% to 95% non-condensing

CERTIFICATION

FCC Part 15; IC; RoHS compliant

DISCLAIMER: Specifications are subject to change without notice. AWID reserves the right to make changes to improve performance without impacting form, fit or function. The XR-3600 model designations are Trademarks of Applied Wireless Identifications Group, Inc. All other trademarks are property of their respective owners.

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XR-3600™
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AWID's XR-3600 UHF Mullion-Mounting Reader is the link between card access by people at doors in buildings, and vehicle access at gates for parking. The XR-3600 reads the same UHF hand-held cards and tags that drivers use for vehicle identification and gate control at a parking facility. These cards and tagsare compatible with AWID's LR-2000, LR-2200 and LR-3000 long-range readers and their "HiLo" sets. The enclosure is a striking, deep black design.

Installation The XR-3600 reader fits perfectly on a door frame or window mullion, a wall, or other surface, using two screws (supplied). With simultaneous Wiegand and RS-232 data output, the XR-3600 reader can be interfaced for a wide variety of access control, special system control, and cardholder identification applications.



Features The reader's 2-color LED and beeper are controlled by the reader itself. No external wiring is required for this feedback.

The XR-3600 is *self-testing*, using its LED and beeper as indicators. It needs no interface to a controller to show that it is performing correctly. The reader can be demonstrated with nothing more than a DC power source (even a battery) and a card or tag.

Operation The XR-3600 reader operates in "repeat read" mode. While a card or tag is held in the reader's read range, it transmits the card's code twice every second. Repeated LED and beeper signals alert the user to remove the card from the reader.

Environment The XR-3600 may be installed indoors or outdoors. It may be exposed directly to rain, snow, lawn sprinklers, etc.Consisting of a one-piece sealed unit, the XR-3600 is strong and secure. Mounting screws are out of sight under push-in plugs.Electronic circuits are protected from moisture.

Credentials The hand-held cards and tags for the XR-3600 are the same as the credentials that AWID offers for its UHF long-range readers in gate applications for vehicle access. Encoding in the cards and tags has the same format and data fields as in AWID's credentials for all other reader types.

The XR-3600 serves separately as an enrolling reader for UHF vehicle tags into a gate-operating system.

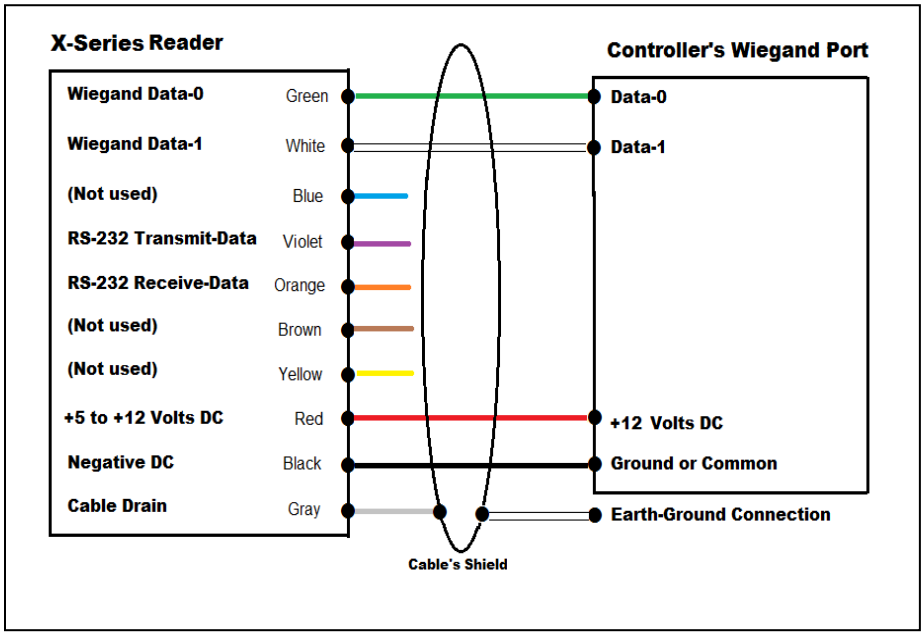
The XR-3600 reader's read range is up to 6 inches. (Mounting the XR-3600 directly on metal slightly reduces the read range.) Presenting any AWID UHF card or tag to the reader causes the beeper to sound and the LED to change color momentarily.

FEATURES

- People access using UHF cards …
  Same cards for vehicles and people
- Quick access at busy entrances …
  Read range up to 6 inches
- Easy mounting …
  Fastens on door/window mullion or wall
- Easy wiring for power and data …
  Connects like a proximity reader
- Combines car and people access …
  Interfaces to common access control
- Reader needs no programming …
  XR-3600 reads all AWID UHF cards
- Compatible with access systems …
  Standard code formats & interfaces
- Visible and audible feedback …
  Reads indicated by LED and beeper
- Great appearance in all locations …
  Attractive enclosure, small size

XR-3600™

UHF Card Reader



ACCESSORIES AND SUPPLIES

- Mounting hardware–2 self-tapping screws are supplied with the XR-3600 reader.
- Power supply–The XR-3600 reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage and current on the "+DC Power" and "Ground" terminals. An external DC power supply (nominal +12 volts, 1 ampere, linear-rated, regulated output) may be used. Ask AWID about specifications.
- Cable for power and data – A single cable interfacing the reader to the panel should be 22 gauge, 4 conductors, **overall shielded**, stranded wires, color-coded, not twisted pairs. Using Wiegand interface, cable may be up to 500 feet long for power and data.
- Installation Sheet - Download full instructions from AWID's Web site www.awid.com.

CREDENTIAL OPTIONS

- Hand-held cards and tags – Clamshell and graphics UHF cards, and keytag (use also for LR-2000, LR-2200 and LR-3000 readers). Ask AWID about selection and instructions.
- All credentials must be AWID's products that are specified for this reader model.

OPERATING CHARACTERISTICS

Reading Distance:
On wall or metal – up to 6 inches

Frequency Band:
902 to 928 MHz
Frequency-hopping technology

Power Supply:
+5 to +12 volts DC supply; rated 1.0 ampere or more; linear type; regulated DC output (Panel's power terminals are OK.)

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Programmed in AWID's UHF credentials
Reads 26-bit to 50-bit codes

Cable (for Wiegand Interface):
22 gauge, 4wires, stranded, color-coded
Overall shielded for both*power and data*
Up to 500 feet long for Wiegand interface

PHYSICAL CHARACTERISTICS

Dimensions:
1.9 x 4.8 X 0.7 inch (4.8 x 12.2 x 1.8 cm)

Weight:
4 ounces (113grams)

Material (Color):
ABS 1-part sealed enclosure (black)

Cable (Integrated with Reader):
10 conductors, 18 inches long
Overall shielded, gray plastic jacket

Mounting (Supplied by Installer):
On mullion,wall or other surface

ENVIRONMENT

Operating Temperature:
-31°Fto+150°F (-35°C to+65°C)

Operating Humidity:
0% to 95% non-condensing

CERTIFICATION

FCC Part 15; IC; RoHS compliant

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AWID

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XP-3620™
UHF Card Reader

AWID's XP-3620 UHF Switchplate-Type Reader is the link between card access by people at doors in buildings, and vehicle access at gates for parking. The XP-3620reads the same UHF hand-held cards and tags that drivers use for vehicle identification and gate control at a parking facility. These cards and tags arecompatible with AWID's LR-2000, LR-2200 and LR-3000 long-range readers and their "HiLo" sets. The enclosure is a striking, deep black design.

Installation The XP-3620 reader fits perfectly on a single-gang electrical utility box, a wall, or other surface, using two screws (supplied).With simultaneous Wiegand and RS-232 data output, the XP-3620 reader can be interfaced for a wide variety of access control, special system control, and cardholder identification applications.



FeaturesThe reader's 2-color LEDs and beeper are controlled by the reader itself. No external wiring is required for this feedback.

The XP-3620 is self-testing, using its LED and beeper as indicators. It needs no interface to a controller to show that it is performing correctly. The reader can be demonstrated with nothing more than a DC power source (even a battery) and a card or tag

Operation The XP-3620 reader operates in "repeat read" mode. While a card or tag is held in the reader's read range, it transmits the card's code twice every second. Repeated LED and beeper signals alert the user to remove the card from the reader.

Environment The XP-3620reader may be installed indoors or outdoors. The reader is secure when its cover is in place after installation. The electronic circuits are protected from moisture. The reader may be exposed directly to rain, water sprinklers, snow, or bright sunlight in a hot environment.

Credentials The hand-held cards and tags for the XP-3620 are the same as the credentials that AWID offers for its UHF long-range readers in gate applications for vehicle access. Encoding in the cards and tag has the same format and data fields as in AWID's credentials for all other reader types.

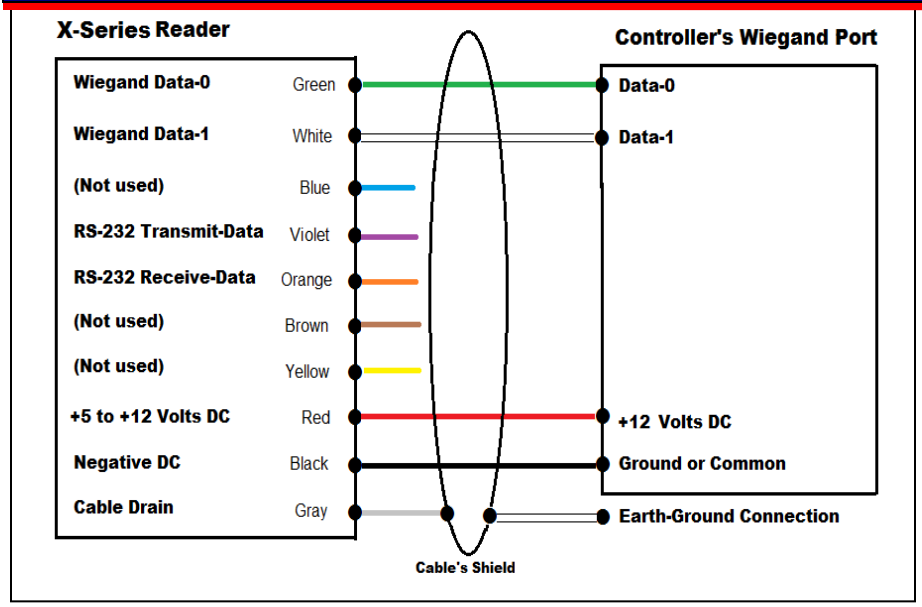
The XP-3620 reader's read range is up to 6 inches. (Mounting the XP-3620 directly on metal slightly reduces the read range.) Presenting any AWID UHF card or tag to the reader causes the beeper to sound and the LED to change color momentarily.

FEATURES

- People access using UHF cards …
  Same cards for vehicles and people
- Quick access at busy entrances …
  Read range up to 6 inches
- Easy mounting …
  Fastens on electrical box or wall
- Easy wiring for power and data …
  Connects like a proximity reader
- Combines car and people access …
  Interfaces to common access control
- Reader needs no programming …
  XP-3620 reads all AWID UHF cards
- Compatible with access systems …
  Standard code formats & interfaces
- Visible and audible feedback …
  Reads indicated by LED and beeper
- Great appearance in all locations …
  Attractive enclosure, small size

XP-3620™

UHF Card Reader



ACCESSORIES AND SUPPLIES

- Mounting hardware– Screws for single-gang electrical utility box are supplied with the XP-3620 reader.
- Power supply–The XP-3620 reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage and current on the "+DC Power" and "Ground" terminals. An external DC power supply (nominal +12 volts, 1 ampere, linear-rated, regulated output) may be used. Ask AWID about specifications.
- Cable for power and data – A single cable interfacing the reader to the panel should be 22 gauge, 4 conductors, **overall shielded**, stranded wires, color-coded, not twisted pairs. UsingWiegand interface, cable may be up to 500 feet long for power and data.
- Installation Sheet - Download full instructions from AWID's Web site www.awid.com.

CREDENTIAL OPTIONS

- Hand-held cards and tags – Clamshell and graphics UHF cards, and keytag (use also for LR-2000, LR-2200 and LR-3000 readers). Ask AWID about selection and instructions.
- All credentials must be AWID's products that are specified for this reader model.

OPERATING CHARACTERISTICS

Reading Distance:
On wall or metal – up to 6 inches

Frequency Band:
902 to 928 MHz
Frequency-hopping technology

Power Supply:
+5 to +12 volts DC supply;rated 1.0 ampere or more; linear type; regulated DC output (Panel's power terminals are OK.)

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Programmed in AWID's UHF credentials
Reads 26-bit to 50-bit codes

Cable (for Wiegand Interface):
22 gauge, 4wires, stranded, color-coded
Overall shielded for both*power and data*
Up to 500 feet long for Wiegand interface

PHYSICAL CHARACTERISTICS

Dimensions:
3.1 x 4.9 X 1.0 inch (7.9 x 12.5 x 2.5 cm)

Weight:
6 ounces (170 grams)

Material (Color):
ABS 2-part enclosure (black)

Cable (Integrated with Reader):
10 conductors, 18 inches long
Overall shielded, gray plastic jacket

Mounting (Supplied by Installer):
On wall, or single-gang utility box

ENVIRONMENT

Operating Temperature:
-31°Fto+150°F (-35°C to+65°C)

Operating Humidity:
0% to 95% non-condensing

CERTIFICATION

FCC Part 15; IC; RoHS compliant

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AWID

Maximum RFID

LR-2000KIT™
UHF Reader Test Kit



AWID's LR-2000KIT UHF Reader Test Kit is the tool that –

- helps to sell a new UHF long-range reader,
- tests a new reader before you leave for the installation site,
- shows correct performance of the reader during installation,
- identifies the source of problem during a service call, and
- provides visible and audible feedback as the reader reads tags.

The LR-2000KIT is provided in a compact, fitted carrying case. It works with the AWID's uAxcess UHF readers, as well as long-range readers. The LR-2000KIT serves as an upgrade for the LR-TEK Kit, which is a *required* first-time-only purchase by every company that installs AWID's long-range readers. These Kits turn much of the work into a *one-man job*.

The LR-2000KIT's 11 valuable tasks can pay for the Kit by its second use.

Demonstrate the UHF Long-Range "EVAL" reader and tags

- The Kit has everything. It sets up on a table in a few minutes.

Test the proposed location *before you buy the reader and tags*

- Survey the area for spurious RF that might interfere with the reader.
- Show the reader reading at the rated distance for the tags or cards.

Bench-test the products at your shop before going to the site

- Be confident of products' good performance before leaving your shop.

Test the reader before interfacing it to your system

- See the reader reading tags, held in fingers and mounted in vehicles.
- Connect the reader to a PC to observe codes, and to change reader's read rate or RF field strength (with AWID's no-cost "LRRS" program).

Test the completed installation

- Prove that reader mounting, power, cable, wiring and tags are good.
- Test everything up to the host system's wiring and programming.

Set up separately near an installation site to confirm tag reads

- Prove good installation of new tags without interrupting gate traffic.

Trouble-shoot an installed system

- Save time by isolating reader and tagged vehicles, substituting the DC power source, or the cable, or the reader, or the tags for test.

Save the LR-2000KIT for use by others when needed

- Store the Kit in a handy place for demos, surveys, tests and repairs.

FEATURES

- Self-contained Kit …
  All components in a small fitted case
- Easy to use …
  Simple instructions are included
- Quick set-up …
  Items connect by clip leads and plugs
- Variety of uses …
  Kit contains all necessary items
- For effective presentations …
  Included reader gives real reads fast
- Build confidence at your office …
  See actual operation on your bench
- Answers questions at installation …
  Kit shows test reader and tags working
- Trouble-shooting in a service call …
  Isolates components of the system
- Shows where repair is needed …
  Substitutes for parts of the installation
- A valuable investment by you …
  Payback from time saved and confidence

Descriptions of the Kit's components and their applications are on page 2.

LR-2000KIT™

UHF Reader Test Kit

COMPONENTS OF THE LR-2000KIT READER TEST KIT

LR-2000-EVAL UHF Long-Range Sensor

An LR-2000 UHF reader *except* with no Wiegand or RS-232 interface ability. Cable 32 inches long, with 4 spring-clips for quick connections. Use with LR-Sounder Test Unit for beeper & LED indicators. For stand-alone use only, not wired to panel.

LR-Sounder Test Unit

The visible and audible feedback device. Clips to the "EVAL" reader, the UHF reader being installed, or any reader with an RS-232 Transmit Data wire.

USB-to-DB9 Cable Adapter

Cable. 22 inches long (black jacket), with DB9 female connector and USB plug. Extends the DB9-to-Clips Cable Adapter (described below) to connect your reader's RS-232 output into a PC or controller that has no 9-pin serial input port.

Download the USB driver: www.awid.com → ACCESS CONTROL tab → (External Links) → LR-TEK USB Driver.

DB9-to-Clips Cable Adapter

Cable. 6 inches long (gray jacket), with 3 spring-clips for RS-232 wires on the reader, and a 9-pin "D" connector for a PC's serial port. Mates with the USB-to-DB9 Cable Adapter for newer PCs. To show your reader's output as a list of code data, and to download the PC's commands to change your reader's repetition rate or RF field strength.

DC Power Supply

AWID's PS-123.3A plug-in module with 6 foot cables for 120 VAC in and 12 VDC out. Two spring-clips for DC voltage to reader and test unit. (When working on a DC power problem, substitute a charged 12 volt, 7.5 ampere-hour battery.)

Test Tags – Set of 7 UHF Tags & Cards

One of each of 5 vehicle-mounted tags and 2 hand-held cards that are compatible with LR-2000, LR-2200, and LR-3000 readers, and their "HiLo" variations.

"LR-2000KIT Quick Installation Guide"

Laminated instructions sheet with full information and simple hook-up diagrams, for basic tests and performance checks.

Carrying Case

Light-weight and compact case, with foam interior and a cut-out for every item. Hinged cover. Carrying handle. Black.

Recommended Accessory (supplied by user)

A camera tripod (available at a local store) is very convenient for supporting the reader during tests and demos. Holds reader at effective 6 ft height.

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AWID

Maximum RFID



LR-TEK™
LR Reader Tech Kit

AWID's LR-TEK UHF Test/Demo Kit is the tool that –

- helps to sell a new UHF long-range reader,
- tests a new reader before you leave for the installation site,
- shows correct performance of the reader during installation,
- identifies the source of problem during a service call, and
- provides visible and audible feedback as the reader reads tags.

The LR-TEK is provided in a small, sturdy carton with fitted padding. It works with AWID's uAxcess UHF reader models as well as long-range readers. The LR-TEK is a low-cost way to observe the performance of a reader without interface to the controller of an access control system, and to change the UHF long-range reader's repetition rate and RF power level. The Kit turns much of the work into a *one-man job*.

* * *

The LR-TEK does 10 valuable things that can quickly pay for the Kit.

Demonstrate your UHF long-range or uAxcess reader and tags

- The LR-Sounder clips to the reader and the power supply's terminals.

Test the proposed reader location

- Survey the area for spurious RF that might interfere with the reader.
- Show the reader reading at the rated distance for the tags or cards.

Bench-test the products at your shop before going to the site

- Be confident of products' good performance before leaving your shop.

Test the reader before interfacing it to your system

- See the reader reading tags, held in fingers and mounted in vehicles.
- Connect the reader to a PC to observe codes, and to change reader's read rate or RF field strength (with AWID's free "LRRS" program).

Test the completed installation

- Prove that reader mounting, power, cable, wiring and tags are good.
- Test everything up to the system's wiring and programming.

Trouble-shoot an installed system

- Save time by isolating reader and tagged vehicles, substituting the DC power source, or the cable, or the reader, or the tags for test.

Save the LR-TEK Kit for use by others when needed

- Store the Kit in a handy place for demos, scans, tests and repairs.

FEATURES

- Self-contained Kit …
  All components in a small fitted carton
- Easy to use …
  Simple instructions are included
- Quick set-up …
  Items connect by clip leads and plugs
- Variety of uses …
  Kit contains all necessary items
- For effective presentations …
  Your reader gives real reads fast
- Build confidence at your office …
  See actual operation on your bench
- Answers questions at installation …
  Kit shows isolated reader & tags working
- Trouble-shooting in a service call …
  Isolates components of the system
- Shows where repair is needed …
  Substitutes for parts of the installation
- A valuable investment by you …
  Payback from time saved and confidence

Instructions are on page 2.

LR-TEK™



COMPONENTS OF THE LR-TEK KIT

LR-Sounder Test Unit Contains a beeper and an LED to indicate every tag read, and a cable with clip leads for DC power and RS-232 Transmit Data. Clips to the power supply and to the reader being tested.

DC Power Supply AWID's PS-123.3A plug-in module – nominal 12 volts output; load up to 3.3 amperes.

USB-to-DB9 Adapter Cable (black, 22 inches) with USB plug and DB9 male connector. Download the USB driver: www.awid.com --> ACCESS CONTROL tab --> (External Links) --> LR-TEK USB Driver.

DB9-to-Clips Adapter Cable (gray, 16 inches) with DB9 female connector and 3 clips for the reader's RS-232 interface wires.

Test Tags AWID's WS-UHF windshield tag (on windshield glass) and CS-UHF clamshell card, for hand tests.

Carton A sturdy container with fitted foam padding to support and protect the components between uses.

INSTRUCTIONS

Start here . . . 1. Connect your LR reader's yellow wire to the reader's black wire. This arms the reader.
2. Clip the LR-Sounder's black and red wires to the same color wires on the reader. (Keep yellow connected.)
3. Clip the power module's black and red wires to other wires with same colors. Plug in the power module.

Then select a task . . .

A. To test or demonstrate an AWID UHF long-range or uAxcess reader

A1. Clip the LR-Sounder's orange wire to the orange wire on your reader.
A2. Present 1 test tag or card to the reader. The LR-Sounder beeps and the LED changes color for every read.

B. To interface an LR reader to a PC's port **(running a suitable driver and program on the PC)**

B1. On the adapter with gray cable, clip the orange, blue and violet wires to the reader's same-color wires.
B2. If the PC has no 9-pin serial port, add the adapter with black cable, mating the two DB9 connectors.
B3. Plug the cable adapter's USB connector or DB9 connector into the matching port on your PC.
B4. Present a single card or tag to the reader. Observe tag reads on the PC's screen.

C. To display the tag's code on a PC **(using Windows HyperTerminal or AWID's LRRS program)**

C1. For HyperTerminal (if available): Start > Programs > Accessories > Communications > HyperTerminal.
C2. For AWID's "LRReaderSettings" program: Download from AWID's Web site > Support > Downloads.
C3. Present a single card or tag to the reader. Observe reads as a line of 18 ANSI characters for each read.

D. To program the long-range reader for "Read Rep Rate" and "RF Power Atten."

D1. Start AWID's "LRReaderSettings" program (downloaded from AWID's Web site > Support > Downloads).
D2. Make the desired change in Read Rep Rate or in RF Power Attenuation. Read the program's Instructions.
D3. After you "Apply" or "Set" the change, check the change immediately by holding a tag or card at the reader and watching the list of Tag Read data.

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AWID

Maximum RFID



LR-2200™

Extra Long-Range Reader

The LR-2200™ Long-Range Reader is designed to enhance safety/security, automate parking administration and provide convenient, hands-free/remote-free, vehicle access.

The LR-2200 offers an impressive combination of single unit construction, small size, and attractive appearance. Unlike many AVI products, the LR-2200 operates in the ETSI EN 302 208 ISM (Industrial, Scientific and Medical) band, offers a myriad of credential options from traditional clamshell badges, hangtags to windshield tags, while providing significant savings in deployment and maintenance expense.



Performance enhancements in automobiles impose unwavering circumstances which call for the flexibility AWID has integrated in the LR-2200 reader and tags. Tag reading distance is commonly up to 4 meters or more, depending on reader mounting, credential type, and environment. Its electronics and antenna are integrated in a single compact enclosure which is suited for outdoor applications.

The LR-2200 offers a price-performance advantage over traditional long-range proximity systems, using battery-free, maintenance-free credentials and operates in the 865-868 MHz UHF band. In addition to Automatic Vehicle Identification (AVI), the LR-2200™ is ideal for Hospitals, Medical Centers, Airports, Hotels, Stadiums, Amusement Parks, extending unparalleled performance while providing Long Range RFID with the best ROI.

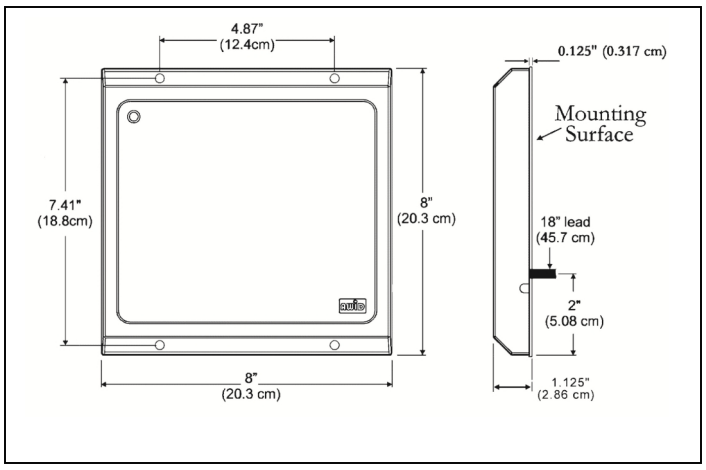
*NOTE: WHEN INSTALLED OUTDOORS AND EXPOSED TO RAIN OR SNOW, OR TO DIRECT SUN IN A HOT ENVIRONMENT, THE LR- MUST BE MOUNTED INSIDE A HOUSING WITH MINIMUM IP64 RATING.

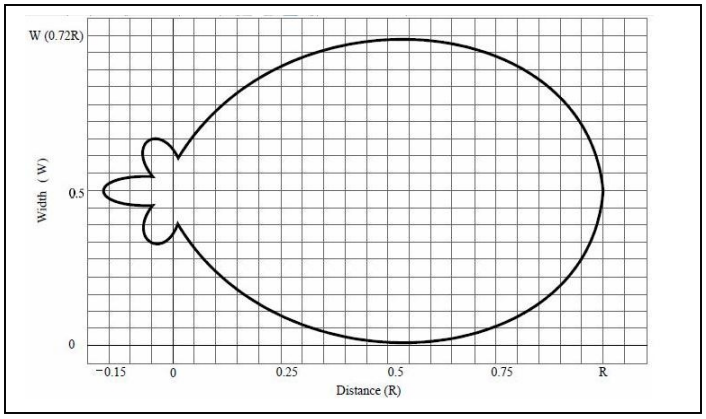
FEATURES

- **Extended reading distance** …
  Up to 7 meters between reader
- **Small, attractive reader** …
  Single unit with antenna
- **Easy reader installation** …
  No reader programming, simple
- **Wide selection of credentials** …
  5 vehicle tags and 2 hand-held
- **Unlimited tag or card life** …
  Passive, battery-free credentials
- **Easy interfacing to control**
  Both Wiegand and RS-232 data
- **No interference between no cross-reading between**
  Programmable RF field strength
- **RF transmission only as**
  Uses vehicle sensor to arm the RF
- **Dual antenna for difficult**
  Optional LR-2200 HiLo MA reader
- **Complies with certifications** …
  ETSI EN302 208, CE
- **Ideal upgrade from old**
  Hands-free vehicle identification
- **Eliminates stop-and-wait**
  Cars continue moving past reader
- **For outdoor applications** …
  *Housing required for rain and sun**

LR-2200™

UHF Extra Long-Range Reader





ACCESSORIES AND SUPPLIES

- LR Installation Kit - A **requirement** for all installers. An effective way to demonstrate the LR-2200, to prove its operation, to measure its performance, to locate tags, and to aim the reader. A one-time purchase.
- Power supply - Each LR-2200 requires a separate, independent, dedicated power supply. Ask AWID for specifications.
- Protective housing – To avoid rain, snow, hot sunlight and vandalism, AWID suggests Model PCH196 Lexan housing from The Housing Company.
- Mounting devices - Consult with supplier for poles, posts, pedestals, bollards, barriers,
- System components - Consult with supplier for access control package, gates, vehicle sensors, etc.
- Installation & Operation Manual - Download Manual from AWID's Web site.

CREDENTIAL OPTIONS

- Vehicle-mounting tags - Tags for permanent or movable applications, inside or outside vehicles. Types are windshield (*WS-UHF*), hangtag (*HT-UHF*), rear-view mirror (*RV-UHF*), metal-mount (*MT-UHF*), and sun-visor (*VT-UHF*).
- Hand-held cards – For presenting to reader. Types are clamshell *(CS-UHF)* and graphics Use these cards also with UA-612 reader.

Ask AWID about tag selection and mounting

OPERATING CHARACTERISTICS

Reading Distance:
Up to 25 feet (7.6 meters)
Frequency Band:
865 to 868 MHz ETSI
Frequency Hopping technology
Antenna Output:
Circular-polarized RF field
Communications Protocol:
Wiegand and RS-232, simultaneous
Code Formats:
Determined by AWID's tags & cards programmed with 26 bits to 50 bits
Cables:
Power - 2 conductors, 18 gauge
Data - 3 conductors, 22 gauge
Stranded, color-coded, overall shielded
Up to 500 feet long
Field-Programmable Features:
Read repetition rate; RF power level
Min: 5dBm / 3.16mW
Max: 30dBm / 100mW
With 0.5dB steps (selectable)
***RF power adjustment will effect read range**
Antenna Gain:
4.77 dBi
E.R.P.
Min: 5+4.77-2.15=9.77 dBm
Min: 30+4.77-2.15=32.62 dBm

PHYSICAL CHARACTERISTICS

Dimensions:
20.3 x 20.3 x 2.86 cm
Weight:
1.04 kg
Material (Color):
ABS enclosure (beige); aluminum back-plate
Cable (Integrated with Reader):
10 conductors, 32 inches long
Overall shielded, plastic jacket
Mounting (Supplied by Installer):
Pan-and-tilt adjustment for aiming

ENVIRONMENT

Operating Temperature:
At 50% Duty Cycle -
-35°C to +65°C (-31°F to +150°F)
At 100% Duty Cycle -
-35°C to +45°C (-31°F to +115°F)
Operating Humidity:
0% to 95% non-condensing
Protection Class:
IP65 rating, weatherproof

CERTIFICATION

ETSI EN 302 208, CE, RoHS

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AWID

Maximum RFID



LR-2000HiLoMA™

Extra Long-Range Reader Set

AWID's LR-2000HiLoMA™ Long-Range Reader set is a special reader for mixed small and large vehicles, for mixed UHF tags and cards, for special conditions of the roadway, and for identifying people walking at a portal. The "HiLo" reader set consists of an LR-2000 master reader and a remote antenna in separate enclosures. The two units are connected to each other by a coaxial cable. The master reader is specially programmed so that the RF fields transmitted by each unit alternate with a 50% duty cycle. The two units of the "HiLo" set may be close to each other with no interference from their RF fields. When using mounting brackets, the two units are typically up to 4 feet apart. The LR-2000HiLoMA uses the same 5 vehicle-mounted tags and 2 hand-held cards that AWID offers for the LR-2000 reader. LR-2000 single readers and LR-2000HiLoMA reader sets may be interfaced with the same Automated Vehicle Identification (AVI) or gate access system.



The LR-2000HiLoMA provides all of the features and benefits of the LR-2000 single reader. In addition, it spreads out the effective RF field so that the field covers a larger space, extended either vertically or horizontally, according to the needs of the application. The reading distance for the "HiLo" set is the same as for the LR-2000 single reader. But with the "HiLo" set, the cross-section of the field's area can be almost twice as large. This makes the "HiLo" set ideal for special site conditions -

• Combination of big trucks or buses with passenger cars – Vehicle tags may bedifferent types and attached at different locations in or on the vehicles. Each unit of the "HiLo" set is aimed optimally for the tags of just one of the vehicle types.

• Vehicles with combination of tags and cards – Some cars have tags inside the vehicles, while in other cars the drivers hold cards out of the side window. One "HiLo" unit may be high to look through the windshield; the other unit may be low facing across the lane at the side of the car.

• Turning or merging lanes, or wide lane – The units of the "HiLo" set are aimed to spread out the RF field horizontally at the tag reading location. This creates a wide zone, or two separate zones, in which tags will be read.

• Change in grade at the reading location – When the slope or grade of the roadway changes as the tag passes through the reader's reading zone, as in a parking ramp, vertical spreading of the effective RF field assures reliable reading of the tags.

The LR-2000HiLoMA reader set uses the same power, cable, wiring, and input reader port in the host system as a single LR-2000 reader. The two units of the LR-2000HiLoMA set share the same reader address in the system.

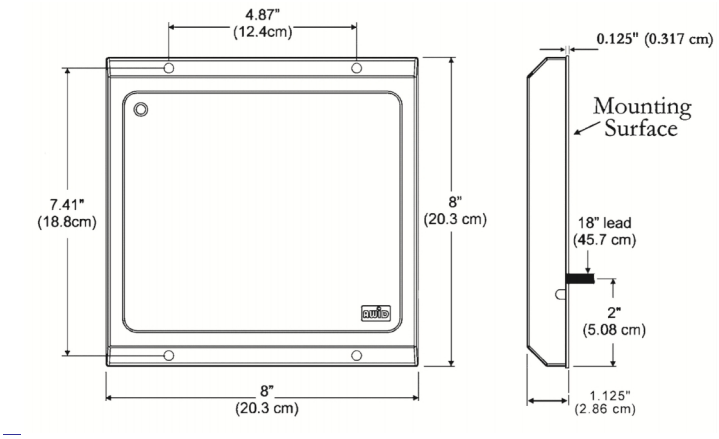
FEATURES

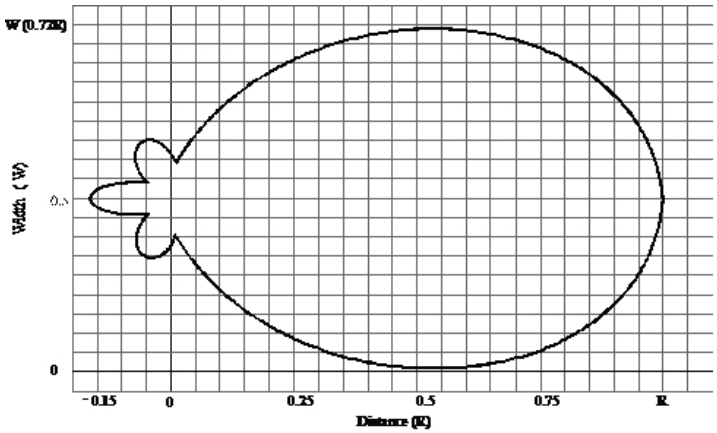
- **Longer reading distance** ...
  Up to 25 feet between reader and tag
- **Small, attractive reader** ...
  Single unit with antenna, 8"x8"x1-1/8"
- **Easy reader installation** ...
  No reader programming, simple wiring
- **Wide selection of credentials** ...
  5 vehicle tags and 2 hand-held cards
- **Unlimited tag or card life** ...
  Passive, battery-free credentials
- **Data output to fit the system** ...
  Selectable read repeat rate
- **No interference between readers, no cross-reading between lanes** ...
  Programmable RF field strength
- **RF transmission only as needed** ...
  Uses vehicle sensor to arm the RF circuit
- **Dual antenna for difficult sites** ...
  Optional LR-2000 HiLo MA reader set
- **LR-2000 mixes with other readers** ...
  Uses same code format as prox readers
- **Easy interfacing to control systems** ...
  Both Wiegand and RS-232 data output
- **Complies with certifications** ...
  ISO-9001:2000; FCC Part 15; IC, RoHS
- **Ideal upgrade from old systems** ...
  Hands-free car ID; cards for people ID
- **Eliminates stop-and-wait entry** ...
  Cars continue moving past reader
- **No need for extra protective**
  Protection class IP65 for outdoor use
- **Easy to buy and own** ...
  Installer needs no FCC registration

***NOTE: WHEN INSTALLED OUTDOORS AND EXPOSED TO RAIN OR SNOW, OR TO DIRECT SUN IN A HOT ENVIRONMENT, LR-2000 MUST BE MOUNTED INSIDE A HOUSING WITH MINIMUM IP64 RATING.

LR-2000HiLoMA™

UHF Extra Long-Range Reader Set





ACCESSORIES AND SUPPLIES

- LR Installation Kit - A requirement for all installers. An effective way to demonstrate the LR-2000, to prove its operation, to measure its performance, to locate tags and, to aim the reader. A one-time purchase.
- Power supply - Each LR-2000 requires a separate, independent, dedicated power supply. Ask AWID for specifications. AWID offers PS-123.3A-0-0.
- Cable for power and data - Correct cable assures good reader performance. Ask AWID for specifications.
- Protective housing – To avoid rain, snow, hot sunlight and vandalism, AWID suggests Model PCH196 Lexan housing from The Housing Company.
- Mounting devices - Consult with supplier for poles, posts, pedestals, bollards, barriers, etc.
- System components - Consult with supplier for access control package, gates, vehicle sensors, etc.
- Installation & Operation Manual - Download Manual from AWID's Web site.

CREDENTIAL OPTIONS

- Vehicle-mounting tags - Tags for permanent or movable applications, inside or outside vehicles. Types are windshield (*WS-UHF*), hangtag (*HT-UHF*), rear-view mirror (*RV-UHF*), metal-mount *MT-UHF*), and sun-visor (*VT-UHF*).
- Hand-held cards – For presenting to reader. Types are clamshell (*CS-UHF*) and graphics (*GR-UHF*). Use these cards also with UA-612 reader.

Ask AWID about tag selection and mounting methods.

OPERATING CHARACTERISTICS

Reading Distance:
Up to 25 feet (7.6 meters)

Frequency Band:
902 to 928 MHz (in USA)
Frequency Hopping technology

Antenna Output:
Circular-polarized RF field

Power Supply:
7 to 15 VDC - regulated
(At 12 VDC) Rated for 1.5 A or more
Separate, independent, dedicated

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Determined by AWID's tags & cards programmed with 26 bits to 50 bits

Cables:
Power - 2 conductors, 18 gauge
Data - 3 conductors, 22 gauge
Stranded, color-coded, overall shielded
Up to 500 feet long

Field-Programmable Features:
Read repetition rate; RF power level

PHYSICAL CHARACTERISTICS

Dimensions of Each Unit:
8 x 8 x 1.125 inches (20.3 x 20.3 x 2.86 cm)

Weight of Each Unit:
37.5 oz (1.06 kg)

Material (Color):
ABS enclosure (beige); aluminum back-plate

Cable (Integrated with Master Reader):
10 conductors, 32 inches long
Overall shielded, plastic jacket

Coaxial Cable for Reader's 2 Units:
Type RG-58 cable, 6 feet long
2 RP-SMA connectors, gold-plated

Mounting (Supplied by Installer):
Pan-and-tilt adjustment for aiming

ENVIRONMENT

Operating Temperature:
At 50% Duty Cycle -
-35°C to +65°C (-31°F to +150°F)
At 100% Duty Cycle -
-35°C to +45°C (-31°F to +115°F)

Operating Humidity:
0% to 95% non-condensing

Protection from Environment:
Use Lexan housings when reader is exposed to rain, snow or to bright sun in hot areas

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; RoHS

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AWID

Maximum RFID



LR-2000™

Extra Long-Range Reader

AWID's LR-2000™ Long-Range Reader is a UHF tag and card reader used in RFID applications like gate access for vehicles, and physical access for people. Its electronics and antenna are integrated in a single compact enclosure. The LR-2000 is optimally designed for Automatic Vehicle Identification (AVI) and Access Control applications such as gate control in a parking facility. It also provides identification and access for people at doorways, wheelchairs at elevators, and gurneys in hospital entrances. The LR-2000 Reader assures security by use of AWID's proprietary encryption for communications between the reader and its UHF vehicle tags and hand-held cards.

The LR-2000 reader is suitable for outdoor applications. (A protective polycarbonate housing may be required – see Note below.) The LR-2000 offers price:performance advantage over conventional long-range proximity card and active-tag UHF systems. The LR-2000 can be combined with AWID's UA-612 door access reader, allowing the same hand-held cards to be used for both vehicle parking access and door access in buildings.



The LR-2000 operates in the license-free 902-928 MHz UHF band. It combines effective UHF technology with economical passive tags and cards, programmable read repetition rate and RF field strength, and simultaneous Wiegand and RS-232 data outputs. It can be interfaced with all standard access and AVI systems. The reader is manufactured in an ISO-9001 certified facility assuring the highest quality standard. The LR-2000 offers an impressive combination of single unit construction, small size, and attractive appearance. Tag reading distance is commonly up to 25 feet and sometimes more, depending on reader mounting, credential type, and environment.

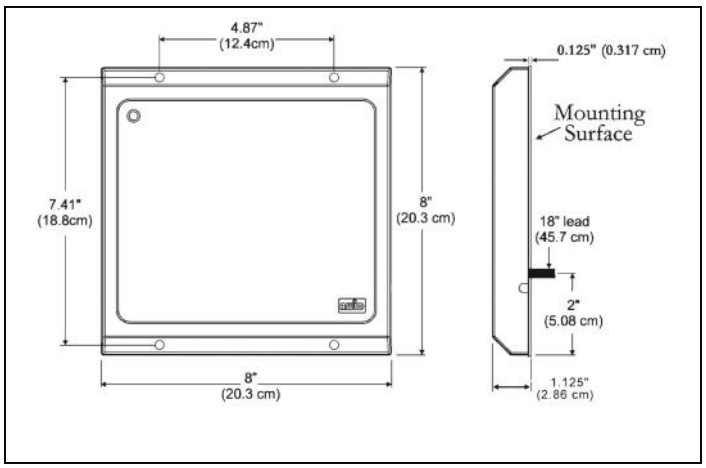
*NOTE: WHEN INSTALLED OUTDOORS AND EXPOSED TO RAIN OR SNOW, OR TO DIRECT SUN IN A HOT ENVIRONMENT, THE LR-2000 MUST BE MOUNTED INSIDE A HOUSING WITH MINIMUM IP64 RATING.

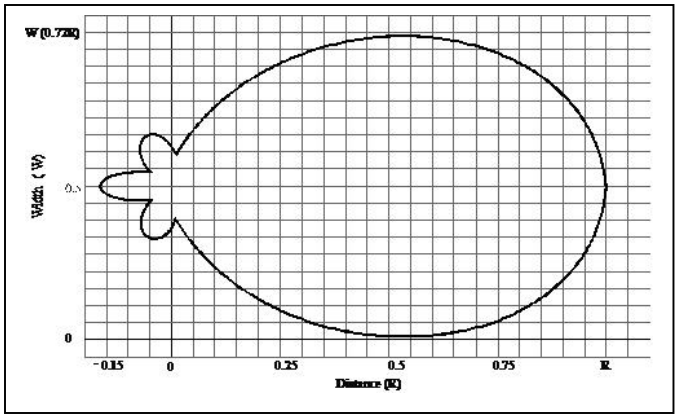
FEATURES

- **Longer reading distance** ...
  Up to 25 feet between reader and tag
- **Small, attractive reader** ...
  Single unit with antenna, 8"x8"x1-1/8"
- **Easy reader installation** ...
  No reader programming, simple wiring
- **Wide selection of credentials** ...
  5 vehicle tags and 2 hand-held cards
- **Unlimited tag or card life** ...
  Passive, battery-free credentials
- **Data output to fit the system** ...
  Selectable read repeat rate
- **No interference between readers, and no cross-reading between lanes** ...
  Programmable RF field strength
- **RF transmission only as needed** ...
  Uses vehicle sensor to arm the RF circuit
- **Dual antenna for difficult sites** ...
  Optional LR-2000 HiLo MA reader set
- **LR-2000 mixes with other readers** ...
  Uses same code format as prox readers
- **Easy interfacing to control systems** ...
  Both Wiegand and RS-232 data output
- **Complies with certifications** ...
  ISO-9001:2000; FCC Part 15; IC, RoHS
- **Ideal upgrade from old systems** ...
  Hands-free car ID; cards for people ID
- **Eliminates stop-and-wait entry** ...
  Cars continue moving past reader
- **For outdoor applications** ...
  *Housing required for rain and sun**
- **Easy to buy and own** ...
  Installer needs no FCC registration

LR-2000™

UHF Extra Long-Range Reader





ACCESSORIES AND SUPPLIES

- LR Installation Kit - A **requirement** for all installers. An effective way to demonstrate the LR-2000, to prove its operation, to measure its performance, to locate tags and, to aim the reader. A one-time purchase.
- Power supply - Each LR-2000 requires a separate, independent, dedicated power supply. Ask AWID for specifications. AWID offers PS-123.3A-0-0.
- Cable for power and data - Correct cable assures good reader performance. Ask AWID for specifications.
- Protective housing – To avoid rain, snow, hot sunlight and vandalism, AWID suggests Model PCH196 Lexan housing from The Housing Company.
- Mounting devices - Consult with supplier for poles, posts, pedestals, bollards, barriers, etc.
- System components - Consult with supplier for access control package, gates, vehicle sensors, etc.
- Installation & Operation Manual - Download Manual from AWID's Web site.

CREDENTIAL OPTIONS

- Vehicle-mounting tags - Tags for permanent or movable applications, inside or outside vehicles. Types are windshield (*WS-UHF*), hangtag (*HT-UHF*), rear-view mirror (*RV-UHF*), metal-mount (*MT-UHF*), and sun-visor (*VT-UHF*).
- Hand-held cards – For presenting to reader. Types are clamshell (*CS-UHF) and* graphics (*GR-UHF*). Use these cards also with UA-612 reader.

OPERATING CHARACTERISTICS

Reading Distance:
Up to 25 feet (7.6 meters)

Frequency Band:
902 to 928 MHz (in USA)
Frequency Hopping technology

Antenna Output:
Circular-polarized RF field

Power Supply:
7 to 15 VDC - regulated
(At 12 VDC) Rated for 1.5 A or more
Separate, independent, dedicated

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Determined by AWID's tags & cards programmed with 26 bits to 50 bits

Cables (for Wiegand Interface):
Power - 2 conductors, 18 gauge
Data - 3 conductors, 22 gauge
Stranded, color-coded, overall shielded
Up to 500 feet long

Field-Programmable Features:
Read repetition rate; RF power level

PHYSICAL CHARACTERISTICS

Dimensions:
8 x 8 x 1.125 inches (20.3 x 20.3 x 2.86 cm)

Weight:
37.5 oz (1.06 kg)

Material (Color):
ABS enclosure (beige); aluminum back-plate

Cable (Integrated with Reader):
10 conductors, 32 inches long
Overall shielded, plastic jacket

Mounting (Supplied by Installer):
Pan-and-tilt adjustment for aiming

ENVIRONMENT

Operating Temperature:
At 50% Duty Cycle -
-35°C to +65°C (-31°F to +150°F)
At 100% Duty Cycle -
-35°C to +45°C (-31°F to +115°F)

Operating Humidity:
0% to 95% non-condensing

Protection Class:
IP65 Weatherproof

Avoiding Interference:
Optimize reader performance by avoiding sources of RF – fluorescent and other arc lighting, UHF transmitters, other readers.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; RoHS

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AWID

Maximum RFID



LR-3000™

Extra Long-Range Reader

AWID's LR-3000™ Long-Range Reader is an Ultra High Frequency (UHF) tag and card reader used in RFID applications like gate access for vehicles and physical access for people. Its electronics and antenna are integrated in a single compact enclosure. The LR-3000 is optimally designed for Automatic Vehicle Identification (AVI) and Access Control applications such as gate control in a parking facility. It also provides identification and access for people at doorways, wheelchairs at elevators, and gurneys in hospital entrances. The LR-3000 Reader assures security by use of AWID's proprietary encryption for communications between the reader and its UHF vehicle tags and hand-held cards. The LR-3000 reader has two LED's – steady red to indicate DC power, and blinking green when a tag is presented. The LR-3000 reader is suitable for outdoor applications. The new ruggedized unit eliminates the need for extra protective housing required by earlier models.



The LR-3000 offers *price:performance* advantage over conventional long-range proximity card and active-tag RF systems. The LR-3000 can be combined with AWID's UA-612 door access reader, allowing the same hand-held card to be used for both vehicle parking access and door access in building.

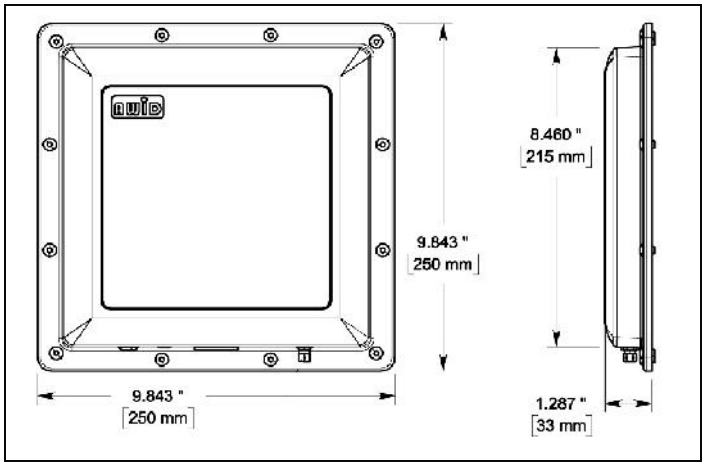
The LR-3000 operates in the license-free 902-928 MHz UHF band. It combines effective UHF technology with economical passive tags and cards, programmable read repetition rate and RF field strength, and simultaneous Wiegand and RS-232 data outputs. It can be interfaced with all standard access and AVI systems. The reader is manufactured in an ISO-9001 certified facility assuring the highest quality standard. The LR-3000 offers an impressive combination of single unit construction, small size and attractive appearance. Tag reading distance is commonly up to 25 feet and sometimes more depending on reader mounting, credential type and environment.

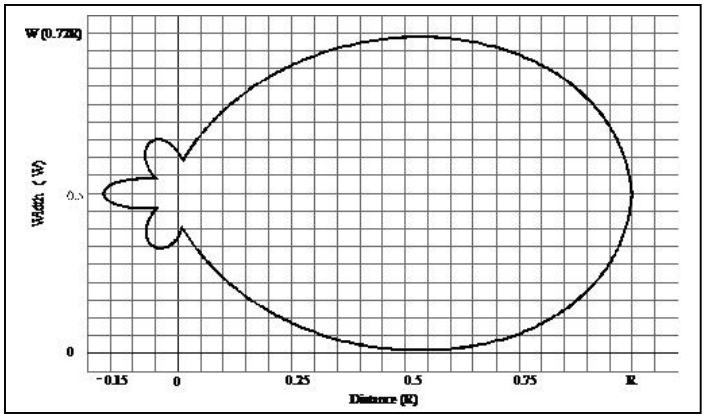
FEATURES

- **Longer reading distance** ...
  Up to 25 feet between reader and tag
- **Small, attractive reader** ...
  Single unit with antenna, 9.8"x9.8"x1.3"
- **Easy reader installation** ...
  No reader programming, simple wiring
- **Wide selection of credentials** ...
  5 vehicle tags and 2 hand-held cards
- **Unlimited tag or card life** ...
  Passive, battery-free credentials
- **Data output to fit the system** ...
  Selectable read repeat rate
- **No interference between readers, and no cross-reading between lanes** ...
  Programmable RF field strength
- **RF transmission only as needed** ...
  Uses vehicle sensor to arm the RF circuit
- **LED status indicators** ...
  Red for power, green for tag presence
- **LR-3000 mixes with other readers** ...
  Uses same code format as prox readers
- **Easy interfacing to control systems** ...
  Both Wiegand and RS-232 data output
- **Complies with certifications** ...
  ISO-9001:2000; FCC Part 15; IC, RoHS
- **Ideal upgrade from old systems** ...
  Hands-free car ID; cards for people ID
- **Eliminates stop-and-wait entry** ...
  Cars continue moving past reader
- **No need to add protective housing** ...
  Protection class IP65 for outdoor use
- **Easy to buy and own** ...
  Installer needs no FCC registration

LR-3000™

UHF Extra Long-Range Reader





ACCESSORIES AND SUPPLIES

- LR Installation Kit - A **requirement** for all installers. An effective way to demonstrate the LR-3000, to prove its operation, to measure its performance, to locate tags and, to aim the reader. A one-time purchase.
- Power supply - Each LR-3000 requires a separate, independent, dedicated power supply. Ask AWID for specifications. AWID offers PS-123.3A-0-0.
- Cable for power and data - Correct cable assures good reader performance. Ask AWID for specifications.
- Mounting devices - Consult with supplier for poles, posts, pedestals, bollards, barriers, etc.
- System components - Consult with supplier for access control package, gates, vehicle sensors, etc.
- Installation & Operation Manual - Download Manual from AWID's Web site.

CREDENTIAL OPTIONS

- Vehicle-mounting tags - Tags for permanent or movable applications, inside or outside vehicles. Types are windshield (*WS-UHF*), hangtag (*HT-UHF*), rear-view mirror (*RV-UHF*), metal-mount (*MT-UHF*), and sun-visor (*VT-UHF*).
- Hand-held cards – For presenting to reader. Types are clamshell (*CS-UHF)* and graphics (*GR-UHF*). Use these cards also with UA-612 reader.

Ask AWID about tag selection and mounting methods.

OPERATING CHARACTERISTICS

Reading Distance:
Tags and cards, up to 25 feet (7.6 meters)

Frequency Band:
902 to 928 MHz
Frequency Hopping technology

Antenna Output:
Circular-polarized RF field

Indicators:
2 LED's – Red: power; Green: tag presence

Power Supply:
7 to 15 volts DC – regulated
(At 12 VDC) Rated for 1 amperes or more
Separate, independent, dedicated to 1 reader

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Determined by AWID's tags & cards
programmed with 26 bits to 50 bits

Cables:
Power - 2 conductors, 18 gauge
Data - 3 conductors, 22 gauge
Stranded, color-coded, overall shielded
Up to 500 feet for Wiegand; 75 feet for RS-232

Field-Programmable Features:
Read repetition rate; RF power level

PHYSICAL CHARACTERISTICS

Dimensions:
9.8 x 9.8 x 1.3 " (25 x 25 x 3.3 cm)

Weight:
38.4 oz (1.09 kg)

Material (Color):
ABS enclosure (white); aluminum back-plate

Cable (Integrated with Reader):
10 conductors, 32 inches long
Overall shielded, plastic jacket

Mounting (Supplied by Installer):
Pan-and-tilt adjustment for aiming

ENVIRONMENT

Operating Temperature:
-35°C to +65°C (-31°F to +150°F)

Operating Humidity:
0% to 95% non-condensing

Protection Class:
IP65 Weatherproof

Avoiding Interference:
Optimize reader performance by avoiding sources of RF – fluorescent and other arc lighting, UHF transmitters, other UHF readers.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; RoHS

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http://www.awid.com

The RFID with Best ROI™

CREDENTIALS FOR UHF READERS
LR-911

VEHICLE MOUNT OPTIONS



WS-1216-0-0 Windshield Tag

- Self-adhesive tag applied inside windshield
- Hands-free vehicle identification
- Secure tag permanently attached directly on glass
- Out of driver's vision – smaller than a business card



MT-1014-0-0 Metal Tag

- Best tag for trucks & buses – tag facing side of lane
- Attached by self-adhesive, or fasteners, or Velcro
- Variety of uses – inside or outside, fixed or movable
- Suitable for requirements of diverse applications

The RFID with Best ROI™

Range

- Vehicle-mounted tags" – up to 11 feet (3.3 m).

Reader Selection

- Vehicle-mounted tags" – use with LR-911 reader only.

Technology in Tags and Cards

UHF communications between LR-911 reader and credentials.

- Excitation frequency: - 902 MHz to 928 MHz, frequency-hopping in 50 channels with pseudo-random pattern; 500 kHz channel spacing.
- Read repetition rate: - About 3 reads per second (factory default; field-programmable to slower repeat rates).•

Encoding for Tags and Cards

- Code format types: - Wiegand-type for general use; other types for proprietary formats.
- Code format options: - Number of bits – between 26 and 56 bits total. Open code formats with 26 bits and 37 bits. Reserved facility codes in special 34-bit format.

Information Required in Purchase Order

- Product part number and quantity.
- Code format name (*nn*-bit-*fff*, where *nn* = total number of bits, and *fff* = 3 letters that designate AWID's format assignment).
- Facility code (also called site code or company code).
- Starting and ending numbers for sequential individual identification numbers for the credentials.

Environmental Conditions

- Operating temperature: MT: 14 ° F to +140 °F (-10 °C to +60 °C) WS: -31 ° F to +140 °F (-35 °C to +60 °C)
- Operating humidity:0% to 95% non-condensing.•

	Width	Height	Thickness	Notes	Material
WS-1216-0-0	3-3/8" inch	2-1/8 inch	1/32 inch	Peel off label	Polyester
MT-1014-0-0	8 inch	1 inch	¼ inch	Peel off label	ABS

Slots and Holes

- WS: Must have no slots or holes, punched or drilled.
- MT: Contains holes at the ends for screws, rivets, wire ties. Must not be punched or drilled

Applications

- Credentials may be used on cars, trucks and buses of all sizes, and on special vehicles (fire trucks, forklifts, etc.).•
- If the vehicles are a mix of different vehicle sizes, such as passenger cars and semi-trailer trucks), use the LR-2000HiLoMA reader set. Select the tags and cards that are appropriate for the application.

Installation Guidelines for Credentials with LR-911 Reader

- When planning the installation, please consult the guideline: LR-911 Tags - Mounting Instructions V1.2.pdf

Options and Accessories

- **LR-911KIT Installation Kit•** : *Required* – a one-time purchase for the installer.

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AWID

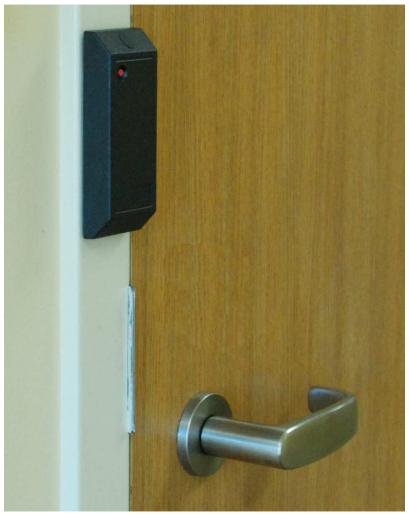
Maximum RFID



SR-2400™
Sentinel-Prox™ Proximity Reader

AWID's SR-2400 Proximity Card Reader is the value-leader for Access Control applications. With a range up to 5.5 inches, the SR-2400 reader delivers excellent performance without compromising quality, durability, attractive appearance, and ease of installation.

Installation The **SR-2400** reader is designed to fit perfectly on the 1-3/4 inch standard metal door frame or window mullion. The metal-compensation that is built into every SR-2400 reader assures minimal loss of read range when the reader is mounted on a metal surface. The SR-2400 reader also can be fastened by 2 screws on any wall or other surface. Installation may be indoors or outdoors, exposed to weather.



Features The SR-2400 reader contains a 3-color LED and a 4 kilohertz beeper. Both LED and beeper are controlled by the reader itself, and also can be controlled externally by the host system. The LED can indicate access-granted by the host. The beeper can be used as an alarm that prevents further card reads until the alarm condition is cleared.

Testing The reader is *self-testing* – using its own LED and beeper, it needs no interface to a controller to assure the installer and cardholder of correct performance. The reader is also *self-diagnostic* – if DC power is unstable, or if electrical noise is induced in the cable, the reader resets and its LED changes to amber.

Operation AWID's proximity readers use a re-present mode that requires that the user remove the card from the reader's field before the card can be read again. This feature eliminates multiple reads from a single presentation of the card. The SR-2400 has both Wiegand data interface for basic 4-wire connection (6 wires when all features are controlled), and also RS-232 serial interface. Code transmission from both interfaces is simultaneous.

Environment The SR-2400 reader is ready for challenging applications. The ABS plastic one-part enclosure, fully potted at the back surface with epoxy resin, stands up to physical abuse and adverse environment.

Credentials All of AWID's 125 kilohertz proximity credentials may be used with the SR-2400 reader. This includes clamshell and graphics-quality cards, keytags, hangtags and adhesive wafers. Read range varies with the credential type.

FEATURES

Compact size …
Fits on a mullion or door frame

Clean, slim design…
Matches good architecture at site

Ready for rough usage…
Rugged, strong construction

Ready for adverse weather…
One-part enclosure with potting

Easy mounting…
2 screws (supplied) for fastening

Special read range in a small unit…
Up to 5.5 inches with cards

Visual and audible indicators…
3-color LED and beeper inside reader

Controllable functions in reader…
LED and beeper can be wired to panel

Easy power…
Connects to panel's DC terminals

Quick wiring to host panel…
Basic 4-wire hook-up; 6 wires maximum

Standard Wiegand data output…
Data-0 & Data-1 panel connection

Compatible with other readers…
Same interface used in other readers

Uniform code format…
Standard 26-bit plus special codes

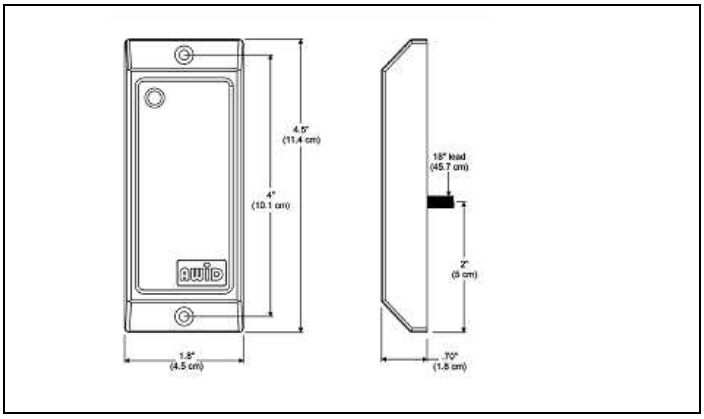
No programming in reader…
SR-2400 is ready to read all AWID codes

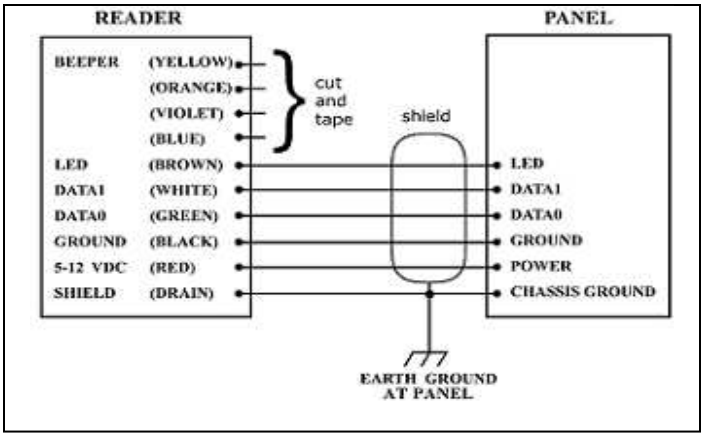
Self-testing for good operation…
LED & beeper indicate performance

High value ratio…
Excellent performance; modest cost

SR-2400™

Sentinel-Prox™ Proximity Reader





ACCESSORIES AND SUPPLIES

Mounting hardware – 2 #6-32 x 1" thread-cutting screws (supplied). Use other fasteners as needed for mounting.

Power supply – Reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage on power and ground terminals. External linear, regulated DC power supply may be used (100 mA or more current rating).

Cable for power and data – 22 gauge, stranded, color-coded, overall shielded, not twisted pair. 4 to 6 conductors depending on connection of reader's controllable functions (LED and beeper). For Wiegand, up to 500 feet.

Protective housing – SR-2400 is suitable for exposure to rain, snow and bright sunshine. Mount reader inside a Lexan housing to remove reader from view and abuse. AWID suggests Model PCH049 housing from The Housing Company.

Installation Sheet – Download full instructions from AWID's web site: http://www.awid.com.

CREDENTIALS

Proximity cards, keytags, hangtags and wafers – AWID offers a selection of cards, tags and wafers for use with the SR-2400 readers.

OPERATING CHARACTERISTICS

Reading Distance:
With cards – up to 5.5 inches (14 cm)
(varies with credential type, voltage applied to reader, and local conditions)
Excitation Frequency:
Transmit and Receive - 125 kHz
Antenna Output:
Omni-directional low-frequency RF field
Indicators (Control by Reader and Panel):
LED – 3 colors, red-amber-green
Beeper – piezo-electric, 4 kHz tone
Power Supply:
+5 volts to +12 volts DC ± 10%, linear, regulated; current rating: 100 mA or more
Communication Protocols:
Wiegand electrical protocol
Code Formats:
Determined by AWID's credentials programmed with 26 bits to 50 bits
Cable (for Wiegand Interface):
4 to 6 conductors (not twisted pairs), stranded, 22 gauge, color-coded, overall 100% shielded, plastic jacket, up to 500 feet

PHYSICAL CHARACTERISTICS

Dimensions:
4.5 x 1.8 x 0.7 inch (11.4 x 4.5 x 1.8 cm)
Weight:
4 ounces (113 g)
Material:
ABS 1-part enclosure, dark gray color
Epoxy resin potting at rear surface
Cable (Integrated with Reader):
10 conductors, 22 gauge, 18 inches long.
Overall shielded, plastic jacket
Mounting:
Door frame, window mullion, wall, cabinet

ENVIRONMENT

Operating Temperature:
-31˚F to 150˚F (-35˚C to 65˚C)
Operating Humidity:
0% to 95% non-condensing
Protection from Environment:
Use Lexan housing when reader must be away from view or damage.
Avoiding Interference:
Optimize reader performance by spacing or shielding reader from neighboring readers, including reader on other side of wall at door.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; UL listed

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AWID

Maximum RFID



SP-6820™
Sentinel-Prox™ Proximity Reader

AWID's SP-6820 Proximity Card Reader is a switchplate-type reader that combines exceptional reading distance and easy mounting directly on a single-gang box. With a read range up to 8 inches, the SP-6820 reader delivers excellent performance without compromising quality, durability, attractive appearance, and ease of installation.

Installation The SP-6820 reader is designed to fit perfectly on a single-gang electrical utility box. The metal-compensation that is built into every SP-6820 reader assures minimal loss of read range when the reader is mounted on a metal surface. The SP-6820 reader also can be fastened by 2 screws on any wall or other surface.

Features The SP-6820 reader contains (a) a 3-color LED, (b) a 4 kilohertz beeper, and (c) a "hold" circuit. Both LED and beeper are controlled by the reader itself. All three functions can be controlled externally by the host system. The LED can indicate access-granted by the host. The beeper can be used as an alarm that prevents further card readers until the alarm condition is cleared. The "hold" circuit delays code transmission from the reader until the host requests it.



Testing The reader is *self-testing* – using its own LED and beeper, it needs no interface to a controller to assure the installer and cardholder of correct performance. The reader is also *self-diagnostic* – if DC power is unstable, or if electrical noise is induced in the cable, the reader resets and its LED changes to amber.

Operation AWID's proximity readers use a re-present mode that requires that the user remove the card from the reader's field before the card can be read again. This feature eliminates multiple reads from a single presentation of the card. The SP-6820 has both Wiegand data interface for basic 4-wire connection (7 wires when all features are controlled), and also RS-232 serial interface. Code transmission from both interfaces is simultaneous.

Environment The SP-6820 reader is ready for installation indoors and outdoors.* The ABS plastic enclosure, quickly installed when its cover is removed, provides a secure package when the cover is snapped on the base. Epoxy resin potting protects the electronic circuits.

Credentials All of AWID's 125 kilohertz proximity credentials may be used with the SP-6820 reader. This includes clamshell and graphics-quality cards, keytags, hangtags, and adhesive wafers. Read range varies with the credential type.

(*) NOTE: IF EXPOSED TO RAIN OR SNOW, UNIT MUST BE PROTECTED BY SUITABLE HOUSING.

FEATURES

Convenient size…
Fits like a cover plate on a box or wall

Clean, handsome design…
Matches good architecture at site

Ready for heavy use at all sites…
Non-contact reading of cards and tags

Perfect for wall, cabinet, single-gang box…
Strong two-part ABS plastic enclosure

Easy mounting…
2 screws match holes in a utility box

Special read range in a small unit…
Up to 8 inches with cards

Visual and audible indicators…
3-color LED and beeper inside reader

Controllable functions in reader…
LED, beeper, hold can be wired to panel

Easy power…
Connects to panel's DC terminals

Quick wiring to host panel…
Basic 4-wire hook-up; 7 wires maximum

Standard Wiegand data output…
Data-0 & Data-1 panel connection

Alternative RS-232 data output…
Interface to PC or special controller

Uniform code format…
Standard 26-bit plus special codes

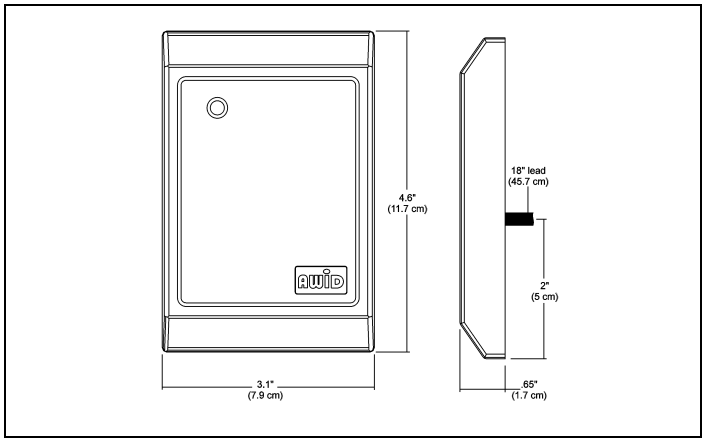
No programming in reader…
SP-6820 is ready to read all AWID codes

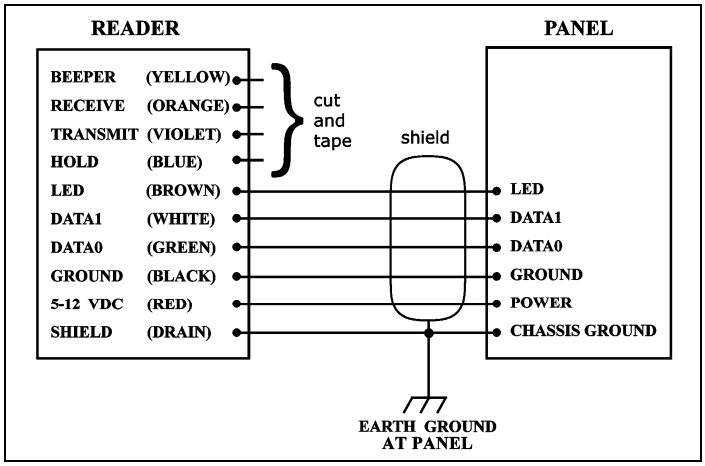
Self-testing for good operation…
LED & beeper indicate performance

High value ratio…
Excellent performance; modest cost

SP-6820™

Sentinel-Prox™ Proximity Reader





ACCESSORIES AND SUPPLIES

Mounting hardware – 2 #6-32 x 1" machine screws (supplied). Use other fasteners as needed for mounting.

Power supply – Reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage on power and ground terminals. External linear, regulated DC power supply may be used (200 mA or more current rating).

Cable for power and data – 22 gauge, stranded, color-coded, overall shielded, not twisted pair. 4 to 7 conductors depending on connection of reader's controllable functions (LED, beeper and "hold"). For Wiegand, up to 500 feet long.

Protective housing – SP-6820 reader is suitable for outdoor installation in most cases. If a reader is to be removed from direct precipitation, view or abuse, install the reader inside a Lexan housing. AWID suggests The Housing Company's Model PCH049 housing.

Installation Sheet – Download full instructions from AWID's web site http://www.awid.com.

CREDENTIALS

Proximity cards, keytags, hangtags and wafers – AWID offers a selection of cards, tags and wafers for use with the SP-6820 reader.

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OPERATING CHARACTERISTICS

Reading Distance:
With cards – Up to 8 inches (20 cm)
(varies with mounting or housing, voltage applied to reader, and credential type)

Excitation Frequency:
Transmit and Receive - 125 kHz

Antenna Output:
Omni-directional low-frequency RF field

Indicators (Control by Reader and Panel):
LED – 3 colors, red-amber-green
Beeper – piezo-electric, 4 kHz tone

Power Supply:
+5 volts to +12 volts DC ± 10%, linear, regulated
Current: 120 mA at 5 V; 200 mA at 12 V

Communication Protocols:
Wiegand electrical interface
RS-232 serial interface

Code Formats:
Determined by AWID's credentials programmed with 26 bits to 50 bits

Cable (for Wiegand Interface):
4 to 7 conductors (not twisted pairs), stranded, 22 gauge, color-coded, overall 100% shielded, plastic jacket, up to 500 ft

PHYSICAL CHARACTERISTICS

Dimensions:
4.6 x 3.1 x 0.65 inches (11.7 x 7.9 x 1.7 cm)

Weight:
8 ounces (227 g)

Material:
ABS 2-part enclosure, beige or dark gray color
Epoxy resin potting on electronics

Cable (Integrated with Reader):
10 conductors, 22 gauge, 18 inches long.
Overall shielded, gray plastic jacket

Mounting:
Single-gang utility box, wall, cabinet

ENVIRONMENT

Operating Temperature:
-31˚F to 150˚F (-35˚C to 65˚C)

Operating Humidity:
0% to 95% non-condensing

Protection from Environment:
Use Lexan housing when reader must be away from rain, snow, view or abuse'

Avoiding Interference:
Optimize reader performance by spacing or shielding reader from neighboring readers.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; UL listed

18300 Sutter Blvd. Morgan Hill, CA 95037
Tel: (408) 825-1100 Fax: (408) 782-7402
http://www.awid.com

AWID

The RFID with Best ROI™

LR-911™
Sentinel-Prox™
Proximity Reader



AWID's LR-911™ Long-Range Reader is a UHF tag reader used in RFID applications for vehicles and controlling access at gates. The electronics and antenna are integrated in a single small enclosure. The LR-911 is optimally designed for Automatic Vehicle Identification (AVI) and Access Control applications such as parking facility and residential gate control. It also provides identification and access for wheelchairs at elevators, and gurneys in hospital entrances. The LR-911 Reader assures secure communications between the reader and its UHF vehicle tags.

Important: The LR-911 reader can be purchased only for applications that require compatibility with existing installations in which other LR-911 readers are already in use, or where the reader must be able to read existing WS-1216-0-0 or MT-1014-0-0 tags. For all other applications, use the **LR-2000** *reader with its 5 vehicle tags and 2 hand-held cards.*

The LR-911 reader is suitable for outdoor applications. (A protective polycarbonate housing must be provided for direct exposure to rain or snow, or to bright sunlight in a hot environment.) The LR-911 offers price:performance advantage over conventional long-range proximity card and active-tag UHF systems.



The LR-911 operates in the license-free 902-928 MHz UHF band. It combines effective UHF technology with economical, long-life passive tags, programmable read repetition rate and RF power level, and simultaneous Wiegand and RS-232 data outputs. It can be interfaced with all standard access and AVI systems. The reader is manufactured in an ISO-9001 certified facility assuring the highest quality standard. The LR-911 offers an impressive combination of single unit construction, small size, and attractive appearance. Tag reading distance is commonly up to 12 feet, depending on reader mounting, credential type, and environment.

The LR-911 reader is available in an optional LR-911HiLoMA package, consisting of a master reader, a remote antenna, and a coaxial connecting cable. The "HiLo" reader set should be used at sites where the effective RF field must be expanded horizontally or vertically, or directed to two neighboring zones, for special conditions of vehicle flow or topography. (Consult AWID to discuss each case.)

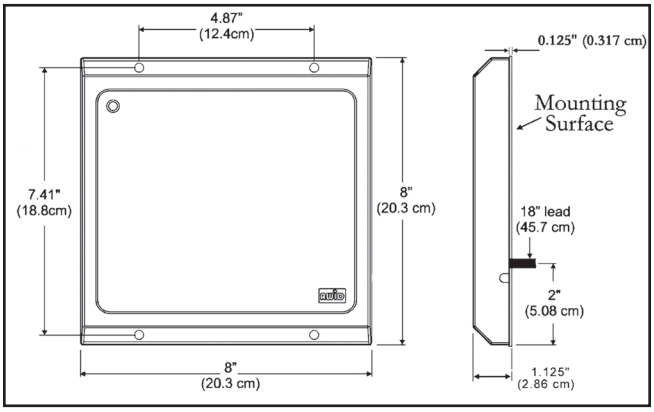
Vehicle tags for use with the LR-911 reader are the WS-1216-0-0 windshield-type tag and the MT-1014-0-0 metal-mount tag. Both tags may be attached inside the vehicle. The MT tag may also be left unattached for quick access and hand-held reading, and may be permanently fastened outside the vehicle.

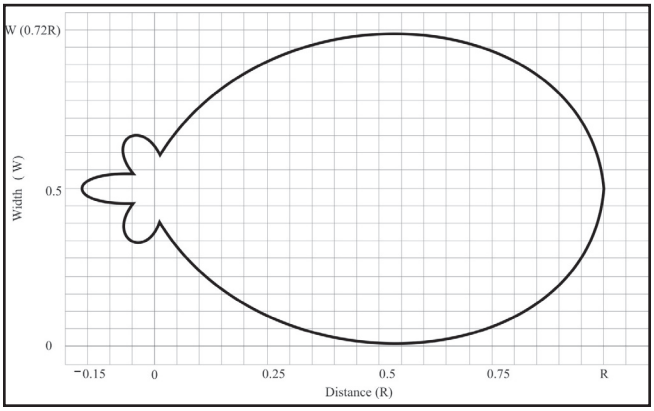
FEATURES

- Long reading distance . . .
  Up to 12 feet from reader to tag
- Small, attractive reader . . .
  Single unit with antenna, 8" x 8" x 1-1/8"
- Easy reader installation . . .
  No programming; simple wiring
- Choice of vehicle credentials . . .
  Windshield and surface-mounted tags
- Unlimited tag life . . .
  Passive battery-free credentials
- Data output to fit the system . . .
  Selectable read repeat rate
- No interference between readers . . .
  Programmable field strength limits zone
- Dual antenna sets for difficult sites . . .
  Optional LR-911HiLoMA reader set
- RF transmission only as needed . . .
  Use vehicle sensor to arm the RF circuit
- LR-911 mixes with other readers . . .
  Uses same code type as prox readers
- Easy interfacing to control systems . . .
  Both Wiegand and RS-232 data output
- Complies with certifications . . .
  ISO-9001:2000; FCC Part 15; IC
- Ideal upgrade for old systems . . .
  Adds vehicle access to card entry
- Eliminates stop-and-wait entry . . .
  Cars continue moving past reader
- For outdoor applications . . .
  *Housing available for rain and sun**
- Easy to buy and own . . .
  Installer needs no FCC registration
- Worry-free installation . . .
  Instructions, installation kit, and ready technical support

LR-911™

UHF Long Range Reader





ACCESSORIES & SUPPLIES

- LR-911KIT Installation Kit – A **requirement** for all installers. An effective way to demonstrate the LR-911, to prove its operation, to measure its performance,
to locate tags, and to aim the reader. A one-time purchase.
- Mounting bracket – Pan-and-tilt adjustable, for aiming the LR-911 at the tags' reading location. AWID offers LR-MB-0-0.
- Power supply – Each LR-911 requires a separate, independent, dedicated power supply. Ask AWID for specifications. AWID offers PS12-3.3A-0-0.
- Cable for power and data – Correct cable assures good reader performance. Ask AWID for specifications. For Wiegand interface, up to 500 feet long.
- Protective housing – To avoid rain, snow, hot sunlight, visibility or vandalism. AWID suggests Model PCH196 Lexan housing from The Housing Company.
- Mounting devices – Consult with supplier for poles, posts, pedestals, bollards, barriers, etc.
- System components – Consult with supplier for access control package, gates, vehicle sensors.
- Installation & Operation Manual – Download Manual from AWID's Web site.
- HH-6600 UHF Handheld Reader – Check codes in tags up to 6 feet.

CREDENTIAL OPTIONS

- Vehicle-mounted tags – Tags for permanent or movable applications, inside or outside vehicles.

Ask AWID about tag selection and mounting methods.

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OPERATING CHARACTERISTICS

Readng Distance:
Up to 12 feet (3.6 meters)

Frequency Band:
902 to 928 MHz (in USA)
Frequency-hopping technology

Antenna Output:
Circular-polarized RF field\

Power Supply:
7 to 15 volts DC – linear, regulated
At 12 VDC, rated for 1.5 A or more
Separate, independent, dedicated

Communications Protocols:
Wiegand and RS-232, simultaneous

Code Formats:
Determined by AWID's tags programmed with 26 bits to 50 bits

Cables (For Wiegand Interface):
Power – 2 conductors, 18 gauge
Data – 3 conductors, 22 gauge
Stranded, color-coded, shielded
Up to 500 feet lon

Field-Programmable Features:
Read repeat rate; RF power level

PHYSICAL CHARACTERISTIC

Dimensions:
8 x 8 x 1.125 inches (20.3 x 20.3 x 2.86 cm)

Weight: 37.5 ounces (1.06 kg

Material (Color):
ABS enclosure (beige); aluminum backplate

Cable (Integrated with Reader):
10 conductors, 32 inches long
Overall shielded, plastic sheathed

Mounting (Supplied by Installer):
Pan-and-tilt adjustment for aiming

ENVIRONMENT

Operating Temperature:
At 50% duty cycle –
-31 to +150 F (-35 to +65 C)
At 100% duty cycle –
-31 to +115 C (-35 to +45 C)

Operating Humidity:
0% to 95%, non-condensing**Protection from Environment:**
Use Lexan housing when reader is exposed to rain or snow, or to bright sunlight in hot area.

Avoiding Interference:

Optimize reader performance by avoiding sources of RF – fluorescent and other arc lighting, UHF transmitters, other readers

CERTIFICATION

ISO-9001:2000; FCC Part 15

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AWID

Maximum RFID



MR-1824™
Sentinel-Prox™ Proximity Reader

AWID's MR-1824 Proximity Card Reader is a high-power reader for mid-range proximity reading distance, in a small self-contained package. Read range with cards is up to 24 inches. (Read range varies, depending upon the tag used and local conditions.) The MR-1824 reader is used frequently in parking facilities, for driver identification and vehicle access.

Metal-Compensation This reader is available in an optional **MR-1824MC** version, which includes metal-compensation. It has best read range when it is mounted on a metal surface at least as large as the reader (8 x 8 inches). Mount the **MR-1824** version at least 4 inches from *all* metal for best read range.

Installation The **MR-1824** reader is fastened by 4 screws on any non-metal wall or other surface.* The **MR-1824MC** reader starts by fastening the ferrite plates behind the reader's plastic base to the metal surface, and then fastening the reader's cover to its base. When installing the reader on a pedestal, either mount the **MR-1824** on a 4-inch-thick plastic housing as a spacer from the metal, or mount the **MR-1824MC** on a metal-plate adapter between the reader and the flange on the pedestal.



Features These readers contain (a) a 3-color LED to indicate successful card read and access-granted, (b) a 4 kilohertz beeper for attention and alarm, and (c) a "hold" circuit to delay data transmission. Both LED and beeper are controlled by the reader itself. All three functions can be controlled externally by the host system.

Testing The reader is *self-testing* – using its own LED and beeper, it needs no interface to a controller to assure the installer and cardholder of correct performance. The reader is also *self-diagnostic* – if DC power is unstable, or if electrical noise is induced in the cable, the reader resets and its LED changes to amber.

Operation AWID's proximity readers use a re-present mode that requires that the user remove the card from the reader's field before the card can be read again. This feature eliminates multiple reads from a single presentation of the card. The MR-1824 has both Wiegand data interface for basic 4-wire connection (7 wires when all features are controlled), and also RS-232 serial interface. Code transmission from both interfaces is simultaneous.

Environment The MR-1824 reader is ready for installation indoors and outdoors.* The ABS plastic two-part enclosure, quickly installed when its cover is removed, provides a secure package when the cover is fastened to the base. Epoxy resin potting protects the electronic circuits.

(*) NOTE: IF EXPOSED TO RAIN OR SNOW, UNIT MUST BE INSIDE A MINIMUM IP64-RATED HOUSING.

FEATURES

Right size for pedestal or door…
Big enough for easy card presentation

Clean, unobstrusive appearance…
Matches good architecture at site

Ready for heavy use at all sites…
Non-contact reading of cards and tags

Perfect for wall, cabinet, pedestal…
Strong two-part ABS plastic enclosure

Easy mounting…
4 screws through reader's cover

Big read range in a mid-sized unit…
Up to 24 inches with clamshell cards

Visual and audible indicators…
3-color LED and beeper inside reader

Controllable functions in reader…
LED, beeper, hold can be wired to panel

Easy power from independent source…
All MR-1824 units use 1 power supply

Quick wiring to host panel…
Basic 4-wire hook-up; 7 wires maximum

Standard Wiegand data output…
Data-0 & Data-1 panel connection

Alternative RS-232 data output…
Interface to PC or special controller

Compatible with other readers…
Wiegand interface used in other readers

Uniform code format…
Standard 26-bit plus special codes

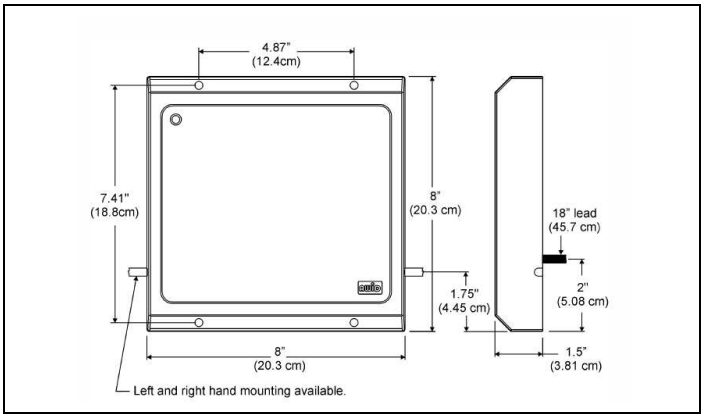
No programming in reader…
MR-1824 is ready to read all AWID codes

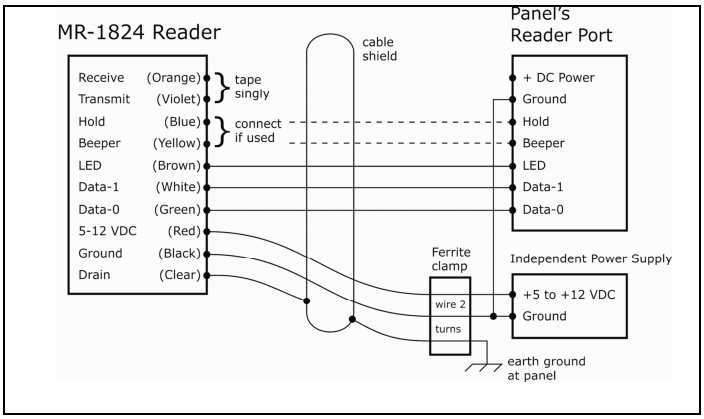
Self-testing for good operation…
LED & beeper indicate performance

High value ratio…
Excellent performance; modest cost

MR-1824™

Sentinel-Prox™ Proximity Reader





ACCESSORIES AND SUPPLIES

Mounting hardware – 4 #6-20 x 1.375" self-tapping screws, 4 plastic screw anchors (supplied). Use other fasteners as needed for mounting.

Power supply – Reader operates with voltage between +5 volts and +12 volts DC. An external linear, regulated DC power supply is required (current rating: 400 mA or more at 5 volts, 1 A or more at 12 volts). Optimum read range occurs when 12 volts DC is applied to reader.

Cable for power and data – 18 gauge, stranded, color-coded, overall shielded, not twisted pair. 4 to 7 conductors depending on connection of reader's controllable functions (LED, beeper and "hold"). For Wiegand, up to 500 feet long.

Protective housing – MR-1824 and MR-1824MC readers are suitable for outdoor installation in most cases. If a reader is to be removed from direct precipitation, bright sunlight in a hot environment, view or abuse, install the reader inside a Lexan housing. AWID suggests The Housing Company's Model PCH196 housing. Use this housing also to space the **MR-1824** away from metal, such as a pedestal or pole.

Mounting devices – Consult with supplier for utility boxes, adapter plates, spacers, poles, posts, pedestals, bollards.

Installation Sheet – Download full instructions and Technical Reference "MR-1824 – Assuring Maximum Read Range" from AWID's web site http://www.awid.com.

CREDENTIALS

Proximity cards, keytags and wafers – AWID offers a selection of cards, tags and wafers for use with the MR-1824 and MR-1824MC readers. All credentials for these readers must be AWID's products.

Ask AWID about credentials. Download the product sheet with cards, keytags, hangtags, and adhesive wafers for all of AWID's proximity readers.

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OPERATING CHARACTERISTICS

Reading Distance:
MR-1824 – Up to 24 inches (60 cm)
MR-1824MC – Up to 16 inches (40 cm)
(varies with mounting or housing, voltage applied to reader, and credential type)
Excitation Frequency:
Transmit and Receive - 125 kHz
Antenna Output:
Omni-directional low-frequency RF field
Indicators (Control by Reader and Panel):
LED – 3 colors, red-amber-green
Beeper – piezo-electric, 4kHz tone
Power Supply:
+5 volts to max +12 volts DC, linear, regulated; current rating: 400 mA at 5 volts, 1 A at 12 volts
Communication Protocols:
Wiegand electrical interface
RS-232 serial interface
Code Formats:
Determined by AWID's credentials programmed with 26 bits to 50 bits
Cable (for Wiegand Interface):
4 to 7 conductors (not twisted pairs), stranded, 18 gauge, color-coded, overall 100% shielded, plastic sheath, to 500 ft.

PHYSICAL CHARACTERISTICS

Dimensions:
MR-1824: 8.0 x 8.0 x 1.0 inches
(20.3 x 20.3 x 2.54 cm)
MR-1824MC: 8.0 x 8.0 x 1.35 inches
(20.3 x 20.3 x 3.43 cm)
Weight:
MR-1824: 25 ounces (709g)
MR-1824MC: 57 ounces (1,617g)
Material:
ABS 2-part enclosure, dark gray only. Epoxy resin potting on reader electronics
MR-1824MC: Ferrite plates behind base
Cable (Integrated with Reader):
10 conductors, 22 gauge, 18 inches long.
Overall shielded, gray plastic sheath
Mounting:
Pedestal, wall, cabinet, housing, etc.

ENVIRONMENT

Operating Temperature:
-31˚F to 150˚F (-35˚C to 65˚C)
Operating Humidity:
0% to 95% non-condensing
Protection from Environment:
Use Lexan housing when reader must be away from moisture, sunlight, view or damage.
Avoiding Interference:
Optimize reader performance by spacing or shielding reader from neighboring readers, including reader on other side of wall at door.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; UL listed

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http://www.awid.com

AWID

Maximum RFID



MM-6800™
Sentinel-Prox™ Proximity Reader

AWID's MM-6800 Proximity Card Reader provides exceptional reading distance in a slim, compact enclosure for Access Control applications. With a read range up to 8 inches, the MM-6800 reader delivers excellent performance without compromising quality, durability, attractive appearance, and ease of installation.



Installation The MM-6800 reader is designed to fit perfectly on the 1-3/4 inch standard metal door frame or window mullion. The metal-compensation that is built into every MM-6800 reader assures minimum loss of read range when the reader is mounted on a metal surface. The MM-6800 reader also can be fastened by 2 screws on any wall or other surface. Installation may be indoors or outdoors, exposed to weather.

Features The MM-6800 reader contains (a) a 3-color LED, (b) a 4 kilohertz beeper, and (c) a "hold" circuit. Both LED and beeper are controlled by the reader itself. All three functions can be controlled externally by the host system. The LED can indicate access-granted by the host. The beeper can be used as an alarm that prevents further card reads until the alarm condition is cleared. The "hold" circuit delays code transmission from the reader until the host requests it.

Testing The reader is *self-testing* – using its own LED and beeper, it needs no interface to a controller to assure the installer and cardholder of correct performance. The reader is also *self- diagnostic* – if DC power is unstable, or if electrical noise is induced in the cable, the reader resets and its LED changes to amber.

Operation AWID's proximity readers use a re-present mode that requires that the user remove the card from the reader's field before the card can be read again. This feature eliminates multiple reads from a single presentation of the card. The MM-6800 has both Wiegand data interface for basic 4-wire connection (7 wires when all features are controlled), and also RS-232 serial interface. Code transmission from both interfaces is simultaneous.

Environment The MM-6800 reader is ready for challenging applications. The ABS plastic one-part enclosure, fully potted at the back surface with epoxy resin, stands up to physical abuse and adverse environment.

Credentials All of AWID's 125 kilohertz proximity credentials may be used with the MM-6800 reader. This includes clamshell and graphics-quality cards, keytags, hangtags, and adhesive wafers. Read range varies with the credential type.

FEATURES

Compact size…
Fits on a mullion or door frame

Clean, slim design…
Matches good architecture at site

Ready for rough usage…
Rugged, strong construction

Ready for adverse weather…
One-part enclosure with potting

Easy mounting…
2 screws (supplied) for fastening

Special read range in a small unit…
Up to 8 inches with cards

Visual and audible indicators…
3-color LED and beeper inside reader

Controllable functions in reader…
LED, beeper, hold can be wired to panel

Easy power…
Connects to panel's DC terminals

Quick wiring to host panel…
Basic 4-wire hook-up; 7 wires maximum

Standard Wiegand data output…
Data-0 & Data-1 panel connection

Alternative RS-232 data output…
Interface to PC or special controller

Compatible with other readers…
Wiegand interface used in other readers

Uniform code format…
Standard 26-bit plus special codes

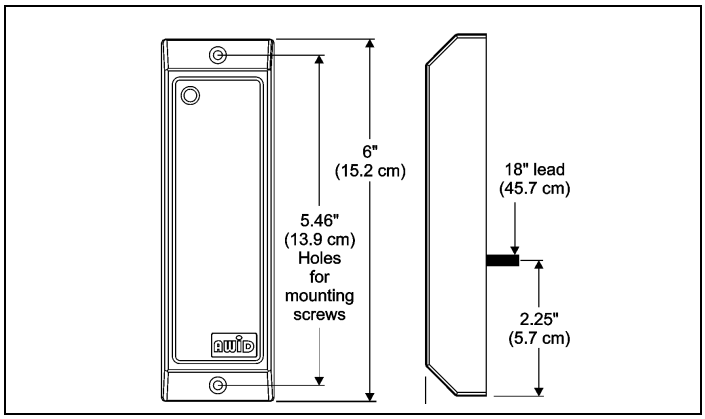
No programming in reader…
MM-6800 is ready to read all AWID codes

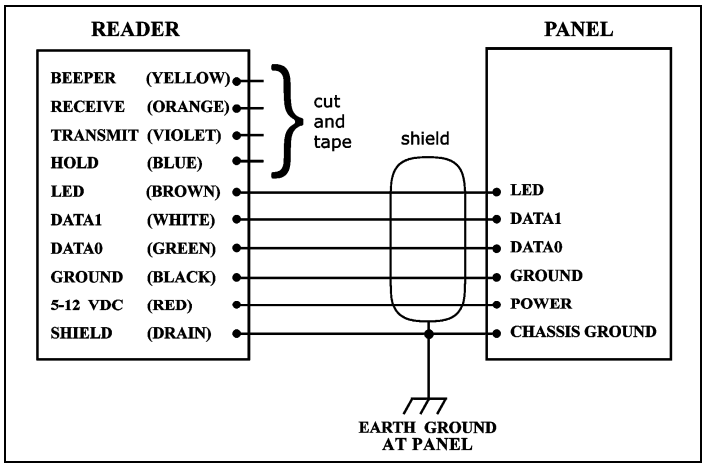
Self-testing for good operation…
LED & beeper indicate performance

High value ratio…
Excellent performance; modest cost

MM-6800™

Sentinel-Prox™ Proximity Reader





ACCESSORIES AND SUPPLIES

Mounting hardware – 2 #6-32 x 1" thread-cutting screws (supplied). Use other fasteners as needed for mounting.

Power supply – Reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage on power and ground terminals. External linear, regulated DC power supply may be used (200 mA or more current rating).

Cable for power and data – 22 gauge, stranded, color-coded, overall shielded, not twisted pair. 4 to 7 conductors depending on connection of reader's controllable functions (LED, beeper and "hold"). For Wiegand, up to 500 feet long.

Protective housing – MM-6800 reader is suitable for exposure to rain, snow, and bright sunshine. Mount reader inside a Lexan housing to remove reader from view and abuse. AWID suggests Model PCH049 housing from The Housing Company.

Mounting devices – Consult with supplier for utility boxes, adapter plates, poles, posts, pedestals, bollards, etc.

Installation Sheet – Download full instructions from AWID's web site http://www.awid.com.

CREDENTIALS

Proximity cards, keytags and wafers – AWID offers a selection of cards, keytags, hangtags and wafers for use with the MM-6800 reader.

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OPERATING CHARACTERISTICS

Reading Distance:
With cards – Up to 8 inches (varies with mounting method, voltage applied to reader, and credential type)

Excitation Frequency:
Transmit and Receive - 125 kHz

Antenna Output:
Omni-directional low-frequency RF field

Indicators (Control by Reader and Panel):
LED – 3 colors, red-amber-green
Beeper – piezo-electric, 4 kHz tone

Power Supply:
+5 volts to +12 volts DC, linear, regulated
Current rating: 120 mA at 5 V, 200 mA at 12 V

Communication Protocols:
Wiegand electrical interface
RS-232 serial interface

Code Formats:
Determined by AWID's credentials programmed with 26 bits to 50 bits

Cable (for Wiegand Interface):
4 to 7 conductors (not twisted pairs), stranded, 22 gauge, color-coded, overall 100% shielded, plastic jacket; up to 500 ft

PHYSICAL CHARACTERISTICS

Dimensions:
6.0 x 1.75 x 1.0 inches (15.24 x 4.45 x 2.54 cm)

Weight:
6 ounces (170 g)

Material:
ABS 1-part enclosure, dark gray color
Epoxy resin potting at rear surface

Cable (Integrated with Reader):
10 conductors, 22 gauge, 18 inches long.
Overall shielded, gray plastic jacket

Mounting:
Door frame, window mullion, wall, cabinet

ENVIRONMENT

Operating Temperature:
-31˚F to 150˚F (-35˚C to 65˚C)

Operating Humidity:
0% to 95% non-condensing

Protection from Environment:
Use Lexan housing when reader must be removed from view or protected from damage.

Avoiding Interference:
Optimize reader performance by spacing or shielding reader from neighboring readers, including reader on other side of wall at door.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; UL listed

18300 Sutter Blvd. Morgan Hill, CA 95037
Tel: (408) 825-1100 Fax: (408) 782-7402
http://www.awid.com

AWID

Maximum RFID



KP-6840™
Sentinel-Prox™ Proximity Reader/Keypad

AWID's KP-6840 Proximity Card and Keypad Reader is a switchplate-type reader combined with a 12-key numeric keypad, in a unit that fits on a single-gang box. Read range with cards is up to 8 inches. The keypad may be used for PIN entry, programming a controller, enrolling card codes, and general data entry.

Installation The KP-6840 reader is designed to fit perfectly on a single-gang electrical utility box. The metal-compensation that is built into every KP-6840 reader assures minimal loss of read range when the reader is mounted on a metal surface. The KP-6840 reader also can be fastened by 2 screws on any wall or other surface.

Features The KP-6840 contains (a) a 3-color LED to indicate successful card read and access-granted, (b) a beeper for attention and alarm, and (c) a "hold" circuit to delay data transmission. LED and beeper are controlled by the reader itself. All three functions can be controlled externally by the host system.



Programming The installer programs these items - (a) In the KP-6840, keypad output format, either 4-bit or 8-bit key-bursts, or 26-bit code transmission (like a reader with a 26-bit card). (b) In the KP-6840 if the keypad has 26-bit output, the facility code that the customer requests. (c) In the system's computer, the KP-6840's Operation Mode.

Testing The reader is *self-testing* – the LED and beeper alone assure the installer and cardholder of correct performance. The reader is also *self-diagnostic* – if DC power is unstable, or if electrical noise is induced in the cable, the reader resets and its LED changes to amber.

Operation The card reader uses a re-present mode that requires that the user remove the card from the reader's field before the card can be read again. The card reader has both Wiegand and RS-232 outputs. The keypad has only Wiegand output. Code transmission from both interfaces is simultaneous. The card reader and keypad outputs share the same data wires.

Environment The KP-6840 reader is ready for installation indoors. For outdoor use* protect the KP-6840 by a hood that keeps water off the unit. If temperature is *below freezing*, use a housing with hinged cover over the keypad. The reader's ABS plastic enclosure is secure when its cover is on. The unit has epoxy resin over its circuits.

Credentials All of AWID's proximity credentials may be used with the KP-6840 reader. This includes clamshell and graphic cards, keytags, hangtags, and wafers. Read range varies with the credential type.

(*) NOTE: IF EXPOSED TO RAIN OR SNOW, UNIT MUST BE PROTECTED BY SUITABLE HOUSING.

FEATURES

Convenient size…
Fits like a cover plate on a box or wall

Clean, handsome design…
Matches good architecture at site

Ready for heavy use at all sites…
Non-contact reading of cards and tags; enter key-strokes on same reader unit

Perfect for wall, cabinet, single-gang box…
Strong two-part ABS plastic enclosure

Easy mounting…
2 screws match holes in utility box

Special read range in a small unit…
Up to 8 inches with cards

Visual and audible indicators…
3-color LED and beeper inside reader

Controllable functions in reader…
LED, beeper, hold can be wired to panel

Easy power…
Connects to panel's DC terminals

Quick wiring to host panel…
Basic 4-wire hook-up; 7 wires maximum

Standard Wiegand data output…
Data-0 & Data-1 panel connection

Alternative RS-232 data output…
Interface to PC or special controller

Uniform code format…
Standard 26-bit plus special codes

Keypad output to match host system…
Field programmable - 4-bit, 8-bit or 26-bit

No programming in card reader…
KP-6840 is ready to read all AWID codes

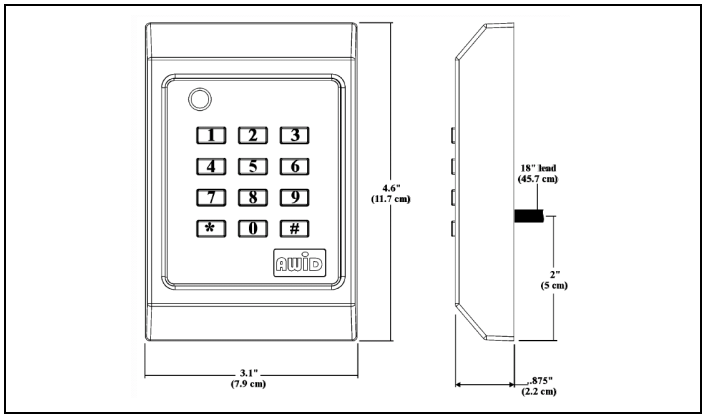
Flexible application for same unit…
Reader + PIN, reader alone, PIN alone

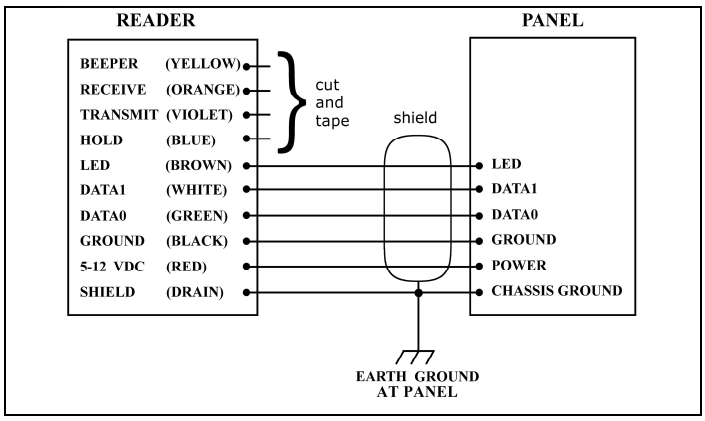
All Operation Modes are available…
Determined by system's programming

High value ratio…
Excellent performance; low cost

KP-6840™

Sentinel-Prox™ Proximity Reader





ACCESSORIES AND SUPPLIES

Mounting hardware – 2 #6-32 x 1" machine screws (supplied). Use other fasteners as needed for mounting.

Power supply – Reader operates with voltage between +5 volts and +12 volts DC. Most controller panels provide suitable voltage on power and ground terminals. External linear, regulated DC power supply may be used (200 mA or more current rating).

Cable for power and data – 22 gauge, stranded, color-coded, overall shielded, not twisted pair. 4 to 7 conductors depending on connection of reader's controllable functions (LED, beeper and "hold"). For Wiegand, up to 500 feet long.

Protective housing – KP-6840 reader-keypad is suitable for outdoor installation if not subject to rain or snow or lawn sprinklers. If temperature is always above freezing, mount reader inside a plastic hood or shield with an open front for access to the keypad. If temperature is below freezing, have hinged door over the keypad to assure that the keys remain clear. AWID suggests The Housing Company's Model PCH049; its hinged door is easily removed or replaced.

Installation Sheet – Download full instructions from AWID's web site http://www.awid.com.

CREDENTIALS

Proximity cards, keytags and wafers – AWID offers a selection of cards, tags and wafers for use with the KP-6840 reader. All credentials for the KP-6840 must be AWID's products.

Ask AWID about credentials. Download the product sheet with cards, keytags, hangtags, and adhesive wafers for all of AWID's proximity readers.

DISCLAIMER: Specifications are subject to change without notice. AWID reserves the right to make changes to improve performance without impacting form, fit or function. The KP-6840model designations are Trademarks of Applied Wireless Identifications Group, Inc. All other trademarks are property of their respective owners.

OPERATING CHARACTERISTICS

Reading Distance:
With cards – Up to 8 inches (20 cm)
(varies with mounting or housing, voltage applied to reader, and credential type)
Reader Excitation Frequency:
Transmit and Receive - 125 kHz
Antenna Output:
Omni-directional low-frequency RF field
Indicators (Control by Reader and Panel):
LED – 3 colors, red-amber-green
Beeper – piezo-electric, 4 kHz tone
Power Supply:
+5 volts to +12 volts DC, linear, regulated
Current rating: 200 mA or more
Communication Protocols:
Wiegand electrical interface (for reader & keypad)
RS-232 serial interface (for reader only)
Code Format – Keypad:
Select 26-bit, or 4-bit or 8-bit bursts
Cable (for Wiegand Interface):
4 to 7 conductors (not twisted pairs), stranded, 22 gauge, color-coded, overall 100% shielded, plastic jacket, up to 500 ft.

PHYSICAL CHARACTERISTICS

Dimensions:
4.6 x 3.1 x 0.88 inches (11.7 x 7.9 x 2.2 cm)
Weight:
8 ounces (227 g)
Material:
ABS 2-part enclosure, dark gray only
Epoxy resin potting on reader electronics
Cable (Integrated with Reader):
10 conductors, 22 gauge, 18 inches long.
Overall shielded, gray plastic jacket
Mounting:
Single-gang utility box, wall, cabinet

ENVIRONMENT

Operating Temperature:
-31˚F to 150˚F (-35˚C to 65˚C)
Operating Humidity:
0% to 95% non-condensing
Protection from Environment:
Use Lexan housing when reader must be away from moisture, sunlight, view or damage.
Avoiding Interference:
Optimize reader performance by spacing or shielding reader from neighboring readers, including reader on other side of wall at door.

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC; UL listed; RoHS

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Maximum RFID

CREDENTIALS for LF PROXIMITY READERS

CS-AWID-0-0 Clamshell-Type Card



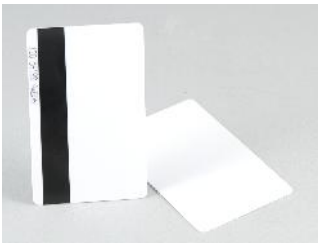
- Rugged white card -- held by hand, clip strap, lanyard
- Molded base – stippled finish, beveled edges
- Includes slot to hang card in "portrait" orientation
- Accepts adhesive or laminated photo ID overlay
- Custom graphics available – logo, multi-color art, text

GR-AWID-0-0 Graphics-Quality Card



- Compliant with ISO and ABA standards for size & finish
- White matte finish for high-quality printing on both sides
- Ready for standard photo ID card printers, both sides
- May be slot-punched for "portrait" or "landscape"
- Custom graphics available – logo, multi-color art, text

GRMAG-AWID-0-0 Graphics Card with Magnetic Stripe



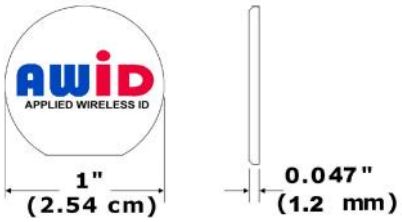
- Includes ½ inch magnetic stripe – embedded & coated
- High-coercivity material for secure programming
- Other coercivity levels available for magnetic stripe
- Customer programs magnetic stripe's code
- 3 uses – prox access, mag stripe data, photo ID badge

KT-AWID-G-0 Keytag



- Small, flat, "triangle" shape, gray color
- For key ring or keychain, or holding in fingers
- Read range close to range with a proximity card
- Keytag may be carried underwater for pool gates
- ABS plastic material for endurance and long life

PW-AWID-0-0 Proximity Wafer



- Small, thin, white PVC, truncated circle – self-adhesive
- Turns any plastic photo ID badge into a proximity card
- … or a card with other technology into a dual-tech card
- … or a non-metal hand-held device into a proximity card
- Reads inside key fob and inside remote control device

Maximum RFID

Read Range* for Credentials with AWID's Readers

Credential Part Number	*Voltage Applied to Reader (+DC)*	SR-2400	MM-6800, SP-6820, KP-6840	MR-1824, MR-1824HiLo	MR-1824MC, MR-1824HiLoMC
CS-AWID-0-0	*12 volts*	5.5 in (14 cm)	8 in (20 cm)	24 in (60 cm)	16 in (40 cm)
	5 volts	4 in (10 cm)	6 in (15 cm)	18 in (45 cm)	12 in (30 cm)
GR-AWID-0-0	*12 volts*	5.5 in (14 cm)	8 in (20 cm)	22 in (55 cm)	14 in (35 cm)
	5 volts	4 in (10 cm)	6 in (15 cm)	16 in (40 cm)	10 in (25 cm)
GRMAG-AWID-0-0	*12 volts*	5.5 in (14 cm)	8 in (20 cm)	22 in (55 cm)	14 in (35 cm)
	5 volts	4 in (10 cm)	6 in (15 cm)	16 in (40 cm)	10 in (25 cm)
KT-AWID-0-0	*12 volts*	4 in (10 cm)	6 in (15 cm)	19 in (48 cm)	12 in (30 cm)
	5 volts	3 in (7 cm)	5 in (12 cm)	14 in (35 cm)	9 in (22 cm)
PW-AWID-0-0	*12 volts*	3 in (7 cm)	3.5 in (9 cm)	10 in (25 cm)	6 in (15 cm)
	5 volts	2.5 in (6 cm)	3 in (7 cm)	8 in (20 cm)	5 in (12 cm)

* "Read range" is maximum reading distance for ideal conditions. Range varies with orientation of the credential, method of mounting the reader, use of a housing for the reader, voltage applied to the reader, and presence of metal.

Reader Selection

- All of AWID's proximity credentials may be read by all of AWID's proximity

Technology in Credentials

- Low-frequency RF communications between proximity readers and credentials.
- Excitation frequency: 125 kHz, transmitting and receiving.
- Read repetition rate: 1 read for each presentation of the credential into the reader's RF field.

Encoding for Credentials

- Code format types: Wiegand-type for general use; other types for proprietary formats.
- Code format options: Number of bits – between 26 and 50 bits total. Open code formats with 26 bits and 37 bits. Reserved facility codes in special 34-bit format.

Information Required in Purchase Order (*Include leading zeros in facility code and ID numbers*)

1. Credential part number and quantity.
2. Code format name: *nn*-bit-*FFF*, where *nn* = no. of bits, and *FFF* = 3 letters for format assignment. Example: 26-bit-STD.
3. Facility code (also called site code or company code).
4. Starting and ending numbers for the sequence of identification numbers.

Environmental Conditions

- Operating temperature: -31° F to +150° F (-35° to +65° C).
- Operating humidity: 0% to 95% non-condensing.
- Sunlight and heat: Do not leave cards and wafers in sunlight in a hot environment, such as inside very hot vehicles.

Size of Credentials

Tag or Card	Width	Height	Thickness
CS-AWID-0-0	3.375 in (85.7 mm)	2.125 in (54.0 mm)	0.075 in (1.9 mm)
GR-AWID -0-0	3.375 in (85.7 mm)	2.125 in (54.0 mm)	0.031 in (0.8 mm)
GRMAG-AWID -0-0	3.375 in (85.7 mm)	2.125 in (54.0 mm)	0.031 in (0.8 mm)
KT-AWID-0-0	1.38 in (35.0 mm)	1.57 in (39.9 mm)	0.22 in (5.6 mm)
PW-AWID-0-0	Diameter: 1.0 in (25.4 mm) – bottom segment removed		0.047 in (1.2 mm)

Slots and Holes

- CS-AWID: Contains a molded slot for clip-strap or lanyard. Do not drill or punch clamshell cards.
- GR-AWID and GRMAG-AWID: Punch slots only at exact locations shown in the instruction sheet packed with cards.
- KT-AWID and PW-AWID: Do not drill or punch anywhere.

Applications

- CS-AWID, GR-AWID and GRMAG-AWID: Presentation by hand to the reader.
- KT-AWID: Attachment to a key ring or keychain.
- PW-AWID: Adhering to a card (usually not proximity) or to a non-metal device.

Options and Accessories

- Photo ID badge printing: Use a standard dye-sublimation card printer for CS, GR and GRMAG cards.
- Custom graphics: AWID can supply all credentials except KT-AWID with logo, multi-color art, and text.
- Card pouches, straps, lanyards, slot punches, etc.: Contact card supply houses.

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http://www.awid.com

Maximum RFID

UA-612™
UHF Card Reader



AWID's UA-612 UHF Access Reader is a combination of UHF generator, reader electronics, and transmit/receive antenna in a single small, attractive switchplate-type enclosure. It is easily installed on an electrical box or wall, with simple wiring like a proximity reader. The enclosure is a modern, sleek design using molded ABS engineering plastic with a deep black color.

The UA-612 reader is the link for physical access by people at doors inside and outside a building, and vehicle access at gates, using a single encoded card. The UA-612 reader reads the same UHF hand-held cards that drivers use for vehicle identification and gate control at a parking facility. These cards are fully compatible with AWID's LR-2000, LR-2200 and LR-3000 long-range UHF readers, and their "HiLo" sets.



With its simultaneous Wiegand and RS-232 data output, the UA-612 reader can be interfaced for a wide variety of access control, specialized system control, and cardholder identification applications. The reader's 3-color LED indicator and 4 kilohertz beeper are controlled by the reader itself, and also by the host system when the LED and beeper control lines are connected.

Installation of the UA-612 reader's small enclosure is quick. It fastens by 2 screws (supplied), which match the tapped holes in a single-gang electrical utility box. The reader may also be mounted on any surface. The reader's cable connects to the controller's reader-input terminals for data input and (optionally) for LED and beeper control, and to the separate power supply.

The credentials for the UA-612 UHF reader are the same hand-held cards that AWID offers for vehicle applications of LR-2000, LR-2200 and LR-3000 readers, and their "HiLo" sets. The driver inside the vehicle presents a card by hand toward the long-range reader for gate control, and later presents the same card to the UA-612 for door access in the building.

The UA-612 serves well for enrolling UHF vehicle tags into a gate-operating system.

The UA-612 reader's read range is up to 6 inches. (Mounting the UA-612 directly on metal reduces read range about 20 %.) Presenting any AWID UHF card to the reader causes the beeper to sound and the LED to change color. If the reader's LED control line is connected to the controller's LED terminal, an authorized card changes the LED from standby-red to green for the programmed time, indicating access-granted.

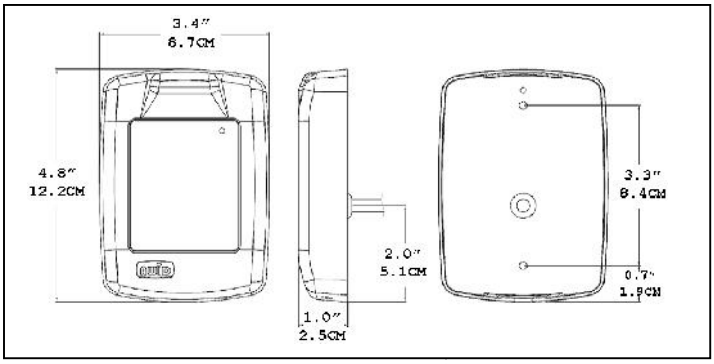
FEATURES

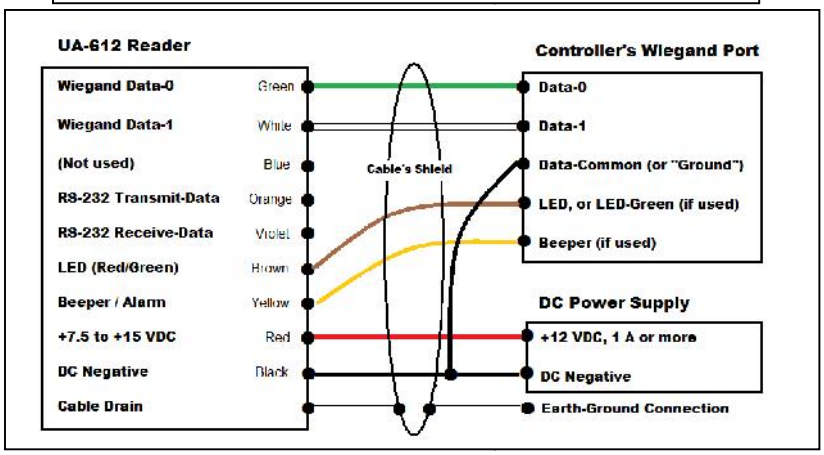
- People access using UHF cards ...
  Same cards for vehicles and people
- Quick access at busy entrances ...
  Read range up to 6 inches
- Easy mounting ...
  Fastens on electrical box or wall
- Easy wiring ...
  Connects like a proximity reader
- Accommodates tamper switch ...
  Installer mounts pushbutton switch
- Combines car & people access ...
  Interfaces to common access control
- Reader needs no programming ...
  UA-612 reads all AWID UHF cards
- Compatible with access systems ...
  Standard code formats & interfaces
- Protected from environment ...
  Electronics sealed from moisture *
- Visible and audible feedback ...
  Reads indicated by LED and beeper
- Great appearance in all locations ...
  Attractive enclosure, small size

* NOTE: WHEN INSTALLED OUTDOORS AND EXPOSED TO RAIN OR SNOW, OR TO DIRECT SUN IN A HOT ENVIRONMENT THE UA-612 MUST BE INSIDE A HOUSING WITH MINIMUM IP64 RATING.

UA-612™

UHF Card Reader





ACCESSORIES AND SUPPLIES

- LR-KIT-0-0 Installation Kit - Use RF signal detector to indicate UHF at the site, test unit to detect data output, sample tags to test read range, and adapter cable to interface to PC's serial port. A one-time purchase.
- Mounting hardware - Screws for single-gang electrical utility box are supplied with the UA-612 reader. Tamper switch, supplied and wired by installer, fits behind the UA-612.
- Power supply - A separate, dedicated DC power source for each UA-612 reader – 12 volts (7.5 to 15 volts at the reader; a battery-charging power supply is OK); current rating 1.0 ampere or more; linear type; regulated DC output. (Do not power the UA-612 from the panel's DC power terminals.) Ask AWID about specifications.
- Cable for power and data - 18 gauge, 2 conductors for power; 22 gauge, 3 to 5 conductors for data and control. Power and data may be combined in a single 18 gauge cable. For Wiegand, up to 500 feet long. Ask AWID about specifications.
- Protective housing - To avoid rain, snow, hot sunlight, visibility or vandalism. Example: Model PCH049 Lexan housing from The Housing Company.
- Mounting devices - Consult your supplier for utility boxes, adapter plates, poles, posts, pedestals, bollards, etc.
- Installation Sheet - Download full instructions from AWID's Web site.

CREDENTIAL OPTIONS

- Hand-held cards – Clamshell cards and graphics-quality UHF cards (use also for LR-2000, LR-2200 and LR-3000 readers). Ask AWID about card selection and holding instructions.

OPERATING CHARACTERISTICS

Reading Distance:
On wall or metal – up to 6 inches

Frequency Band:
902 to 928 MHz
Frequency Hopping technology

Power Supply (Separate for Each Reader):
Nominal 12 volts DC supply
Rated for 1.0 ampere or more
Linear type; regulated DC output

Communications Protocol:
Wiegand and RS-232, simultaneous

Code Formats:
Programmed in AWID's UHF cards
Reads 26-bit to 50-bit codes

Cable (for Wiegand Interface):
18 gauge, 5-7 conductors, stranded
Overall shielded for power & data
Up to 500 feet long

PHYSICAL CHARACTERISTICS

Dimensions:
4.8 x 3.4 x 1.0 inch (12.2 x 8.7 x 2.5 cm)

Weight:
8 ounces (227 grams)

Material (Color):
ABS 2-part enclosure (black)

Cable (Integrated with Reader):
10 conductors, 18 inches long
Overall shielded, plastic jacket

Mounting (Supplied by Installer):
On wall, or single-gang utility box

ENVIRONMENT

Operating Temperature:
At 50% duty cycle -
-31°F to +150°F (-35°C to +65°C)
At 100% duty cycle -
-31°F to +115°F (-35°C to +45°C)

Operating Humidity:
0% to 95% non-condensing

Protection from Environment:
Use Lexan housing when reader is exposed to rain, snow, or bright sunlight in hot weather

CERTIFICATION

ISO-9001:2000; FCC Part 15; IC;
UL listed; RoHS compliant

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APPLIED WIRELESS ID

Applied Wireless Identifications Group, Inc.
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UHF Long-Range Readers

Support 1 – Getting Started

These notes are for AWIDôs LR-2000, LR-2200 and LR-3000 reader models, and their ñHiLoò variations.

CONTENTS

Section A. Application
Section B. Installation
Section C. Reader Model
Section D. Reader Frequency Band
Section E. Credential Type
Section F. Accessories & Hardware
Section G. DC Power & Cables
Section H. Check List
Section I. Support People

A. APPLICATION

To start the pre-sale process, know what the end userôs purpose is for the planned installation. Mark the choices.

- Identifying: vehicles / people / containers / other.
- Tagging: cars and trucks / motorcycles and golf carts / wheelchairs and gurneys / walking people / other.
- Purpose: operate gate / unlock door / detect movement / track tagged item / identification / mustering.
- Quantities: number of lanes = ___ / read tags only to enter or in both directions.

B. INSTALLATION

Before selecting products, know how they will be installed. Mark the choices.

- Road characteristics: width = ___ feet / level or changing grade / straight or turns.
- Surroundings: buildings / structures / pillars / poles, posts, pedestals / parked vehicles.

C. READER MODEL

- If **vehicles** are *all* about the same size, and tags are in the same location, on a straight, level, single-lane road ï
  ➔ Use the basic reader model (single antenna unit) ï LR-2000 or LR-2200 or LR-3000.
- If **vehicles** are a mixture of small and large ï for example, passenger cars and trucks ï
  ➔ Use the ñHiLoò reader model (dual antenna units).
- If **tags** will be attached at different locations on some vehicles ï
  ➔ Use the ñHiLoò reader model (dual antenna units).
- If there will be a combination of both vehicle **tags** and hand-held **cards** ï
  ➔ Use the ñHiLoò reader model (dual antenna units).

- If the **road** near the readers is wider than a single lane ï
  ➔ Use the ñHiLoò reader model (dual antenna units).
- If the **road** near the reader curves or makes a turn near the reader ï or changes grade (up or down a ramp) ï
  ➔ Use the ñHiLoò reader model (dual antenna units).
- If the reader will be installed in a **country** outside North America ï
  ➔ See Section D for selection of reader model by frequency band.
- If the reader will be **outdoors and exposed** directly to rain or snow, or directly to bright sunlight in hot weather ï
  ➔ Use reader Model LR-2000 or LR-2200 installed in a protective housing, or Model LR-3000 (no housing).

D. READER FREQUENCY BAND

- In the **United States, Canada and Mexico**, the frequency band for ISM (industrial, scientific & medical) applications is 902-928 MHz ï
  ➔ Use reader Model LR-2000 or LR-3000 for long-range tags and cards, and Model UA-612 for card reading.
- In the countries in the **European Union**, and in all **other countries** that have adopted the ETSI EN 302 208 ISM band (865-868 MHz) ï
  ➔ Use reader Model LR-2200 for long-range tags and cards.
- The same AWID UHF tags and cards function normally in both frequency bands.

E. CREDENTIAL TYPE (Tags and Cards)

Available credentials are:
WS-UHF adhered inside windshield / **RV**-UHF adhered behind rear-view mirror / **HT**-UHF hooked on rear-view mirror / **VT**-UHF clipped on sun visor / **MT**-UHF fastened to vehicle / **CS**-UHF held in fingers / **GR**-UHF held in fingers.

- For **secure, permanent** applications (tags are destroyed if they are pulled off the mounting surface) ï
  ➔ Use WS-UHF or RV-UHF tags, or MT-UHF tags if they are adhered or fastened to the surface.
- For **convenient, movable** applications (tags can be carried from one vehicle to another, or shared by users) ï
  ➔ Use HT-UHF or VT-UHF tags, or CS-UHF or GR-UHF cards, or MT-UHF tags if not secured to the surface.
- For **temporary** use in a vehicle or by a user ï
  ➔ Use HT-UHF or VT-UHF or MT-UHF tags, or CS-UHF or GR-UHF cards.
- For **people walking** through doors in a building, using AWIDôs Model UA-612 UHF wall-mount reader ï
  ➔ Use CS-UHF or GR-UHF hand-held cards.

F. ACCESSORIES & MOUNTING HARDWARE

- **Mounting Bracket**: For most applications, the reader must be mounted on a bracket with a pan-and-tilt-adjustable head, to aim the readerôs RF fields. (Exception: Mounting the reader flat against a side-wall, to read tags on the side of trucks and trailers.) The bracketôs arm must be long enough for turning and tilting the reader, inside its protective housing (if used).
  AWIDôs **LR-MB** mounting bracket is an 11-inch long arm with adjustable head, and standard slots for readers, cameras, etc.
- **Protective Housing**: (Not for LR-3000.) AWIDôs UHF long-range readers are ready for indoor and outdoor installations. If the reader is mounted outdoors **and** it is exposed directly to rain or snow, or to bright sunlight in hot weather, a protective housing contributes to the readerôs excellent performance and long life.
  The housing must not be metal. Polycarbonate material assures negligible reduction of RF field strength.
  (Example: The Housing Company, Model PCH196.)

- **Installation Kit**: AWID requires every company that installs these products to purchase the **LR-KIT-0-0**. It is a first-time, one-time investment with proven payback. The Kit is valuable for pre-sale demonstration, site evaluation, location decisions, testing reader and tag performance, testing the system, and isolating the components for trouble-shooting.
- **Poles, Posts, Pedestals**: This mounting hardware may be necessary to support the reader. These devices are available from Parking and Traffic suppliers. (Example: TAPCO.)

G. DC POWER & CABLES

DC power and cables for AWIDôs UHF long-range readers are standard products available from most security-industry distributors. To assure good performance, it is important to observe the specifications below. High quality is best!

- **DC Power**: Each AWID UHF long-range reader must have a *separate* DC power supply that is *dedicated* to the one reader. Specifications ï 12 volts DC nominal; 2 amperes or more current capacity; linear rated (if available); regulated DC output. (Examples: Altronix SMP3 and LPS3.)
- **Cables**: Cables for the readerôs power and data transmission may be either combined or separate. If the DC power supply is near the controller panel, combined cable may be most cost-effective. Cat5 is not suitable.
  For **combined** cable ï 18 gauge, 6 conductors, overall 100% shield, stranded, color-coded, not twisted pairs.
  For **separate** cables ï Power: 18 gauge, 2 conductors, overall 100% shielded, stranded, color-coded.
  ï Data: 22 gauge, 4 conductors, overall 100% shielded, stranded, color-coded, not twisted pairs.

H. CHECK LIST

	Product	See Sections	Quantity	Source
1.	Reader	C, D	1 per lane.	AWID.
2.	Credentials (tags and cards)	E	1 per vehicle.	AWID.
3.	Mounting bracket	F	1 per basic reader; 2 per ñHiLoò reader set.	AWID or distributor.
4.	Protective housing (if required)	F	1 per basic reader; 2 per ñHiLoò reader set.	Supplier or online.
5.	LR-KIT-0-0 Installation Kit	F	1 for lifetime.	AWID.
6.	Poles, posts, pedestals	F	1 per reader.	Parking or Traffic supplier.
7.	DC power supplier	G	1 per reader.	Security distributor.
8.	Cable(s) for power and data	G	Up to 500 feet (Wiegand).	Security distributor.

I. AWID'S SUPPORT PEOPLE

Sales	Please contact your AWID supplier or the Regional Sales Manager.
Customer Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 3.
Technical Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 1.

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UHF Long-Range Readers

Support 2 – Preparing to Install

These notes are for AWIDôs LR-2000, LR-2200 and LR-3000 reader models, and their ñHiLoò variations.

CONTENTS

Section A. Purpose
Section B. Guidelines
Section C. Good Practices
Section D. Tools and Supplies
Section E. Documents for Reference
Section F. Testing the Site
Section G. Shop-Testing Products
Section H. Clues for Good Testing
Section I. Check List
Section J. Support People
Section K. Hook-Up Diagrams

A. PURPOSE

While preparing to install AWIDôs UHF long-range readers and credentials, the steps below will guide the installers.

To start a new project, see AWIDôs ñSupport 1 ï Getting Startedò. It helps to assure that the correct products are ordered and collected for the clientôs application.

B. GUIDELINES

1. First thing ï Know the clientôs goals and desires. Know what will work, and what needs to be changed.
2. Study the siteôs layout. Make plan drawings. Get architectôs prints. Take photographs.
3. Define the roadway so that all vehicles follow the same path ï one lane wide. Mark the lane if necessary.
4. A vehicle-length between the reader and the gate may allow the gate to open before vehicles roll up to the gate.
5. Ideal vehicle speed may be 15 miles per hour. This should assure time for reliable reading of all tags.
6. If possible, select a reader location where the vehicles travel in a straight line as the tags are read.
7. Know where to mount the reader ï at the side of the roadway, or above the roadway, or facing turning vehicles.
8. Plan on reader height that relates to the physical structure, vehicle types, tag type and location on vehicles.
9. Assure that there is open space between the reader and the tags ï no fence, bushes, structure to block the UHF.
10. If vehicles will have access to more than one gate, the arrangement of reader and tag locations must be consistent.
11. Mount the reader using an adjustable-head bracket. The reader must be aimed at the location of tags for reading.
12. At the reading distance, have the reader and tags aligned with each other ï facing each other, in parallel planes.
13. Watch for conditions that may require the ñHiLoò dual-antenna reader set, or a protective housing for readers.
14. Scan the site for radiation that might affect reading. Use the Installation Kitôs ñProHunterò RF Signal Detector.

C. GOOD PRACTICES FOR ALL UHF READER INSTALLATIONS

1. Use only overall shielded cable (100% rated) for readerôs power and data, and for door locks and gate operators.
2. A readerôs power and data may share the same cable, or run in separate cables. Use AWIDôs cable specifications.
3. Use a separate shielded cable for each reader. This helps to prevent cross-talk in long cable runs.
4. Never connect 2 or more readers *in parallel* into the same power wires or data wires of the cable.
5. Never connect 2 or more reader cables *in parallel* into the same port on the panel, or into the same power supply.
6. When making power connections, connect negative DC *first* and positive DC *last*. Disconnect in reverse order.
7. Remove DC power before cutting wires and before making data wire connections. Never bunch-cut hot wires.
8. Feed Wiegand Data-0 and Data-1 wires in different pairs of twisted-pair cables, to prevent data crosstalk.
9. UHF readers have no audible or visible indicators. Use the Installation Kitôs test unit for beeper and LED.
10. UHF readers are wired differently from proximity readers with the same Wiegand interface. Use the diagrams!
11. UHF readers must not be grounded or tied together. Let DC power, drains and shields float.
12. Unused wires must be taped or capped separately at the reader, insulated from ground and from other wires.

D. TOOLS AND SUPPLIES

For installing and trouble-shooting the AWID UHF readers, the following tools and devices are always *very* useful.

- AWIDôs LR-KIT-0-0 Installation Kit ï a **required** first-time, one-time purchase for every installing company.
- Back-up battery, 12 volts, 7.5 ampere-hours, fully charged (to substitute for DC power supply and power cable).
- Proximity reader and compatible card (to substitute for the UHF long-range reader and data cable into the panel).
- Spare tags or cards from the clientôs supply for users (with codes programmed into the system).
- Digital DC meter with ranges for 20 volts or more, and 5 amperes or more.
- Camera tripod, with camera seating pad (1/4ò-20 screw).
- Common hand tools and wiring supplies.
- If available ï dual-trace oscilloscope, and UHF spectrum analyzer with directional and 360-degree antennas.

E. DOCUMENTS FOR REFERENCE

- Quick Installation Guide for the AWID UHF long-range reader model to be installed.
- ñInstallation & Operation Manualò for the AWID UHF long-range reader model (available on AWIDôs Web site).
- Technical Reference issues describing special conditions for this application ï installing the reader inside a protective housing, tags on big trucks or forklifts, and others. See Technical References in AWIDôs Web site.
- Instructions for the UHF tags and cards.
- Quick Installation Guide and product sheet for the LR-KIT-0-0 Installation Kit.

F. TESTING THE INSTALLATION SITE

The LR-KIT-0-0 Installation Kit supplies the means of testing and evaluating the environment into which the UHF long-range reader will be installed. These tests can be run without interface to any access control system or controller.

1. With the ñProHunterò RF Signal Detector from the Kit held in your fingers, scan the area around the planned site for the reader. Watch for indications of spurious RF radiation from a neighboring source. This may be a cell phone tower, communications antenna, another UHF reader, arc-type lighting fixture (including fluorescent), buried loop sensor, or security camera. (Such extraneous radiation may not interfere with the AWID readers.)
2. Set up the Kitôs ñEVALò reader. Clip the Kitôs Test Unit to the EVAL reader. Clip the Kitôs plug-in DC power module, or a back-up battery, to the EVAL readerôs wires. To arm the EVAL reader, connect its **yellow** wire to the **black** wire. (A camera tripod is very convenient for supporting the reader during testing, hands-free, up to a height of 6 feet.) See Figure 1 (page 4) for clip connections ï **black**, **red**, **orange** and **yellow** wires.
3. Read a single tag or card from the Kit, or from the clientôs supply. Measure how far that tag can be read in front of the EVAL reader. Hold the tag or card as instructed. Have all other UHF tags far behind the EVAL reader to prevent inadvertent reading of other tags.
4. If the tests indicate less than rated reading distance for the reader and credential models ï
   (a) Move the EVAL reader around to other locations at the installation site. Find an alternative RF-quiet area.
   (b) Remove power from all other devices that may generate interfering radiation. Look for improved tag reading.
   (c) To test the Kitôs components without interference, carry the test gear to a remote location free of RF sources.
5. To test-read a credential in or on a vehicle, secure a tag temporarily by tape. For a WS-UHF windshield tag, press it inside the windshield glass using a fist-size block of plastic foam. This flattens the WS tag against the glass.
6. Invite the client to observe these tests, for confidence in good performance of the products before installation.

G. SHOP-TESTING AWID'S PRODUCTS

When the AWID products arrive, open the packages, account for all items, and know the purpose of each item. Before taking them to the site for installation, use the Installation Kit to see the reader, the tags, the power supply, and other system components working in the friendly environment of your own shop.

1. Hang the reader on a wall or shelf, about 6 feet high, with plenty of clear space in front of the reader. If possible, use a driveway or parking lot. A ¼ò-20 screw inserted in the readerôs back surface is convenient for quick testing.
2. Follow the same procedure as in Section F, except substitute the reader that will be installed, in place of the Kitôs ñEVALò reader.
3. To see the readerôs data in an access control system, connect the readerôs *3* Wiegand data lines (green, white *and blue*) to the reader input port on your shopôs controller panel. Use the wiring diagram. Observe code inputs for a test tag, with the tag held in your fingertips, far to the side of your body, out to the rated reading distance.
4. Use this procedure to build confidence in the operation and performance of the products, and in your own ability to install the products quickly and correctly at the site. Call AWID with questions.

H. CLUES FOR GOOD TESTING

1. Hold the test tag or card in your fingertips, at armôs length beside you, with a flat side facing the reader.
2. Have just one tag or card in front of the reader. Move all other tags far behind the reader.
3. Start by holding the tag or card close to the reader. Gradually move the tag away from the reader, in front of the reader, moving the tag up and down, back and forth, to map the extent of the working field.

I. CHECK LIST

___ 1. Assure that the plan meets the ñGuidelinesò for an effective and satisfying installation.

___ 2. Be familiar with the ñGood Practicesò that lead to good results.

___ 3. Collect the ñTools and Suppliesò that will be needed in shop-testing and for the installation at the site.

___ 4. Be familiar with the site ï where each part of the system will be located, and how the parts will work together.

___ 5. Test AWIDôs products at you shop, to know how all items work and how they will be installed at the site.

___ 6. Contact AWIDôs Technical Support with questions.

J. AWID'S SUPPORT PEOPLE

Sales	Please contact your AWID supplier or the Regional Sales Manager.
Customer Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 3.
Technical Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 1.

K. HOOK-UP DIAGRAMS

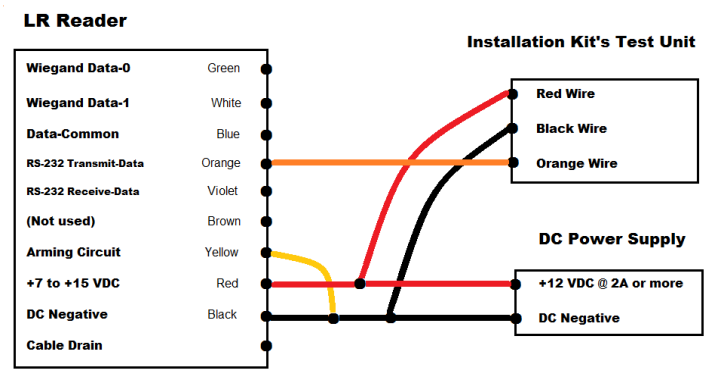


Figure 1. Test Unit Wiring.

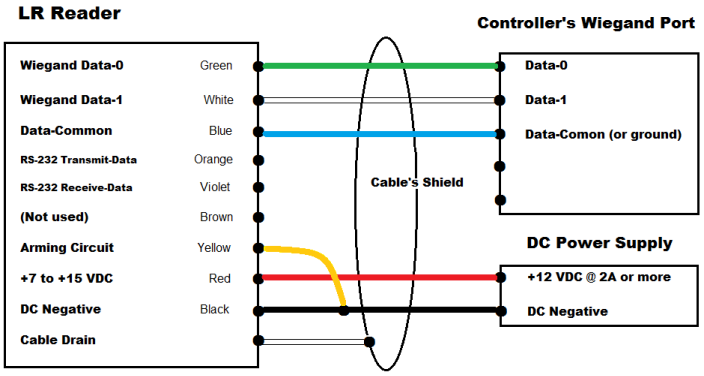


Figure 2. Installation Wiring (Wiegand).

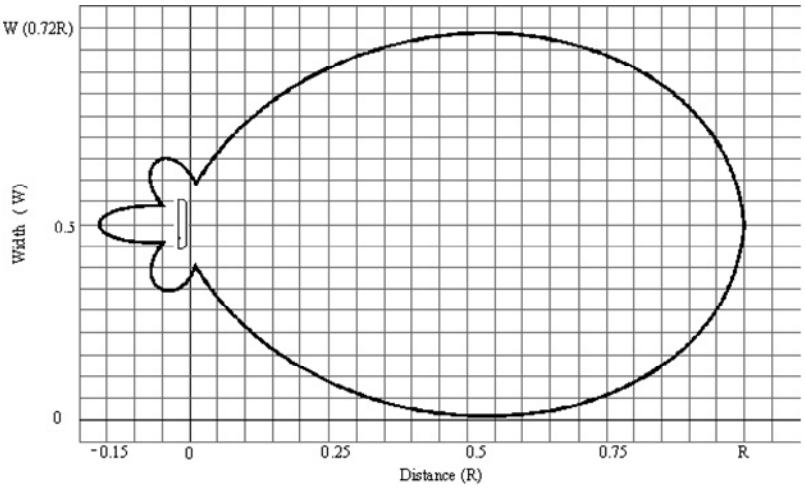


Figure 3. Effective RF Field for UHF Long-Range Readers.

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UHF Long-Range Readers
Support 3 – Installing

These notes are for AWIDôs LR-2000, LR-2200 and LR-3000 reader models, and their ñHiLoò variations.

CONTENTS

Section A. Purpose
Section B. Tools and Supplies
Section C. Reference Documents
Section D. Guidelines
Section E. Strategy
Section F. Mounting Single Unit
Section G. Mounting ñHiLoò Set
Section H. Initial Reader Testing
Section I. Connections at Reader
Section J. Interface and Program
Section K. Installing Credentials
Section L. Aligning Reader and Tags
Section M. System Testing
Section N. Check List
Section O. Support Contacts
Section P. Hook-Up Diagrams

A. PURPOSE

AWID offers these suggestions to assure quick and successful installation of the UHF long-range readers and credentials.

Before starting a new project, see AWIDôs ñSupport 1 ï Getting Startedò.
To prepare for the installation, see ñSupport 2 ï Preparing to Installò.
If there are operating or performance concerns, see ñSupport 4 ï Trouble-Shootingò.

B. TOOLS AND SUPPLIES

For installing and trouble-shooting the AWID UHF readers, the following tools and devices are always *very* useful.

- Installation Kit (Model LR-KIT-0-0) ï a **required** first-time, one-time purchase for every installing company.
- Back-up battery, 12 volts, 7.5 ampere-hours, full charge (substitutes for DC power supply and cable).
- Tags or cards from the clientôs supply for users (with codes programmed into the system).
- DC meter, digital, with ranges for 20 volts or more, and 5 amperes or more.
- Hand tools and wiring supplies (common van supplies).

C. REFERENCE DOCUMENTS

- Quick Installation Guide for the AWID UHF long-range reader model to be installed.
- ñInstallation & Operation Manualò for UHF long-range reader model (available on AWIDôs Web site).
- Technical Reference issues describing special applications ï installing the reader inside a protective housing, tags on big trucks or forklifts, and others. See Technical References in AWIDôs Web site.
- Instructions for the UHF tags and cards.
- Quick Installation Guide and product sheet for the LR-KIT-0-0 Installation Kit.

D. GUIDELINES

1. Review the Support memos for ñ1 ï Getting Startedò and ñ2 ï Preparing to Installò. Look at every item.
2. To preserve the readerôs Warranty, keep it assembled. Do not remove the screws. Do not drill holes anywhere.
3. Be sure that the height and location of the reader matches the roadway, the vehicles, the tags and their locations.
4. Check on consistency for all readers and tags ï readers on same side of roadway, tags in same position in cars.
5. Have a means of adjusting the readerôs aiming, except when the reader is aimed straight across the lane at tags.
6. Use a polycarbonate enclosure to protect the reader from direct rain or snow, or from bright sunlight when hot.
7. Assure that there is open space (no posts or structure or trees or shrubs) between the reader and the tags or cards.
8. At the reader area, avoid sources of RF ï fluorescent lamps, arc-lights, radio transmitters, other UHF readers.
9. Locate the DC power supply 12 feet *or more* from the reader, to reduce RF transmission into the reader.
10. Using 18 gauge power cable and 22 gauge data cable, reader may be up to 500 feet from power supply and panel.

E. STRATEGY

1. Test products to be installed: Before going to the site, test each product on your bench for complete confidence in perfect performance.
2. Test installed products: Test the long-range reader at each stage in the installation ï before and after interface to the host system.
3. Keep everything accessible: Do not tighten fasteners or seal wiring junctions until the system is tested and works completely. Then ñwrap upò the job.
4. Solve problems: SEE ñSupport 4ò of this series for an effective trouble-shooting procedure to identify and cure problems in the installation.

F. MOUNTING THE READER – SINGLE ANTENNA UNIT

1. Remove the long-range reader from its carton. Cut off and discard the white in-line connector from the cable.
2. Insert ¼ò-20 screws through the slots of the mounting bracketôs adjustable head, into the readerôs 2 capture nuts.
3. If there is no adjustable bracket, use an adapter plate, or drill holes through the mounting surface, for ¼ò screws.
4. If a protective enclosure for the reader is required, ask for AWIDôs Technical Reference on mounting the reader.
5. Run the readerôs cable to the cable junction. Use conduit and boxes. Keep wire tie points accessible for testing.

G. MOUNTING THE READER – DUAL ANTENNA UNITS (“HiLo”)

1. Review the items in Section E. They apply to the ñHiLoò reader set as well.
2. Install each reader unit on its own mounting bracket, and inside its own protective enclosure (if needed).
3. Run the 6 foot mini-coax cable between the two antenna units. Tighten and seal the brass connectors if exposed.

H. INITIAL READER TESTING

This Section uses AWIDôs LR-KIT-0-0 Installation Kit, its instructions sheet, and the test wiring in Figure 1.

1. Strip the readerôs **black**, **red**, **orange** and **yellow** wires.
2. Clip the Kitôs Test Unit (**black**, **orange** and **red** wires) to the wires with the same colors on the reader.
3. Apply DC power (usually nominal 12 volts) to the **black** and **red** wires. A back-up battery (7.5 A-hr) is ideal.
4. To arm the reader (so it generates RF), clip its **yellow** wire to the **black** wires.
5. Measure the voltage on the readerôs **black** and **red** wires. It should be within 0.4 volts of the no-load voltage.
6. Hold the Kitôs ñProHunterò RF Signal Detector in front of the reader. Measure the distance for steady ñchirpsò.
7. If the ProHunter chirps to 60 feet or more, hold the Kitôs sample tags and cards in front of the reader in fingertips.
8. If the Test Unit beeps, and its LED changes color, to the rated distance, the initial tests are successful.

See Figure 1. Test Unit Wiring (page 5).

I. WIRE CONNECTIONS AT THE READER

This Section refers to Figure 2 for the readerôs permanent wire connections.

1. If the reader is to be armed continuously, permanently connect the **yellow** wire to the **black** wire at the reader. If the readerôs arming is controlled by external relay contacts, connect **yellow** to **black** though those contacts.
2. Connect the 3 Wiegand data wires ï **green**, **white** and **blue** ï from the reader to the panelôs reader input port. Select the terminal for the **blue** Data-Common wire carefully. It may labeled be ñGroundò or ñCommonò.
3. Connect the **drain** of the readerôs cable to **shields** of data and power cables. Let them float. *Do not ground them.*
4. Connect the readerôs **black** and **red** wires to the DC powerôs negative & positive terminals. *Do not ground them.*
5. Separately insulate the unused **violet** and **brown** wires. Keep the **orange** wire available to connect the Test Unit.

See Figure 2. Installation Wiring (page 5).

J. INTERFACE AND PROGRAMMING

1. Look for data input at the controller panel while reading a tag or card. Use the panelôs LED indicator, relay, etc.
2. Program the host system for the reader type, the code format (number of bits), and the credentialôs site code.
3. Enter the assigned credentialsô ID numbers into the database, along with the usersô identification data.
4. Program the host system for door or gate numbers, time zones, priority levels, anti-passback, and other features.
5. Look for input of events on the host systemôs events monitor and reports.

K. INSTALLING CREDENTIALS

Instructions for all tag and card types are in AWIDôs ñInstallation Instructions ï Credentials for LR-2000 é ò and Manual.

1. Be certain that the correct credential type has been selected for the usersô application and desired characteristics.
2. Test the location for the tags on a few vehicles, using tape, before applying tags to all vehicles.
3. To test a new WS tag ï Keep the tagôs adhesive covered. Press the tag inside the windshield at several positions, using a plastic foam block. When a good position is identified, expose the adhesive and press the tag on the glass.
4. Either ñportraitò or ñlandscapeò orientation of the tag may be best on a particular vehicle. Try both for best result.
5. If properties of a few cars interfere with tag performance, use AWIDôs Technical Reference ñAlternatives é ò.

L. ALIGNING READER AND CREDENTIALS

- RFID credentials (tags and cards) work best when they are aligned with the reader, and parallel to the reader.
- When the credentials are at the planned reading distance from the reader ï
  1. Aim the reader so that it is facing directly the location of credentials on vehicles.
  2. Locate the credentials on vehicles so that they are aligned with the reader ï face-to-face with the reader.
  3. Have clear line-of-sight between the credentials and the reader.
- This usually means that the reader will be higher than the tags, and aimed downward somewhat.
- In the ñHiLoò dual-antenna set, the two units may be close together, facing each other, or any other configuration.

M. SYSTEM TESTING

- Do tags on all vehicles, or held by all people, read correctly and promptly and consistently?
- Does the gate operate without delay when a valid credential is presented to the reader?
- Does the systemôs event monitor display the proper information? Do events reports present correct activity?

N. CHECK LIST

___ 1. Test the reader at the shop before it is installed, for confidence in its performance before you take it to the site.

___ 2. Test the reader when it is fastened to its mounting, before you wire it into the system.

___ 3. Test the reader when it is wired into the system and programmed for the application software.

___ 4. Test the reader when tags are attached to the vehicles.

___ 5. Watch for full operation of the gate. Watch for correct display of code data and reports of events.

___ 6. Prepare instructions for the systemôs manager or end users: How to attach tags. How to drive past the reader.

___ 7. If a problem develops, SEE ñSupport 4 ï Trouble-Shootingò.

O. AWID'S SUPPORT PEOPLE

Sales	Please contact your AWID supplier or the Regional Sales Manager.
Customer Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 3.
Technical Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 1.

P. HOOK-UP DIAGRAMS

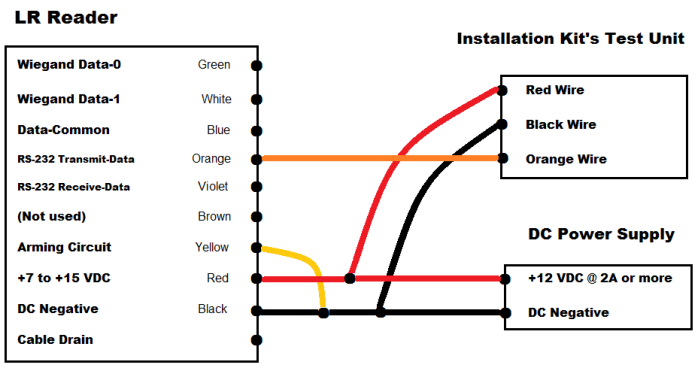


Figure 1. Test Unit Wiring.

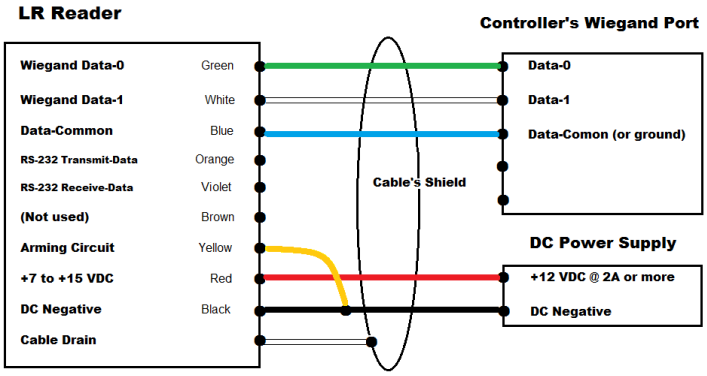


Figure 2. Installation Wiring (Wiegand).

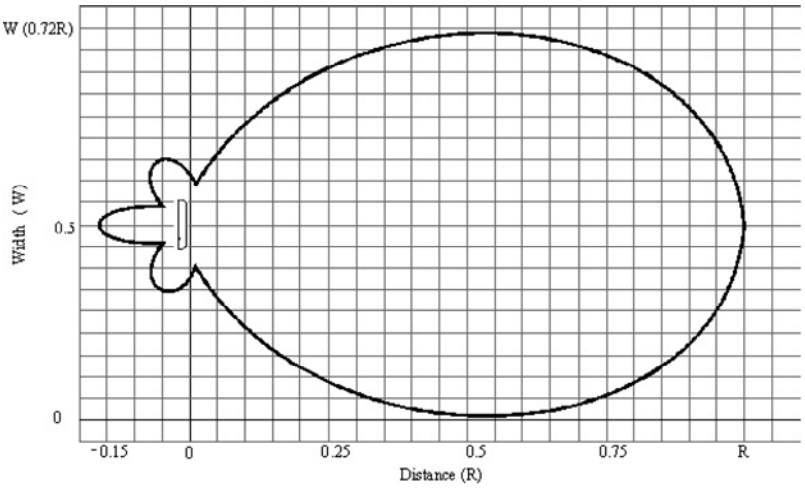


Figure 3. Effective RF Field for UHF Long-Range Readers.

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UHF Long-Range Reader

Support 4 – Trouble-Shooting

These notes are for AWIDôs LR-2000, LR-2200, LR-3000 and LR-911 reader models, and the ñHiLoò sets.

CONTENTS

Section A. Purpose
Section B. Tools and Supplies
Section C. Reference Documents
Section D. Check List
Section E. Guidelines (Notes)
Section F. Problems ➔ Solutions
Section G. Things to Check
Section H. Support People
Section I. Hook-Up Diagrams

A. PURPOSE

AWID offers these suggestions as a procedure that field technicians can follow for thorough analysis, diagnosis and cure of problems with the UHF long-range readers and their associated credentials.

Review the 3 earlier ñSupportò memos in this series to be sure that correct products were chosen for the application, and that they were installed correctly.

B. TOOLS AND SUPPLIES

For installing and trouble-shooting the UHF readers, the following tools and devices are always *very* useful.

- Installation Kit (Model LR-KIT-0-0) ï a **required** first-time purchase for every installing company.
- Camera tripod ï supports the long-range reader up to 6 ft high. (The tripodôs ¼ò-20 screw fits the reader.)
- Back-up battery, 12 volts, 7.5 ampere-hours, full charge (substitutes for DC power supply and cable).
- Tags or cards from the clientôs supply for users (with codes programmed into the system).
- Proximity reader and compatible card (substitutes for the UHF long-range reader interfaced to the panel).
- DC meter, digital, with ranges for 20 volts or more, and 5 amperes or more.
- Hand tools and wiring supplies (common techniciansô supplies).

C. REFERENCE DOCUMENTS

- ñQuick Installation Guideò for the AWID UHF long-range reader model to be installed.
- ñInstallation & Operation Manualò for AWIDôs UHF long-range reader model (from AWIDôs Web site).
- Technical Reference issues for special applications ï installing the reader inside a protective housing, tags on big trucks or forklifts, and others. See Technical References in AWIDôs Web site.
- Instructions for the UHF tags and cards.
- ñQuick Installation Guideò and product sheet for the LR-Installation Kit.
- ñTags é RF Blocking by Vehicle Featuresò

D. CHECK LIST

AWID recommends this plan when trouble-shooting an installation ï

1. Start with the Installation Kit: Does the ProHunter detect the readerôs RF field to 60 feet? Do the clip-on Test Unitôs beeper & LED show steady reads to rated distance? SEE the Kitôs Quick Installation Guide.
2. Break the task into defined steps; for example ï (a) readerôs RF generation (use KIT); (b) readerôs tag reading (use KIT); (c) power supply; (d) cable; (e) wire connections; etc.
3. Isolate the parts of the system ï look at each part by itself, to be sure of its performance separately.
4. Substitute an equivalent component to be sure that that item is normal. Then move to the next item.
5. Bypass trouble spots: To test the power cable, wire the reader directly to the power supply, or clip a battery to the reader. To test the data cable, wire the reader directly to the panelôs reader port terminals.
6. Finger-tighten fasteners, and keep wire junctions accessible, until system testing proves good results.

E. GUIDELINES (* See Notes at end of this section)

1. Warranty: To preserve it ï Keep the reader assembled. Do not remove screws. Do not drill holes.*
2. Matching reader & credentials: If there is *no* reading, be sure that tags and reader are compatible types.
3. Number of credentials: There must be only *one* tag or card in the readerôs field at any time.
4. Head-end systemôs monitor: What helpful message is on the monitor? ñAccess denied é (why?)ò.
5. **Isolation ï Substitution – Bypass**: Use this routine to know *first* that the long-range reader works well.*
6. Environment: Disarm the reader (yellow wire disconnected from black wire). Is spurious RF detected?*
7. Test reader: Does the Installation Kitôs EVAL reader read tags normally at the same location?*
8. Isolated reader: Disconnect the installed reader; power it by a battery. Does the test unit beep for reads?*
9. Swap 2 readers: Interchange this reader with another reader in the system. Does the problem move?*
10. Substituted reader: Use a proximity reader and card, in place of the UHF reader. Do they read OK?*
11. Remote reader: When necessary to be sure of the readerôs performance, test it alone at a distant location.
12. Power supply: Check AWIDôs power supply specs. Measure DC voltage at power supply and reader.
13. Substituted battery: Disconnect the power supply at the readerôs black & red wires. Clip on a battery.
14. Truck battery: In absence of a charged back-up battery, clip on your truckôs battery. Turn off the engine!
15. Cables: Check AWIDôs cable specs. Do all cables meet AWIDôs requirements?
16. Wire hook-up: Are 7 reader wires connected? ï correctly? Are cable drains tied together and *floating?*
17. Tag tests: Do the Kitôs test tags read OK on EVAL and installed readers? Do customerôs tags read also?
18. WS tag: Holding block of plastic foam, press WS tag inside windshield glass. Move around and read.*
19. Alternative tags: A few cars block the tagôs RF. AWID offers a variety of tags to suit all conditions.
20. Matching locations: Do the reader and tags see each other at the reading distance? ï aligned? ï parallel?
21. Consistency: Are reader and tag locations and aiming the *same* at all gate areas in the site?
22. External influences: Do the reader and tags work equally well at any location in the installationôs area?
23. Reader matching: Its height and location must match the roadway, vehicles, tag type, and their locations.

24. Reader aiming: The reader must have an adjustable mounting (pan and tilt) except in special cases.
25. Enclosure - shade (except LR-3000): Keep tag in shade during hot weather. Use protective housing.
26. Enclosure - moisture (except LR-3000): Keep direct rain and snow off reader. Use protective housing.
27. Open space: Have no posts, structure, trees, shrubs or people between the reader and the tags or cards.
28. Match reader output to system: If needed, slow down the readerôs repetition rate, or have a single read.
29. **Wrap-up**: ***Never*** seal wire connections or tighten fasteners until system tests prove good performance.

* NOTES FOR "GUIDELINES"

1. Warranty: AWIDôs Warranty on Material and Workmanship accepts that the installer will remove the 10-pin connector that protects the individual wires of the readerôs cable. But ï *Never* bunch cut a group of wires when power is applied to them. The reader must never be disassembled (4 screws removed), nor have holes drilled in the plastic enclosure or the aluminum back-plate. Applying incorrect power or reversed DC polarity to the reader will damage the reader. Voltage surges and spikes on power or data wires may damage the readerôs circuits. Repair for this kind of event is not covered by the Warranty.

5. Isolation ï Substitution ï Bypass: AWID uses a procedure that lets the technician see the long-range reader operating by itself, free of influences of the environment and other sources of trouble, like power, cabling, wiring, grounding, RF interference, etc. When tests show that the reader itself is performing well, AWID continues to trouble-shoot the rest of the system.

6. Environment: Disarm the reader (either disconnect the yellow wire from the black wire, or disconnect the red wire from the DC power supply). Using the ñProHunterò RF Signal Detector from the LR-Installation Kit, test for background radiation. The ProHunter ñchirpsò repeatedly, and its LED changes color briefly, when it detects RF in a band from about 100 MHz to 3 GHz. Not all chirping means less read range.
   - Presence of external RF indicates need to determine if the long-range reader is affected.
   - If the readerôs performance is reduced, install it at a different location, ~20 feet from the original location.
   - Reduced reading distance may be OK if tagged vehicles drive closer to the reader, or at slower speed.

7. Test Reader: The ñEVALò reader in the Installation Kit is a regular LR-2000 reader except that it has no ability to interface to a controller panel. The EVAL therefore serves as a stand-alone test-reader, substituting for the installed long-range reader at this site. Connect the Kitôs Test Unit to the EVAL reader.
   - If the EVAL readerôs performs at AWIDôs rating, the environment is OK and does not affect the reader.

8. Isolated Reader: Disconnect DC power and Wiegand data wires from the installed reader. Connect the Kitôs Test Unit (small box with 3 clip leads) and a back-up battery to the isolated reader. Follow instructions in the Kitôs Quick Installation Guide, and look at Figure 1 on page 8 of this Support memo.
   - If the isolated reader performs as rated, the problem is caused by something else in the installation ï power supply or cables or wire connections or grounding, etc.

9. Interchanged Readers: Having two or more long-range readers at the site is a great advantage. Just interchange two of the readers, leaving the power supply and cables where they are, and moving only the reader units. (Or use a spare reader from the shelf for this substitution.)
   - If the problem moves with the reader, the reader itself is at fault.
   - If the problem stays with the readerôs original location, some other factor besides the reader is at fault.

10. Substituted Reader: To decide if the problem is in the UHF long-range reader, or in the system to which the reader is interfaced, substitute a small proximity reader in place of the long-range reader. Use the same wire connections for power (black and red) and for Wiegand data (green and white ï but not blue).
    - If the proximity reader works normally, the problem is probably in the long-range reader.
    - If the proximity reader has the same problem as the long-range reader, the problem is very likely in the system beyond the reader. Check the data cable, the controller panel, and the host system.

18. WS Windshield Tag: The windshield tag has only about 6 feet read range when it is held loose by fingers at the reader. The tag generates full rated reading distance only when it is permanently and correctly adhered inside the vehicleôs windshield. The tag may be tested well by pressing the tag by a fist-sized block of plastic shipping foam against the inside of the windshield. The tagôs peelable sheet, which protects its adhesive, must be against the glass. The foam flattens the tag against the glass, and keeps your hand from the tag. The tag may then be moved around and tried with portrait and landscape orientation, to find best performance.

F. PROBLEMS ➔ SOLUTIONS

See Section G for individual parts of the system to check, as suggested in this Section.

- If the reader is not reading a card at all ï
  ➔ Check: DC Power, Voltage Level, Voltage Drop, Cable, Wire Connections, Controlling Arming.
- If the reader reads a card intermittently or inconsistently ï
  ➔ Check: All above. Also ï Environmental RF, Panel Substitution, Data Rate, Matching Conditions.
- If the readerôs card reading can be restarted by cycling its DC power off and on ï
  ➔ Check: DC Power, Cable, Grounding, Controlling Arming.
  ➔ Avoid: Sources of electrical noise, like cables to door lock and machinery switches. Remove splices.
  ➔ Add: Diode protection and filtering in door lock or gate operator cables.
- If the reader reads the cardôs code correctly but only at short distance ï
  ➔ Check: DC Power, Voltage Drop, Cable, Environmental RF.
  ➔ Avoid: Fluorescent lights (to 12 feet), other arc-type lights, other readers, cell towers, radio antennas.
- If the reader reads with short reading distance at certain times in the mid-day, and otherwise is normal ï
  ➔ Test (except LR-3000): Shade the reader with an umbrella. If the reader recovers in a short time é
  ➔ Add (except LR-3000): Protective housing to keep reader in shade during sunny hours of the day.
- If the reader reads normally, but there is no code input to the controller ï
  ➔ Check: Cable, Wire Connections, Grounding, Reader Substitution, Panel Substitution.
  ➔ Test: Code pulses on interface data lines (Wiegand or RS-232) ï contact AWID for test procedure.
- If the reader reads the card, but the host system rejects the code and the gate does not open ï
  ➔ Check: Cable, Wire Connections, Grounding, Data Processing Rate.
- If the reader was reading OK and then failed completely ï
  ➔ Check: DC Power, Voltage Level, Voltage Drop, Cable, Wire Connections, Grounding, Controlling Arming, Reader Substitution, Panel Substitution.
  ➔ Add: Surge and spike protection in the readerôs wires (all wires).
- If the reader reads hand-held tests for testing at rated distance, but not some or all tags in vehicles ï
  ➔ Check: RF Blocking, Accommodating RF, Matching Conditions.

G. THINGS TO CHECK

DC Power: Each long-range reader must have its own power supply ï separate, independent, dedicated to that one reader. The readerôs power lines (red and black) must be connected only to that power supply. That readerôs power supply must be connected only to that reader. DC power source must *float* ï no ground connection. . . . **IF** the readerôs power supply is shared with anything else, **THEN** disconnect everything from the DC power supply except that one reader.

Voltage Level: The voltage applied to the long-range reader is itself seldom a cause of concern. The reader will work well between 7 volts and 15 volts DC, *if* there is not more than 0.5 volts difference between the power supply and the reader. . . . **IF** voltage *drop* is more than 0.5 volts, **THEN** there is something in the installation that is either drawing too much power, or preventing enough current flow to enable the reader to read with full range. The problem may be the power supply (it must meet AWIDôs specification), *or* the power cable, *or* the wire connections, *or* the reader itself.

Voltage Drop: . . . **IF** the voltage *drop* between (a) the power supply (with nothing connected to it) and (b) the reader (connected to the power cable) is more than 0.5 volts DC, **THEN** run this 5-point voltage drop test. It will identify the location of the voltage drop. (All of these voltages are DC.)

1. Start with all power wires (positive and negative; red and black) disconnected at the power supply and at the reader. Measure voltage from the power supply. (It is usually between 12.0 and 13.8 volts.)
2. Connect the 18 gauge, shielded power cable to the power supplyôs terminals ï black to negative; red to positive. Measure voltage at the power supplyôs terminals. It *must* be the same as the voltage in step 1.
3. Go to the disconnected end of the power cable near the reader. Measure voltage on the loose black and red wires of the cable. It *must* be the same as the voltage in steps 1 and 2. This is true for any length and for any gauge of wires up to the Wiegand limit of 500 feet.
4. Arm the reader by connecting its yellow wire to its black wire. Then connect the readerôs power wires to the power cableôs wires ï black to black; red to red. Measure voltage at the black and red wires. It is normally about 0.4 volts less than in steps 1, 2 and 3.
5. Return to the power supply. Measure voltage on the power supplyôs terminals when all power wires remain connected, and the readerôs yellow arming wire is connected to the black wire. It should be about the same as in step 1, but it may drop about 0.4 volts normally.

- Analysis: (a) If the difference in power supply voltage between steps 1 and 5 is more than about 0.4 volt, there may be a problem with the power supply ï not able to supply the current that the reader requires.
  (b) If the difference in reader voltage between steps 4 and 5 is more than about 0.4 volts, the power cable may not able to carry the readerôs current load, or the reader may be drawing more than its normal current. Use a DC ammeter (scale 1 ampere or more) to measure the current, first without a tag, and then with a tag at the reader.
  (c) Use the DC ammeter also to pinpoint the location of current leakage. Insert the meterôs probes into breaks in the red/positive wire, and look for different current flow at different points in the circuit. A correct installation has equal current at every point in the DC power circuit for the reader.
- Quick Test: Substitute a battery (12 volts, 7 ampere-hours, charged) in place of the DC power supply ï
  (a) Disconnect the readerôs red and black wires from the power cable. Clip the battery to the readerôs black and red wires. Measure the voltage on these wires, and compare it with the batteryôs no-load voltage. The voltage drop should be about the same as in the 5-step voltage drop test (above), and the reader should read tags.
  (b) Reconnect the power cable to the reader. Disconnect the power cable at the DC power supply. Clip the battery to the cableôs black and red wires. Measure the voltage on these wires. Voltage and reader performance should be the same as in Quick Test (a).

Cable: . . . **IF** tests indicate that there may be a problem in a power cable or a data cable, **THEN –**

(a) Check continuity of all wires in the cable, and check for short circuits between the wires.
(b) Substitute spare wires in the cable in place of a wire that seems to have an open-circuit or short-circuit.
(c) Run cable on the ground or floor to jumper from the reader to the power supply, or to the controller panel, bypassing the existing cable (disconnected at both ends). This also identifies problems with water or short circuits or breaks in conduit.
(d) Move the reader to make direct connections of the 3 Wiegand data lines (green, white and blue) to the panelôs reader port, bypassing the data cable. Then check for normal reads.

Wire Connections: . . . **IF** failure of any function seems to be absence of continuity through a junction, **THEN** jumper around the junction and watch for restored operation. Avoid junctions and splices. Eliminate junctions inside conduit (use unbroken lengths of cable); avoid relay and switch contacts in the wiring.

Grounding: . . . **IF** the readerôs DC power supply or the Wiegand data lines or the cable shields are grounded anywhere, **THEN** the readerôs performance may be affected and its life may be shortened!

(a) Both negative and positive DC power lines must not be grounded anywhere. The readerôs black and red wires go to the power supplyôs terminals, but they are not grounded.

(b) The readerôs green and white wires are like all other Wiegand-interfaced readers ï to Data-0 and Data-1. The readerôs BLUE wire is Data-Common. It must go the panelôs reader port terminal that serves that purpose. Connect to the ñCommonò terminal, if any. If not, the blue wire usually connects to the reader portôs ñGroundò terminal, not because it is grounded, but because it is that portôs Data-Common, in addition to DC power negative for other reader types.

(c) All cablesô shields or drains must be connected together. Then they float ï do not ground them anywhere.

Controlling Reader's Arming: . . . **IF** arming and disarming the reader (for example, a buried loop to detect vehicles), **THEN** use the readerôs yellow wire. Do *not* switch the readerôs data lines or power lines.

Reader Substitution: . . . **IF** the problem could be the reader itself, **THEN** substitute a different reader ï

(a) To prove that the host system is operating correctly, disconnect the long-range reader. Connect a different kind of reader, for example, a small proximity reader (with a compatible card), at the panelôs reader port, and then at the ñgateò end of the data cable. Program that cardôs code into the system, and watch for ñAccess grantedò and gate operation.

(b) To prove whether or not the original installed long-range reader is functioning, replace it with a spare reader of the same type, using the same UHF tags or cards for test.

(c) A perfect test is to interchange two long-range readers, and observe if the problem with one of the two readers remains at its original location or moves with the reader to the other location.

(d) If a ñworkingò (interfaced) reader is not available for substitution, use the Installation Kitôs ñEVALò reader. Power it normally, and clip the Kitôs SP-6820-LR test unit to the EVAL readerôs black, orange and red clips. Reading by the EVAL reader is indicated by the test unitôs beeps and LED color changes.

Panel Substitution: . . . **IF** everything listed above tests normal, **THEN** the problem may be the host system ï a reader input port, or the controller, or the application systemôs software or firmware ï

(a) Connect the data cable from the reader to a different reader port, or
(b) Connect the data cable to a different panel, or
(c) Connect the data cable to a different access control system.

Data Processing Rate: . . . **IF** the host system receives code inputs from the reader, but the codes are garbled, or different lengths (number of bits) randomly, or inconsistent, **THEN** the problem may be the systemôs inability to process the credentialôs data at the rate that the reader transmits it to the system.

(a) Force single reads from the long-range reader by flashing the test tag to the reader quickly ï for only 1/3 second every few seconds. Does the system now see correct codes? If so ï

(b) Reduce the long-range readerôs read repetition rate, using AWIDôs downloaded LRReaderSettings program in the Web siteôs ñSupportò tab. (Visit www.AWID.com/Support.)

(c) If read repetition rate does *not* affect the code, the problem is probably noise into the long-range reader through the data cable or the DC power supply. See cablesôand power supplyôs specifications and tests.

RF Blocking and Distortion: . . . **IF** solid material (except windshield glass) is between reader and tags, **THEN** the RF data between reader and tags may have reduced field strength. Avoid trees, bushes, fences, eaves. **IF** the RF field encounters metal in or near the effective RF field, **THEN** the field shape may be distorted, enhanced or reduced. Avoid metal coating and antenna on windshields, structures, posts, reinforced concrete. **IF** a spurious field intercepts the readerôs and tagôs field, **THEN** range may be short. Avoid cell towers, radio antennas, fluorescent (up to 12 ft) and other arc lights, pre-collision warning systems on high-end cars.

Environmental RF: . . . **IF** the components of the system are individually normal but the total system works with short read range, **THEN** ï

1. Remove power or disarm the long-range readers.
2. Test for spurious RF in the readersôarea, using the Installation Kitôs ñProHunterò RF Signal Detector.
3. Connect the Kitôs test unit to the long-range reader (wired and powered normally). Test for code reading.
4. Test read range for all available credentials (one at a time). Note the maximum reading distance.
5. Move the long-range reader and Kit to a remote location. Is reader operation normal away from the site?
6. In each test, compare long-range reader and Kitôs EVAL reader. They should have the same read range.

Accommodating Extraneous RF: . . . **IF** tests confirm presence of extraneous RF, *and* it affects reader performance, **THEN** ï

(a) If possible, move the reader to a location with weaker spurious RF; or
(b) Find a more effective location on vehicles for the tags; or
(c) Substitute a different tag type, which may read better in a modified RF field; or
(d) Adjust the physical layout to accommodate shorter read range ï change the vehiclesôroadway (straighter, closer to the reader); reduce vehiclesôspeed at the reading distance; move the reader closer to the edge of the lane or above the lane; re-aim the reader for shorter reading distance; train drivers for tolerant driving.

Matching Conditions: . . . **IF** the application has particular vehicles types and sizes, and requirements for tag or card type, and traffic flow, and data input, **THEN** ï

(a) Match positions for the tags and the readers. Be sure that the tags and the reader are aligned (on the same axis, facing each other, parallel to each other at the reading distance). Both reader & tags are directional.

(b) Assure *consistency* at all reader locations for this installation. Have all tags at the same location in all vehicles, and all readers at the same position relative to tags on the vehicles.

(c) Match data for readers and system. If the display shows varying tag data or format, slow the readerôs repetition rate. If the host needs *one* input for each event, assure a single read. SEE AWIDôs solutions.

H. AWID'S SUPPORT PEOPLE

Sales	Please contact your AWID supplier or the Regional Sales Manager.
Customer Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 3.
Technical Support	Please contact AWIDôs corporate offices ï 408-825-1100, option 1.

I. HOOK-UP DIAGRAMS

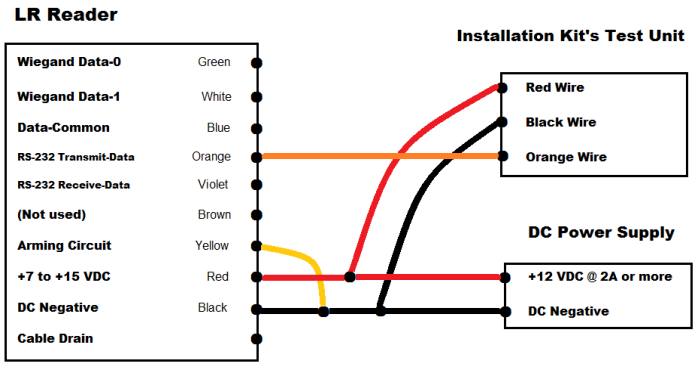


Figure 1. Test Unit Wiring.

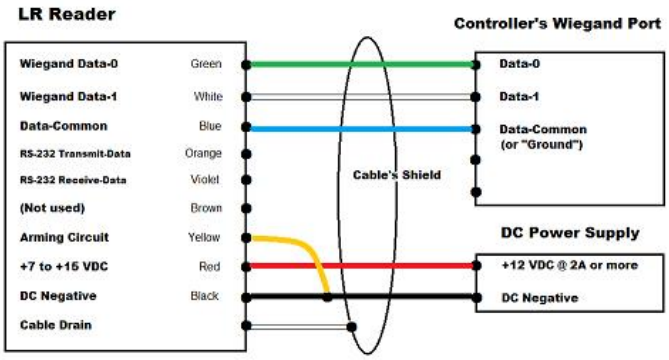


Figure 2. Installation Wiring (Wiegand).

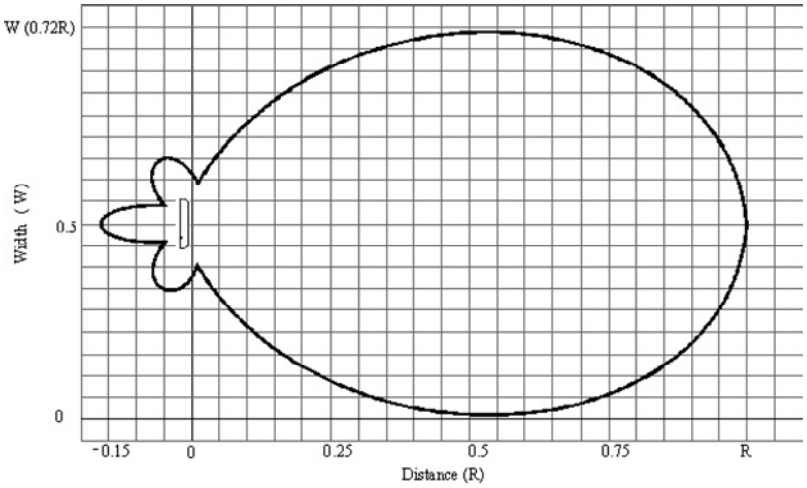


Figure 3. Effective RF Field for UHF Long-Range Readers.

UA-612 UHF Card Reader

Overview of Solution

AWID's Model UA-612-M-U reader controls access for people at locked doors, with the same UHF encoded cards that are used for long-range access of vehicles at automated gates and doors. This combination allows one card to serve both applications – the *single-card solution* that has been the goal in many applications and markets. The UA-612 reader mounts easily on a wall, or screws to a single-gang utility box. The UA-612's output matches proximity and UHF long-range readers. Both clamshell and graphics cards are available .

Value Proposition

- Wiegand and RS-232 interfaces, for all standard access control systems and special controllers.
- Codes in compatible cards identical to codes in credentials for proximity readers systems.
- Mix-and-match reader and credential types in the same access control system.
- Installation like other types of card readers, using the same controller panels and system software.
- Passive tag technology for unlimited card life.
- Modest cost for a strong package of product appearance, features and applications.

Questions to Identify Potential Customers

Q#1: Is individual identification of cars or trucks or other vehicles required at the same site?

Q#2: Are hand-held cards used for access at the vehicle gates?

Q#3: Can these cards be carried by drivers to doors for people-entry in the building?

Q#4: Can the cards be presented within about 6 inches of the UA-612 reader at the door?

Q#5: Can the UA-612 reader be interfaced, and the cards' codes be programmed, into the access control system?

Competition

No competitor offers a similar solution of long-range cards for vehicle gates and people doors.

Contacts

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Technical Support, Applications: Leigh Hickcox Phone: 203-268-8566
L.Hickcox@awid.com

AWID – UA-612 UHF Reader

Key Features

- Small, attractive reader – single unit, slim design.
- Easy installation – plug-and-play reader; quick wiring.
- 2 card types – clamshell and graphics-quality.
- Same UHF cards that provide access at vehicle gates.
- Unlimited card life – passive; no battery.
- LED control by UA-612, or by panel for door-unlock.
- Beeper control by UA-612, or by panel for alarm.
- Mix with other readers – same codes and interface.
- May be installed outdoors (protect from direct rain).
- Use as the enrolling reader for vehicle-gate systems.



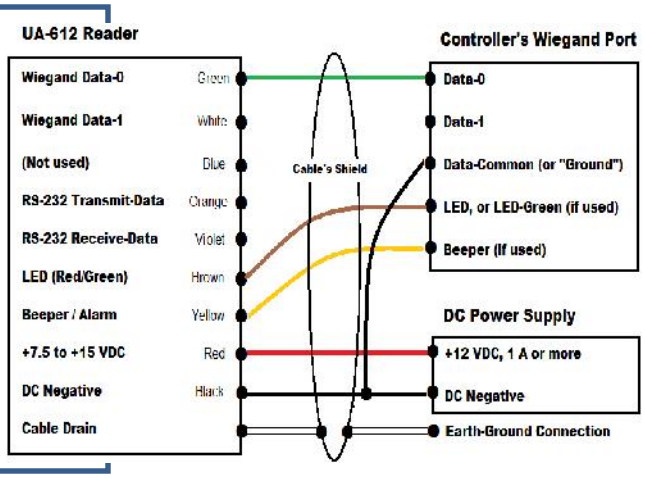
Key Differentiators

- Eliminates need for a second card – one card grants access for both vehicles at gates and people at doors.
- Compatible with other access control devices in the same system.
- Installs like a proximity reader – same tag codes & data interface.
- Combines with other AWID readers for other applications.
- Easily replaces legacy readers on wall – low or high frequency.
- Has the same or better read range than the most popular readers for people access.
- Accommodates a tamper alarm switch.
- Requires no programming of codes or features into the reader.



Vertical Markets

- All markets in which physical access control is desired and practical.
- This covers every conceivable market in which people require access to electronically controllable locked doors and gates.



LR-3000 UHF Long-Range Reader

Overview of Solution

AWID's Model LR-3000-B-U reader is used in RFID applications like gate access to parking facilities and gated communities. It provides hands-free access to automated gates and doors, at a fraction of the product and installation cost of a toll-highway type of reader and tag. The LR-3000 reader also serves disabled users for door and elevator access in buildings, and forklifts in industrial plants. AWID offers 5 different types of vehicle-mounting tags, and 2 types of hand-held cards, to assure optimum solution in many applications.

Value Proposition

- Wiegand and RS-232 interfaces, for all standard access control and special control systems.
- Codes in long-range vehicle tags identical to codes in credentials for proximity readers systems.
- Mix-and-match reader and credentials types in the same access control system.
- Installation like other types of card readers, using same controller panels and system software.
- Passive tag technology for unlimited tag and card life.
- Modest cost for a strong package of product features and applications.

Questions to Identify Potential Customers

Q#1: Is individual identification of cars or trucks or other vehicles required in the application?

Q#2: Can the vehicles move in a specific lane toward the reader?

Q#3: Will vehicles move at speed of about 15 miles per hour, or less?

Q#4: Can the encoded tag or card be aligned with the reader, facing the reader directly at the reading distance (typically 15-20 feet), with clear line-of-sight between the tag and the reader?

Q#5: Is there a hand-held application in which the need to hold the tag or card can be eliminated by a hands-free product?

Competition

- TransCore
- Nedap
- (Toll highway readers)

Contacts

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Technical Support, Applications: Leigh Hickcox Phone: 203-268-8566
L.Hickcox@awid.com

AWID – LR-3000 UHF Reader

Key Features

- Long reading distance – up to 25 feet.
- Small, attractive reader – single unit, slim design.
- Easy installation – plug-and-play reader; quick wiring.
- Wide selection of credentials – 7 tags and cards.
- Unlimited tag or card life – passive; no battery.
- Flexible data output – variable read repetition rate.
- No cross-talk with other readers – settable RF field.
- RF output as needed – reader has an arming control.
- 2 status LEDs – indicate power on and tag reading.
- Mix with other readers – same codes and interface.
- May be exposed to weather – indoor/outdoor use.



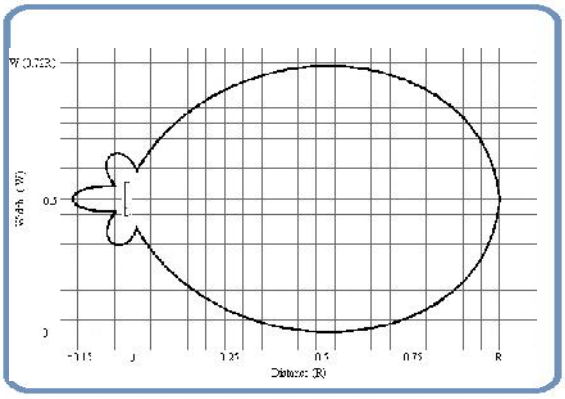
Key Differentiators

- Replaces hand-held cards or fobs, and reader at side window.
- Makes vehicle identification fully automatic.
- Eliminates stopping the car for code reading.
- Lets the gate be open as the authorized vehicle reaches it.
- Works with a buried loop or pressure sensor for gate control.
- Compatible with other access control devices in the same system.
- Installs like a proximity reader – same tag codes & data interface.
- Mates with other AWID readers for other applications.
- Ideal upgrade from legacy system – same cable, mounting, power.



Material List

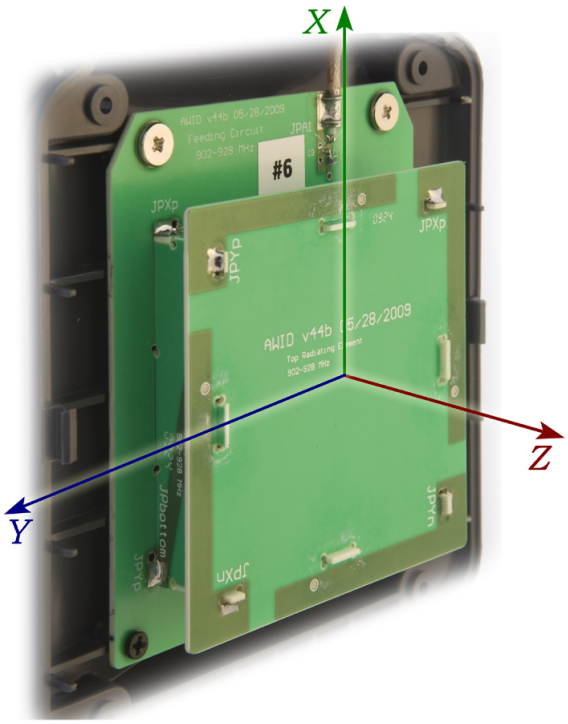
- LR-3000-B-U UHF reader
- LR-MB-0-0 mounting bracket
- Tags and cards (see list)
- LR-KIT-0-0 installation kit
- DC power supply, 12 V, 2.5 A
- Pole, post or pedestal
- Cable for data
- Cable for DC power
- Vehicle sensors
- Gate, gate motor
- Access control system



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ANT-915-CP-0.5 rev.44b – Data Sheet
Compact Circular Polarized Antenna for RFID

Document rev.1.2, 04/05/2012



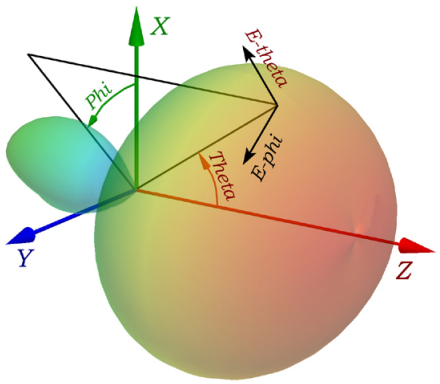
Features

- Maximum achieved realized gain and frequency bandwidth within small volume.
- Variation of the Maximum Gain is less than ±1.4dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within frequency band 908-920MHz at the fixed Phi angle.
- It provides low reflection of the transmitter signal into receiver. The return loss is more than 18dB.
- Extremely light – weight is 20g or 0.7oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year experience with design of RFID hardware.
Antenna provides uniform electromagnetic field which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for handheld application.
Antenna may be adopted for installation into various plastic enclosures with minor correction of the tuning components.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	RHCP		Right hand circular polarization
Peak of the Linear Polarized Realized Gain	+1.14	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+1.14 to -1.70 Δ=2.84	dBi dB	within Phi angle ±180^{O} and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	908-920 Δ=12	MHz MHz	Free or Open Space condition. Fixed Phi angle
Front to Back Ratio of Radiation	6.5	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	60^{O} (±30^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	102^{O} (±51^{O})	degree	E-theta Component Free or Open Space condition.
Peak of the Circular Polarized Realized Gain.	+3.90	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	0.9	dB	within frequency band 902 – 928MHz Free or Open Space condition
Maximum Axial Ratio within Cone with Theta=±30^{O}	2.2	dB	within frequency band 902 – 928MHz
Maximum input VSWR	1.30		Reference impedance is 50 Ohm. Within frequency band 902 – 928 MHz
Minimum Return Loss	17.9	dB	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.
Maximum Input Power	2.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	13.7 4.2	feet m	Transmitter Power is 1.0 Watt. RFID Tag requires Field Strength 1.5 [V/m] for activation: as Alien Squiggle Inlay, ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	10.4 – 13.7 3.2 – 4.2	Feet m	within Phi angle ±180^{O} and the frequency band 902 - 928MHz
Frequency Bandwidth of ±5% Read Range Variation	908-920	MHz	Free or Open Space condition.
Width of the Cone with ±5% Read Range Variation	±30^{O}	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	2.3	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±13	%	In the bore-sight direction within frequency band 902 – 928MHz. Free or Open Space condition.
Reflection Coefficient	1/62	times	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.

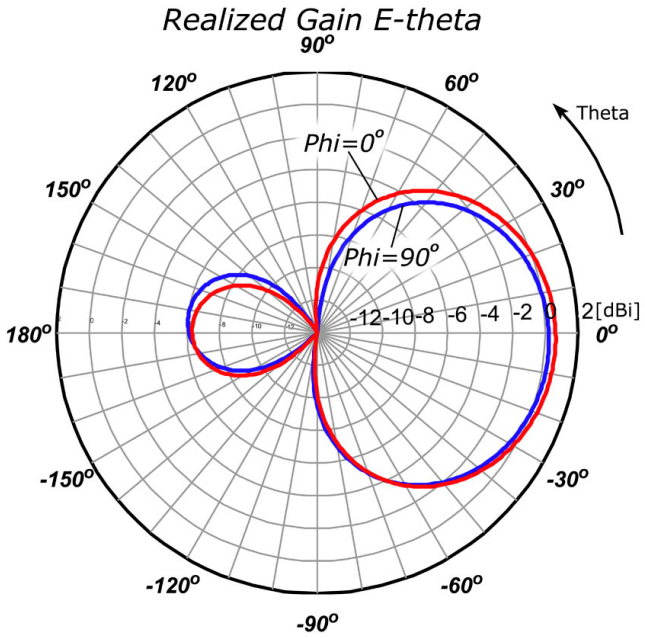
Environmental Specifications

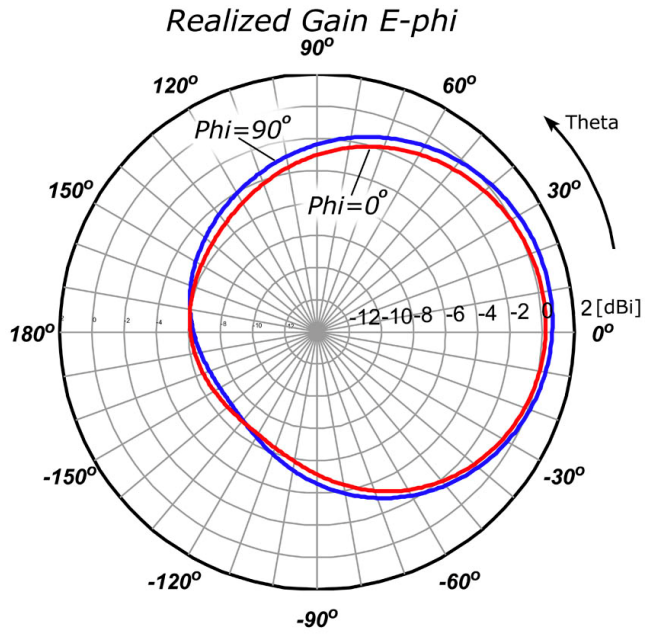
Parameter	Value	Units	Notes
Operation temperature	-30 +80	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	N/A		Antenna may be employed for outdoor installations with additional enclosure for protection against rain, snow and sun radiation.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	2.80 x 2.38 x 0.59 71.1x 60.5 x 15.1	in mm	Details on mechanical drawing
Weight	07 20	oz g	Without plastic enclosure
Coaxial Cable Length	4.0 102	in mm	Cable - RG-178 Connector - MMCX Right Angle PLUG
Enclosure Material	Plastic ABS		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

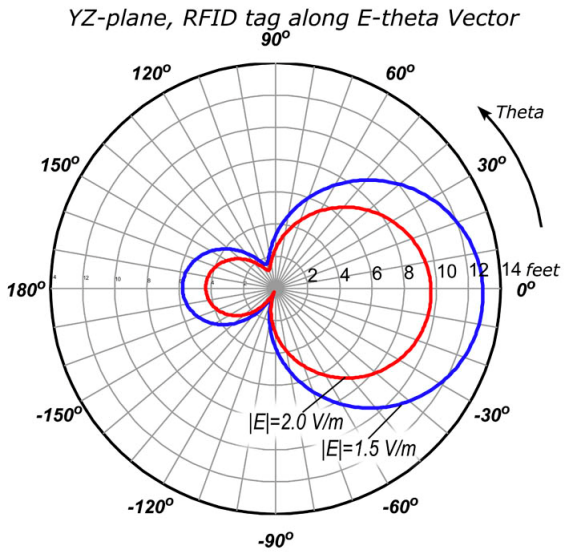
2-D Radiation Patterns in free space

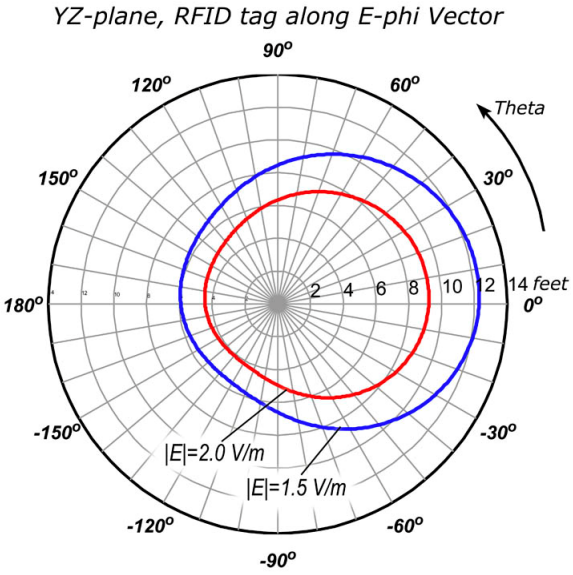


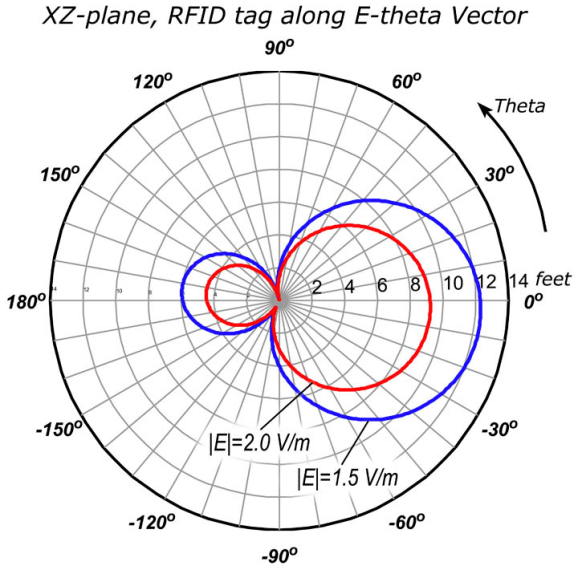


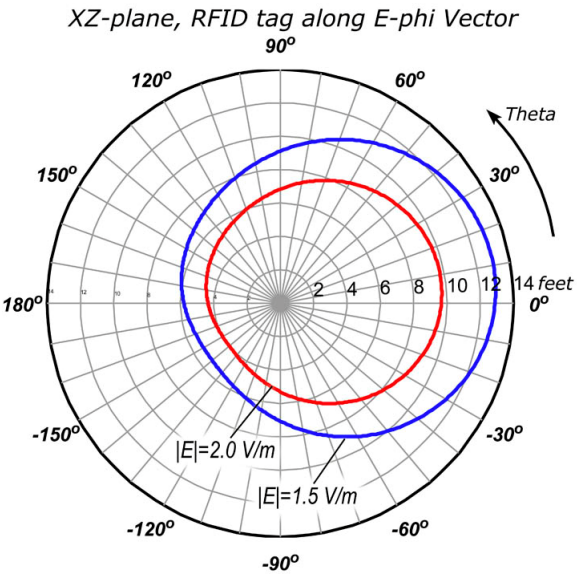
- Frequency is 915 MHz.
- Free space condition.
- Feeding Coaxial Cable loss 0.50dB

2-D Read Range Patterns





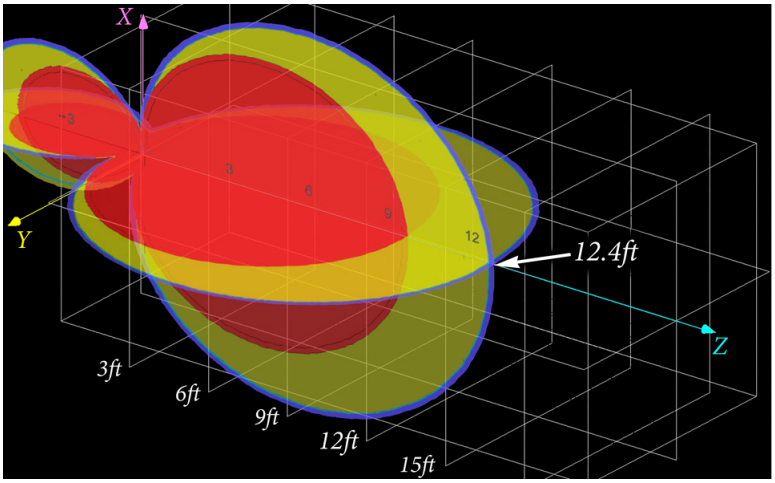




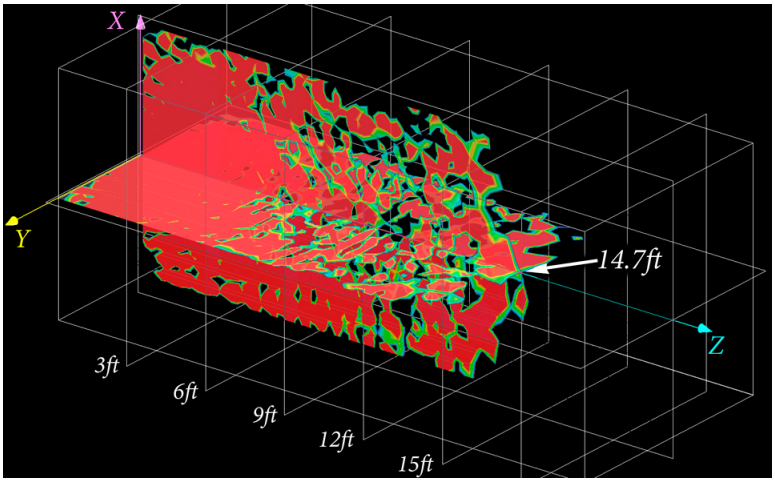
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay “ALN-9540” with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj “Monza-2” RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 915 MHz
- Free Space
- Feeding Coaxial Cable loss 0.50dB

3-D Read Range Patterns



Antenna is positioned in Free Space

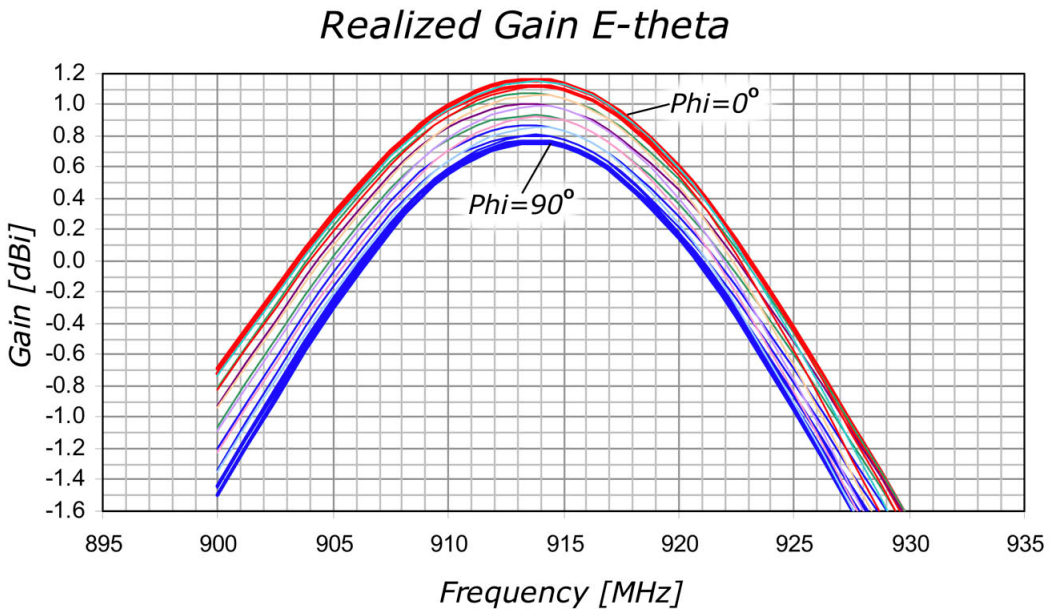


Inside the room 8ft x 8ft x 20ft with conductive floor

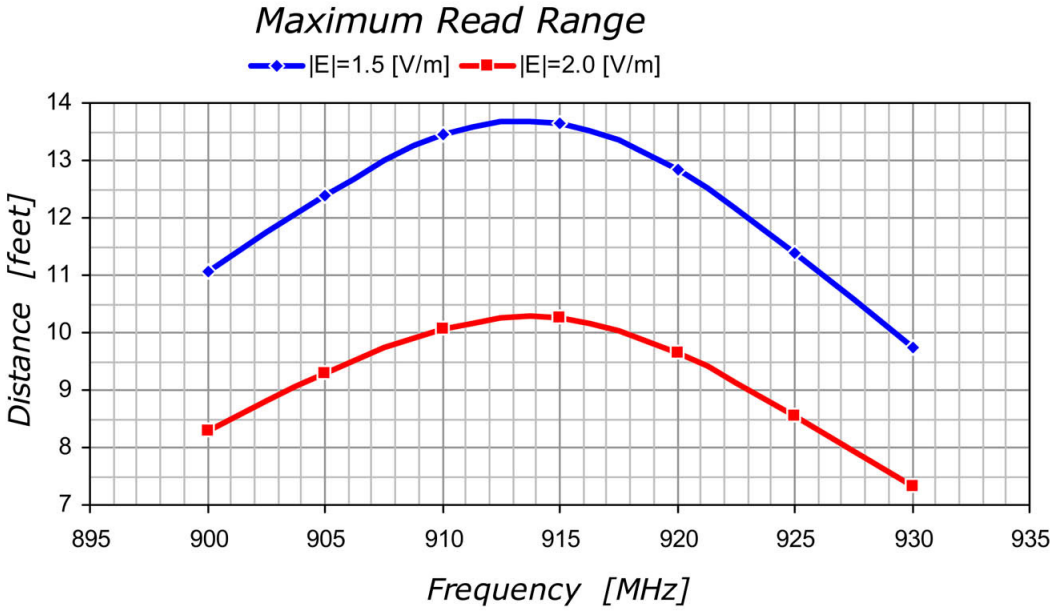
The Green Zone corresponds to the tags require the activation field strength 1.5 [V/m] (Alien Technology - Higgs-2 IC or NXP Semiconductors - SL3ICS1202). The Red Zone corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 915 MHz
- In the room antenna is 4 feet above the conductive floor

Frequency Response Diagram

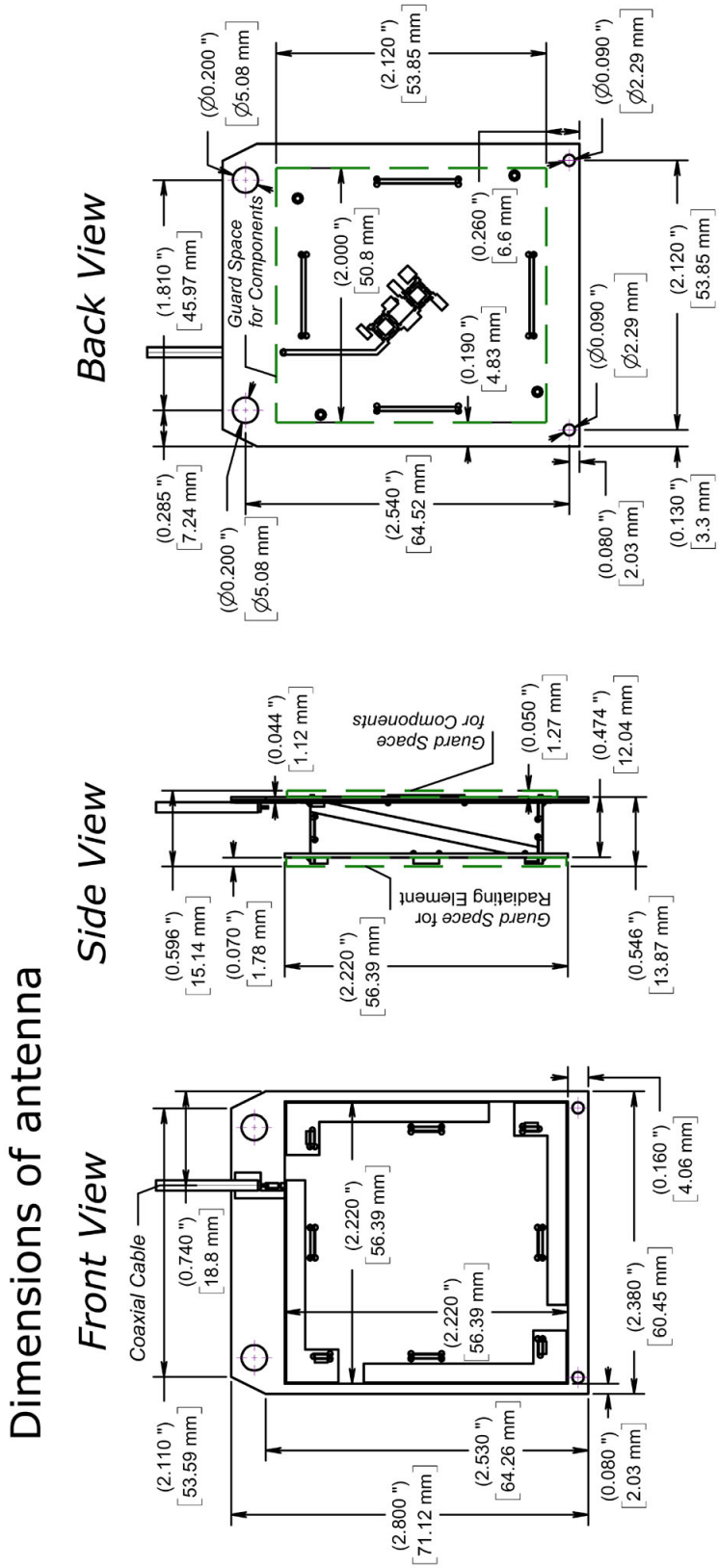


Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}. Without Feeding Coaxial Cable loss.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space
- Without Feeding Coaxial Cable loss.


Dimensions of antenna
Back View
Side View
Front View
Guard Space for Components
Guard Space for Components
Radiating Element
Coaxial Cable
(Ø0.200 ") [Ø5.08 mm]
(2.120 ") [53.85 mm]
(Ø0.090 ") [Ø2.29 mm]
(1.810 ") [45.97 mm]
(2.000 ") [50.8 mm]
(0.260 ") [6.6 mm]
(0.190 ") [4.83 mm]
(0.285 ") [7.24 mm]
(2.540 ") [64.52 mm]
(0.080 ") [2.03 mm]
(0.130 ") [3.3 mm]
(0.044 ") [1.12 mm]
(0.050 ") [1.27 mm]
(0.474 ") [12.04 mm]
(0.596 ") [15.14 mm]
(0.070 ") [1.78 mm]
(2.220 ") [56.39 mm]
(0.546 ") [13.87 mm]
(0.740 ") [18.8 mm]
(0.160 ") [4.06 mm]
(2.380 ") [60.45 mm]
(2.110 ") [53.59 mm]
(2.530 ") [64.26 mm]
(2.800 ") [71.12 mm]

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR within range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 18dB to 14dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +16dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for installation inside the plastic enclosure with certain symmetrical shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different plastic enclosure, but will require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.2in/5.0mm away from the back surface of the antenna.
- Any nonconductive objects have to be position 0.4in/10mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

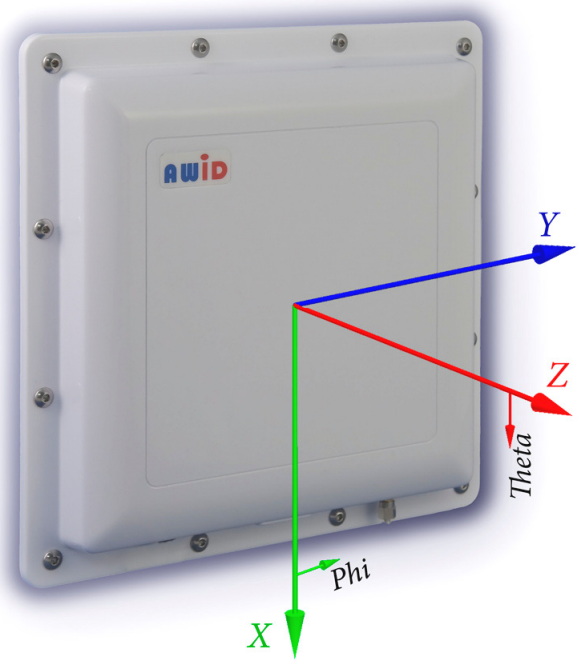
- Any conductive objects have to be position 1in/25mm away from the back surface of the antenna.
- Any conductive objects have to be position 2in/50mm away from sides of the antenna.
- Any conductive objects have to be position 4in/100mm away from the front surface of the antenna.

This antenna is covered by US patent 8106846.

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ANT-915-CP-R rev.2.16d – Preliminary Data Sheet
Circular Polarized Antenna for RFID

Document rev.1.0, 04/12/2012



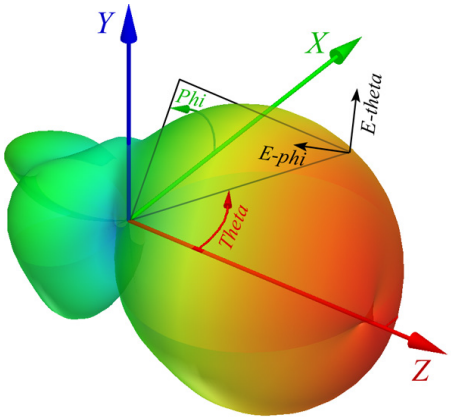
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Variation of the Maximum Gain is less than ±0.39dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 889 - 944MHz at the fixed Phi angle.
- It provides very low reflection of the transmitter signal into receiver. The return loss is more than 23dB.
- Moderate light – weight is 980g or 36oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year experience with design of RFID hardware.
Antenna provides uniform electromagnetic field which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for stationary and mobile applications.
It may be employed for outdoor installations under environment conditions up to IP65.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	RHCP		Right hand circular polarization
Peak of Linear Polarized Realized Gain	+5.50	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+5.50 to +4.73 Δ=0.77	dBi dB	within Phi angle ±180^{O} and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	888.7 - 943.6 Δ=54.9	MHz MHz	Free or Open Space condition. Fixed Phi angle.
Front to Back Ratio of Radiation	16.1	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	38^{O} (±19^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	66^{O} (±33^{O})	degree	E-theta Component Free or Open Space condition.
Peak of the Circular Polarized Realized Gain.	+8.37	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	0.42	dB	within frequency band 902 – 928MHz
Maximum Axial Ratio within Cone with Theta=±30^{O}	4.3	dB	within frequency band 902 – 928MHz
Maximum input VSWR	1.15		Reference impedance is 50 Ohm. Within frequency band 902 – 928 MHz
Minimum Return Loss	23.0	dB	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	22.3 6.8	feet m	Transmitter Power is 1.0 Watt. RFID Tag is Alien Squiggle Inlay ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	20.8 – 22.3 6.3 – 6.8	Feet m	within Phi angle ±180^{O} and the frequency band 902 - 928MHz. Free or Open Space condition.
Frequency Bandwidth of ±5% Read Range Variation	889-944	MHz	Free or Open Space condition.
Width of the Cone with ±15% Read Range Variation	±30^{O}	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	4.6	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±3	%	In the bore-sight direction within frequency band 902 – 928MHz. Free or Open Space condition.
Reflection Coefficient	1/172	times	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.

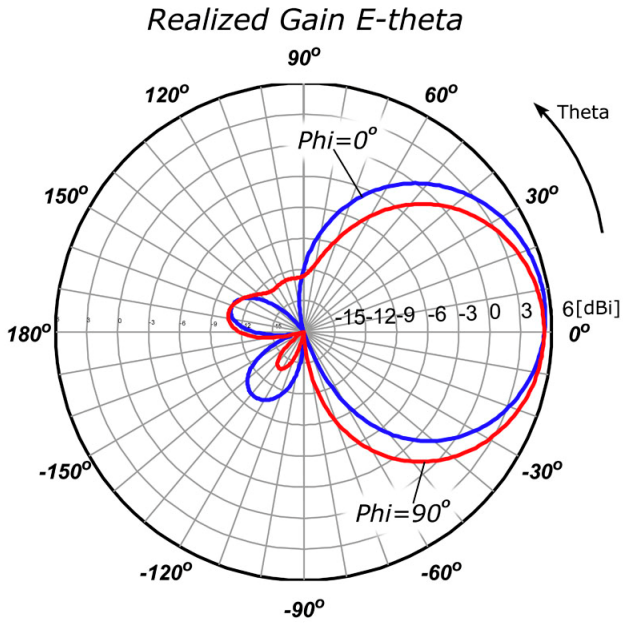
Environmental Specifications

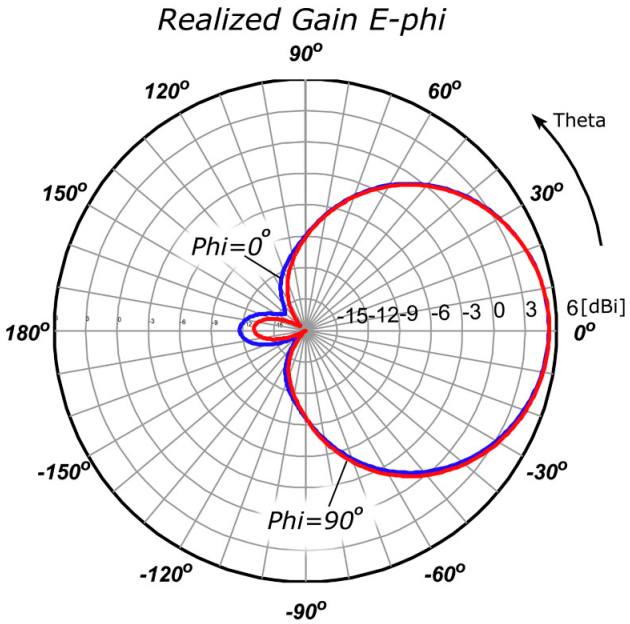
Parameter	Value	Units	Notes
Operation temperature	-30 +70	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	IP65		Antenna may be employed for outdoor installations.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	9.84 x 9.84 x 1.29 250 x 250 x 33	in mm	Details on mechanical drawing
Weight	36 980	oz g	Without mounting components and RF cable
RF Connector	SMA		Reverse Polarity
Enclosure Material	Plastic ABS Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

2-D Radiation Patterns in free space

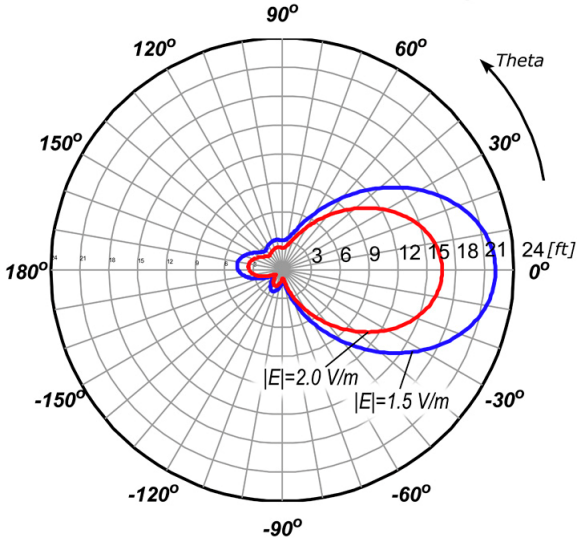




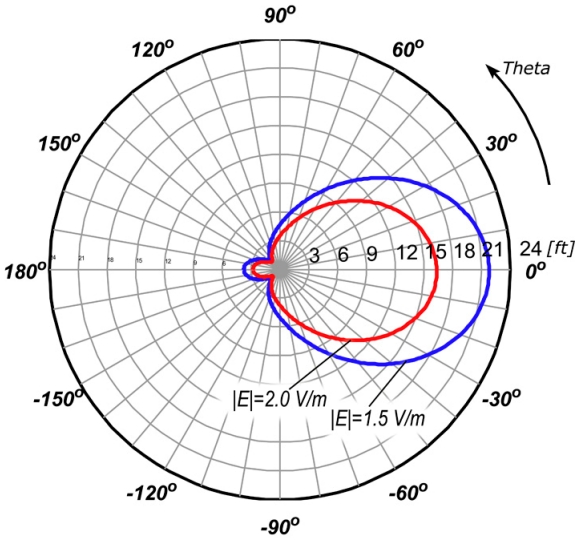
- Frequency is 915 MHz.
- Free space condition.

2-D Read Range Patterns

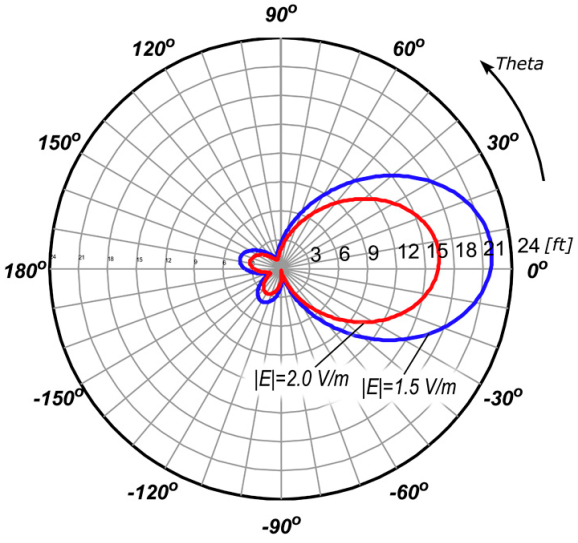
YZ-plane, RFID tag along E-theta Vector



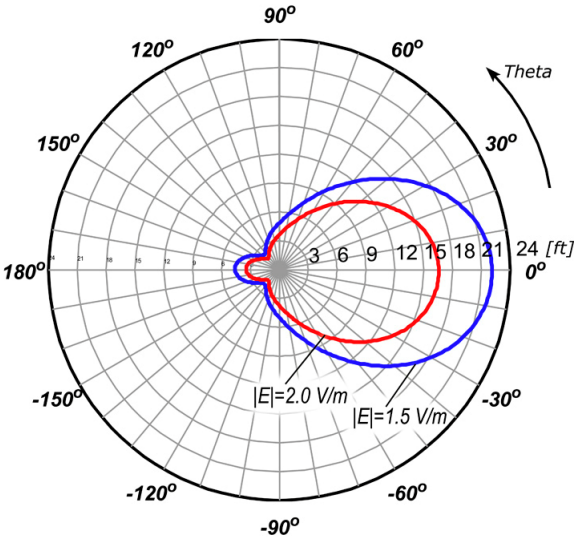
YZ-plane, RFID tag along E-phi Vector



XZ-plane, RFID tag along E-theta Vector



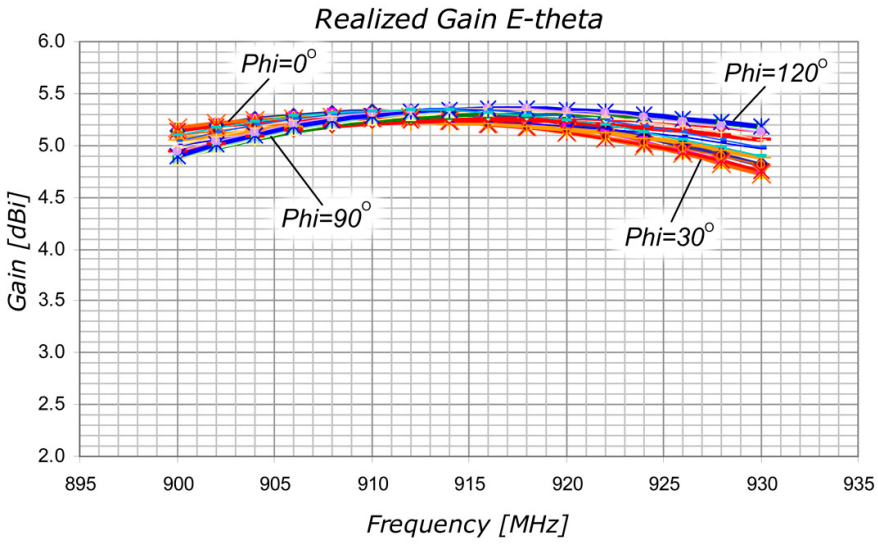
XZ-plane, RFID tag along E-phi Vector



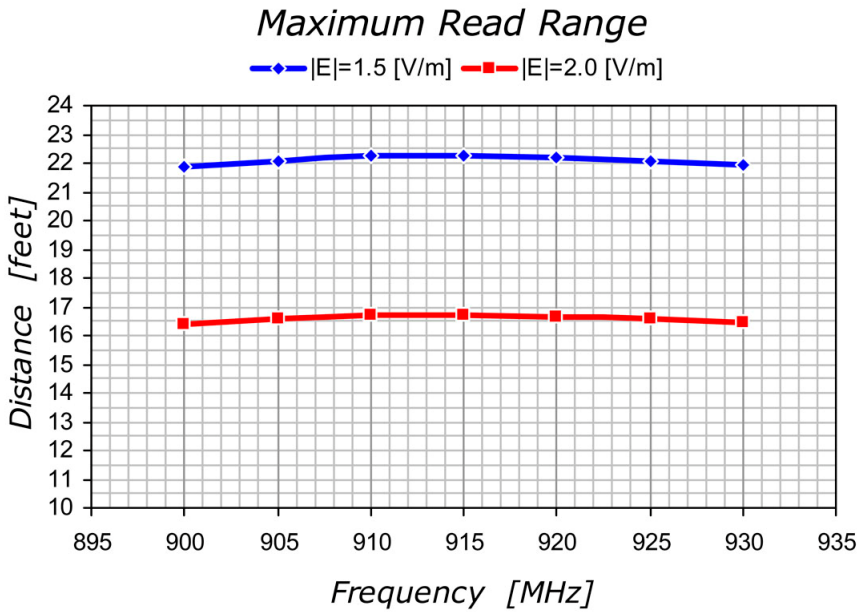
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 915 MHz
- Free Space

Frequency Response Diagram

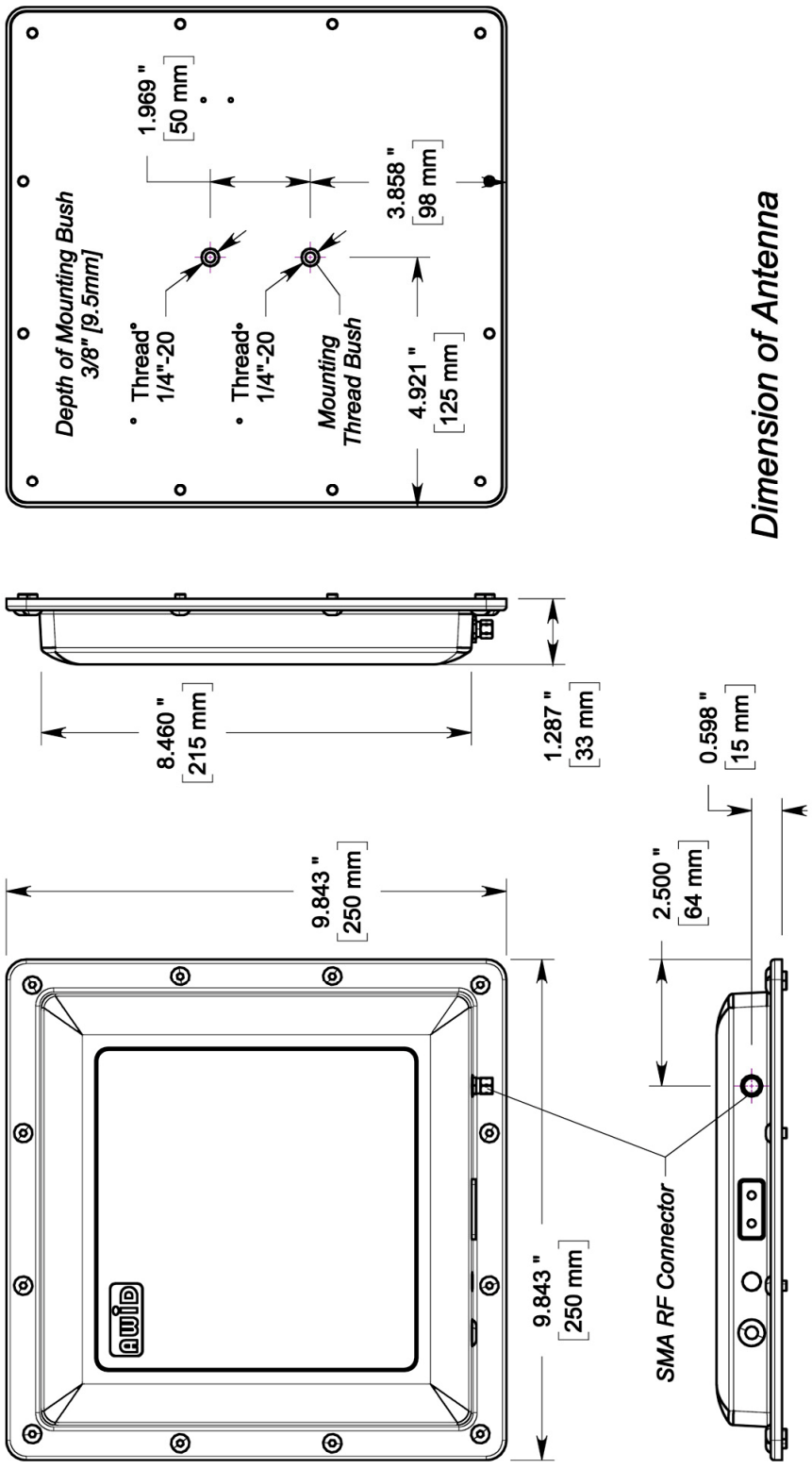


Angle Phi variation is from 0^O to $+180^O$, angle Theta is 0^O.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space



Dimension of Antenna

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR with range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 23dB to 10dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +20dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on the Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for plastic enclosure with certain shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different or additional plastic enclosure, but may require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.3in/8mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

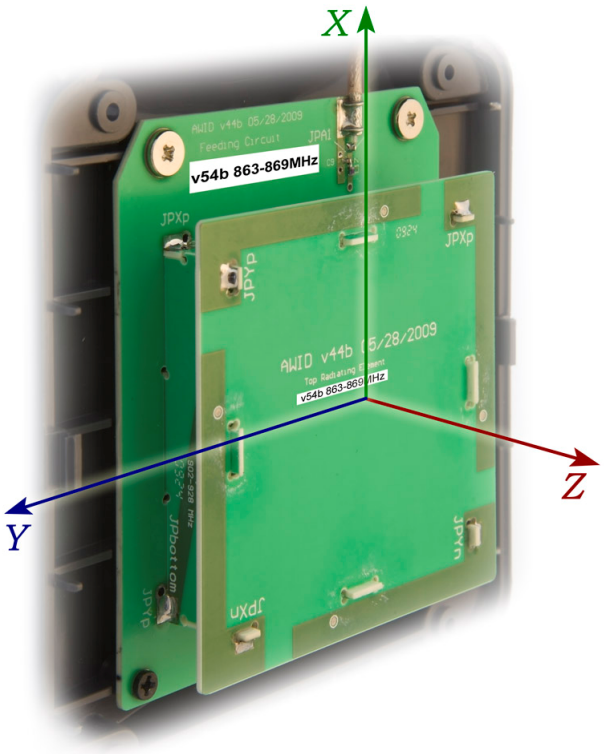
2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

Applied Wireless Identifications Group, Inc.
18300 Sutter Blvd., Morgan Hill, CA 95037 • Tel: 408-825-1100 • Fax: 408-782-7402

ANT-867-CP-0.5 rev.54b – Data Sheet
Compact Circular Polarized Antenna for RFID

Document rev.1.1, 04/09/2012



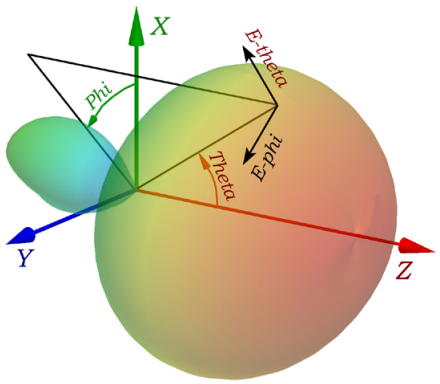
Features

- Maximum achieved realized gain and frequency bandwidth within small volume.
- Variation of the Maximum Gain is less than ±0.27dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within frequency band 859-876MHz at the fixed Phi angle.
- It provides low reflection of the transmitter signal into receiver. The return loss is more than 18dB.
- Extremely light – weight is 20g or 0.7oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year experience with design of RFID hardware.
Antenna provides uniform electromagnetic field which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for handheld application.
Antenna may be adopted for installation into various plastic enclosures with minor correction of the tuning components.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	863 – 869	MHz	EU, Armenia, Croatia, Iceland, India, Iran, Jordan, Macedonia, New Zealand, Norway, Russian Federation, South Africa, Switzerland, Tunisia Turkey, United Arab Emirates.
Polarization	RHCP		Right hand circular polarization
Peak of the Linear Polarized Realized Gain	+0.91	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+0.91 to +0.38 Δ=0.53	dBi dB	within Phi angle ±180^{O} and the frequency band 863 - 869MHz Free or Open Space condition.
-1dB radiation bandwidth	859.4-875.8 Δ=16.4	MHz MHz	Free or Open Space condition. Fixed Phi angle
Front to Back Ratio of Radiation	5.7	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	60^{O} (±30^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	102^{O} (±51^{O})	degree	E-theta Component Free or Open Space condition.
Peak of the Circular Polarized Realized Gain.	+3.86	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	0.5	dB	within frequency band 863 – 869MHz Free or Open Space condition
Maximum Axial Ratio within Cone with Theta=±30^{O}	1.4	dB	within frequency band 863 – 869MHz
Maximum input VSWR	1.30		Reference impedance is 50 Ohm. Within frequency band 863 – 869 MHz
Minimum Return Loss	17.9	dB	Reflection of the transmitter signal into receiver within frequency band 863 – 869MHz.
Maximum Input Power	2.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	13.2 4.02	feet m	Transmitter Power is 1.0 Watt. RFID Tag requires Field Strength 1.5 [V/m] for activation: as Alien Squiggle Inlay, ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	12.5 – 13.2 3.81 – 4.02	Feet m	within Phi angle ±180^{O} and the frequency band 863 – 869MHz
Frequency Bandwidth of ±5% Read Range Variation	859-876	MHz	Free or Open Space condition.
Width of the Cone with ±5% Read Range Variation	±30^{O}	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	1.9	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±2.6	%	In the bore-sight direction within frequency band 863 – 869MHz. Free or Open Space condition.
Reflection Coefficient	1/62	times	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.

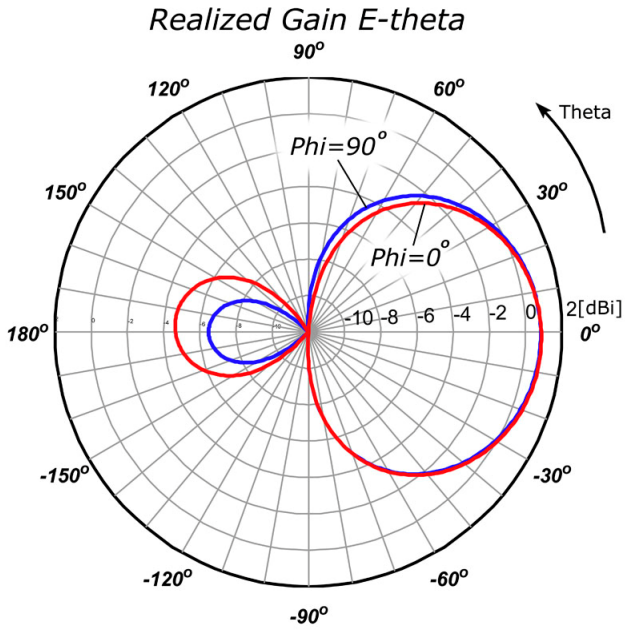
Environmental Specifications

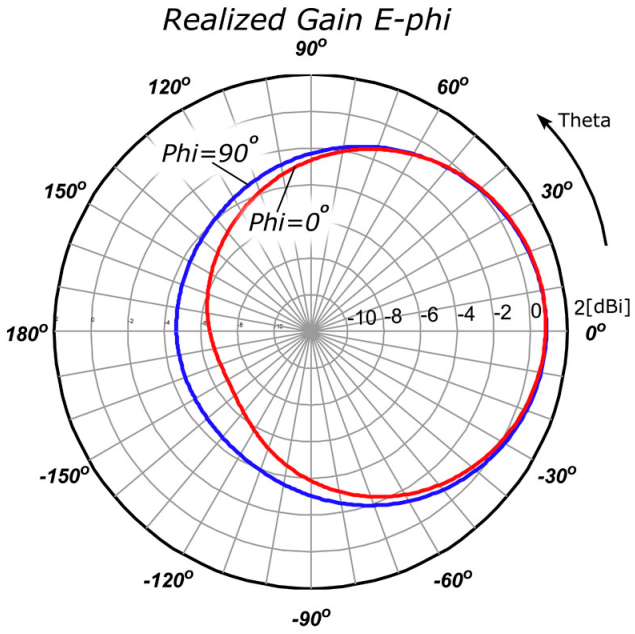
Parameter	Value	Units	Notes
Operation temperature	-30 +80	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	N/A		Antenna may be employed for outdoor installations with additional enclosure for protection against rain, snow and sun radiation.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	2.80 x 2.38 x 0.59 71.1x 60.5 x 15.1	in mm	Details on mechanical drawing
Weight	07 20	oz g	Without plastic enclosure
Coaxial Cable Length	4.0 102	in mm	Cable - RG-178 Connector - MMCX Right Angle PLUG
Enclosure Material	Plastic ABS		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

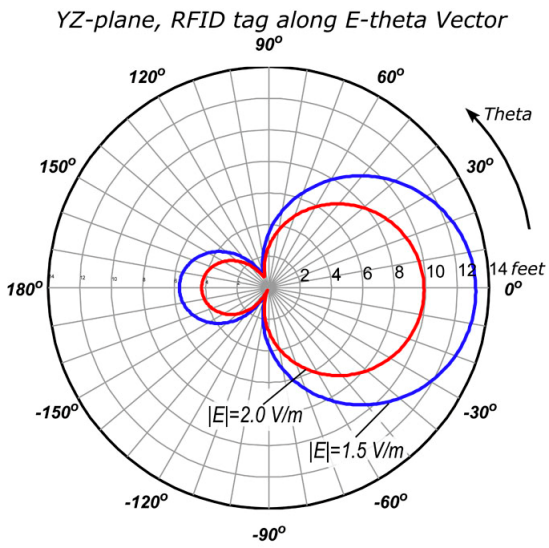
2-D Radiation Patterns in free space

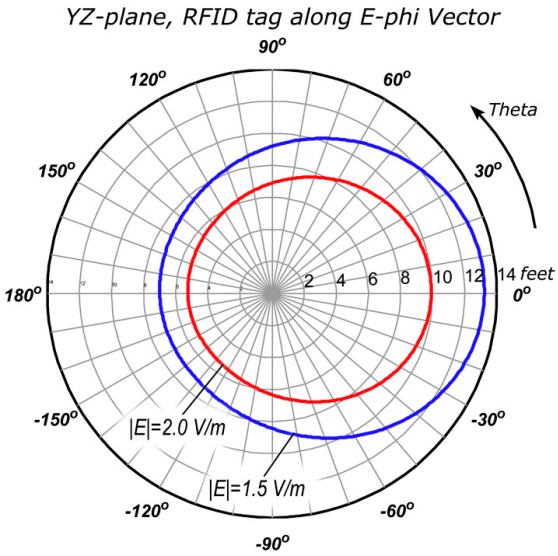


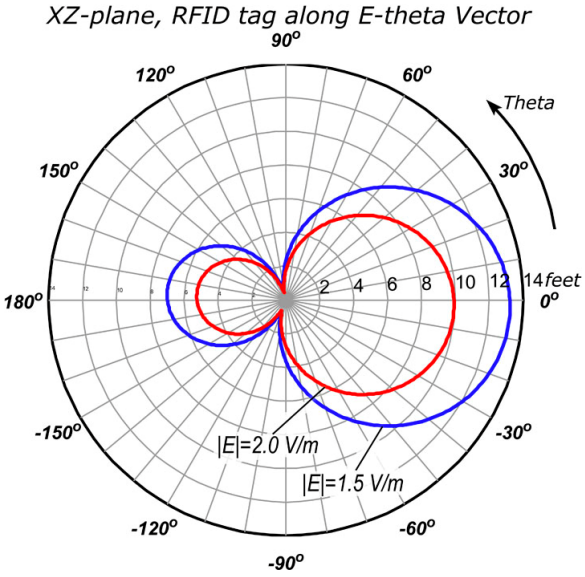


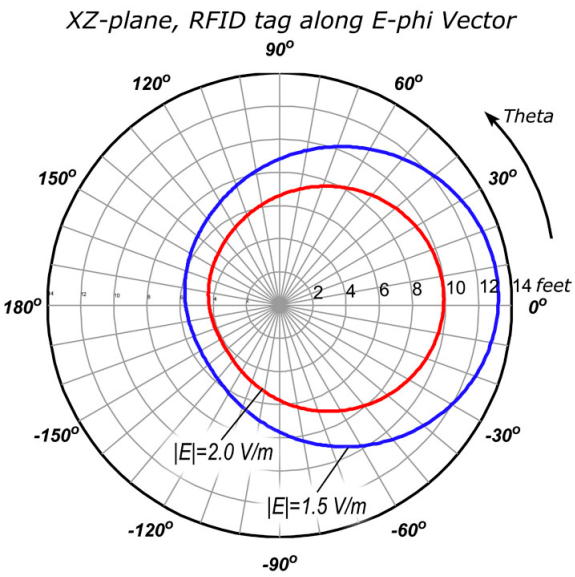
- Frequency is 867 MHz.
- Free space condition.
- Without Feeding Coaxial Cable Loss

2-D Read Range Patterns





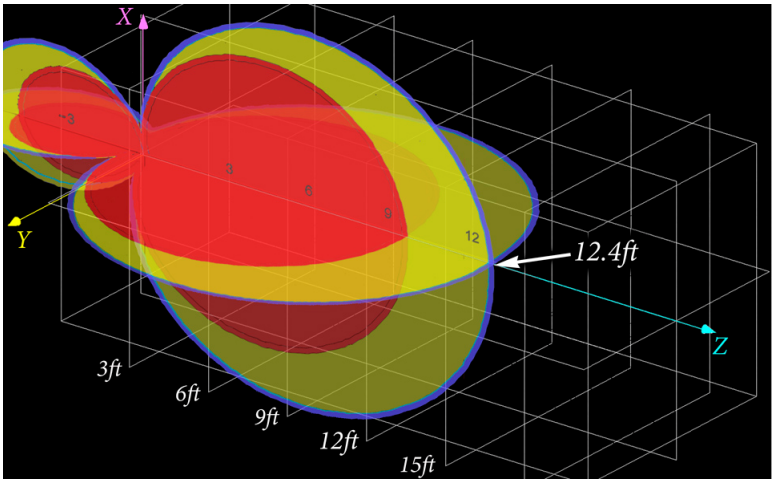




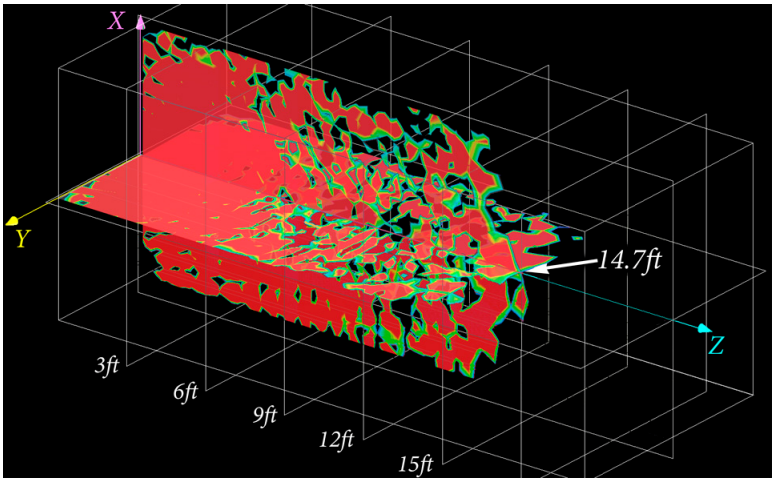
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 867 MHz
- Free Space
- Without Feeding Coaxial Cable Loss

3-D Read Range Patterns



Antenna is positioned in Free Space

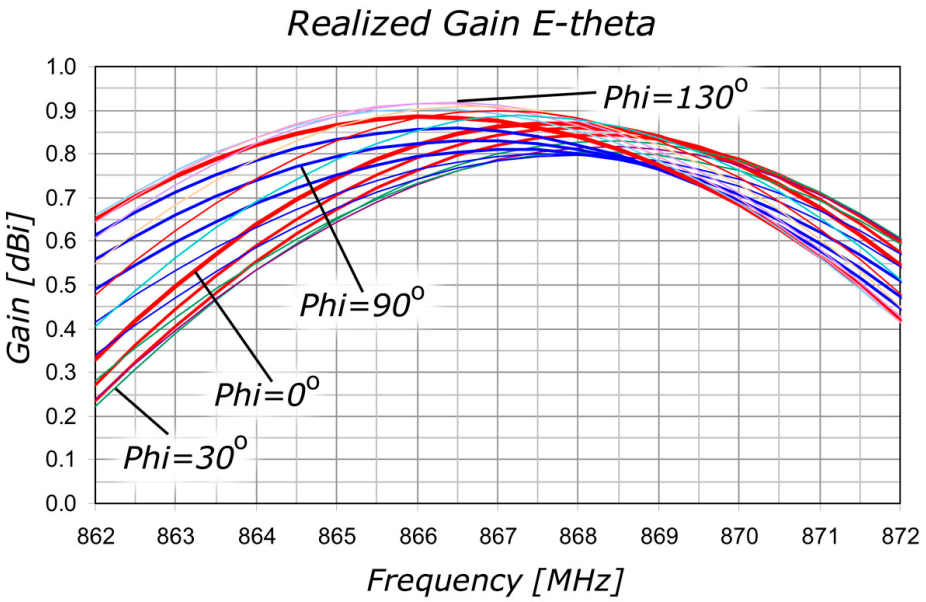


Inside the room 8ft x 8ft x 20ft with conductive floor

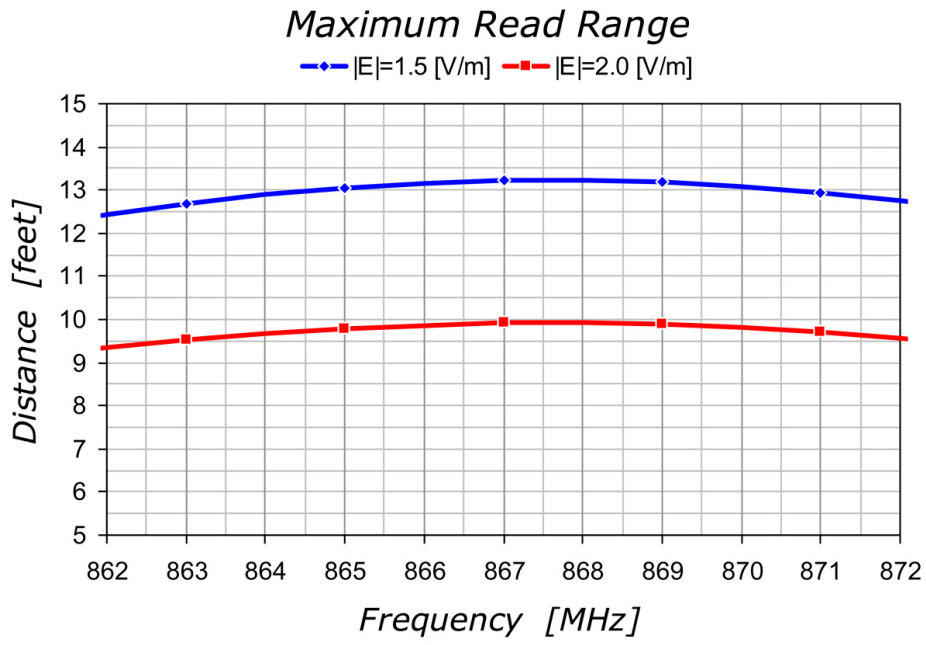
The Green Zone corresponds to the tags require the activation field strength 1.5 [V/m] (Alien Technology - Higgs-2 IC or NXP Semiconductors - SL3ICS1202). The Red Zone corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 867 MHz
- In the room antenna is 4 feet above the conductive floor

Frequency Response Diagram



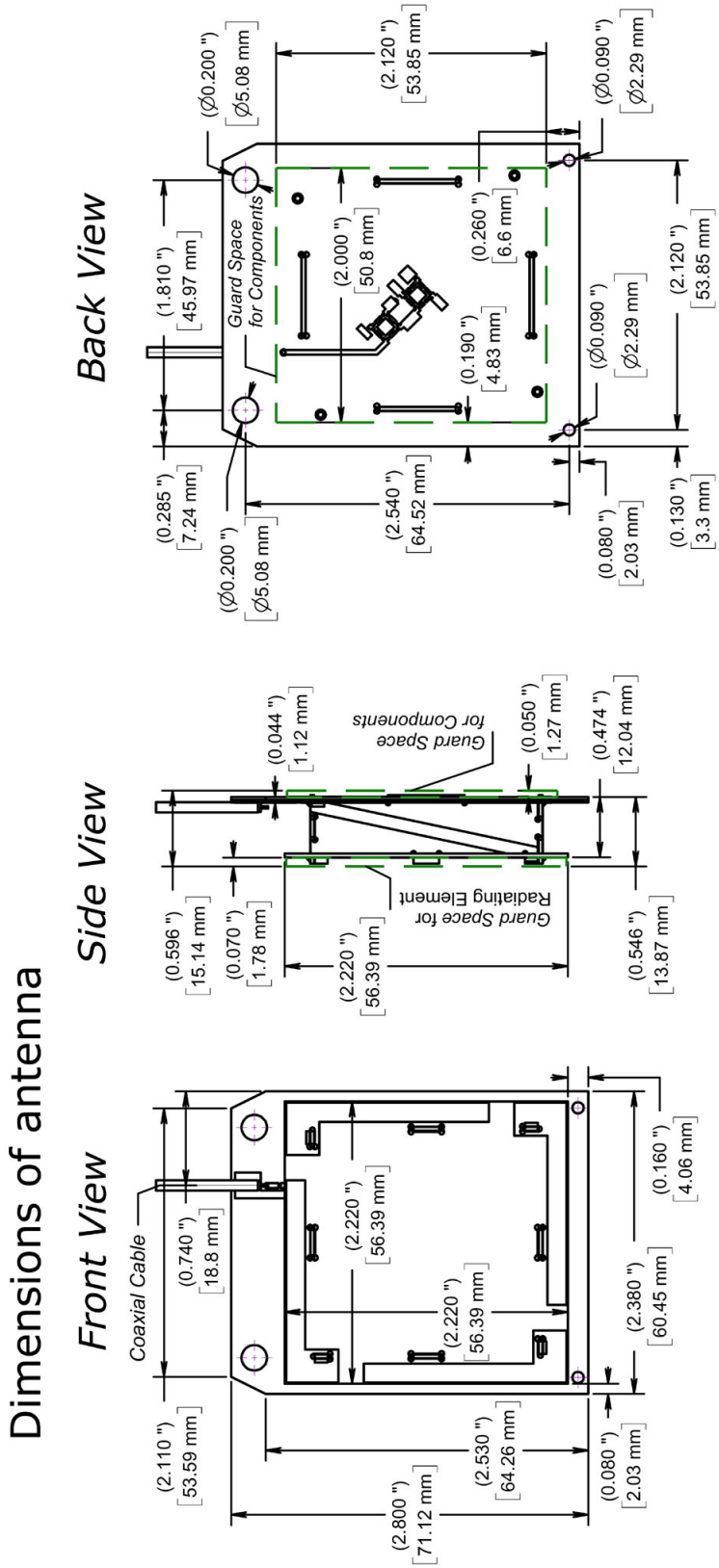
Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}. Without Feeding Coaxial Cable loss.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space
- Without Feeding Coaxial Cable loss.

Dimensions of antenna



Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR within range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 18dB to 14dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +16dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for installation inside the plastic enclosure with certain symmetrical shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different plastic enclosure, but will require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.2in/5.0mm away from the back surface of the antenna.
- Any nonconductive objects have to be position 0.4in/10mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

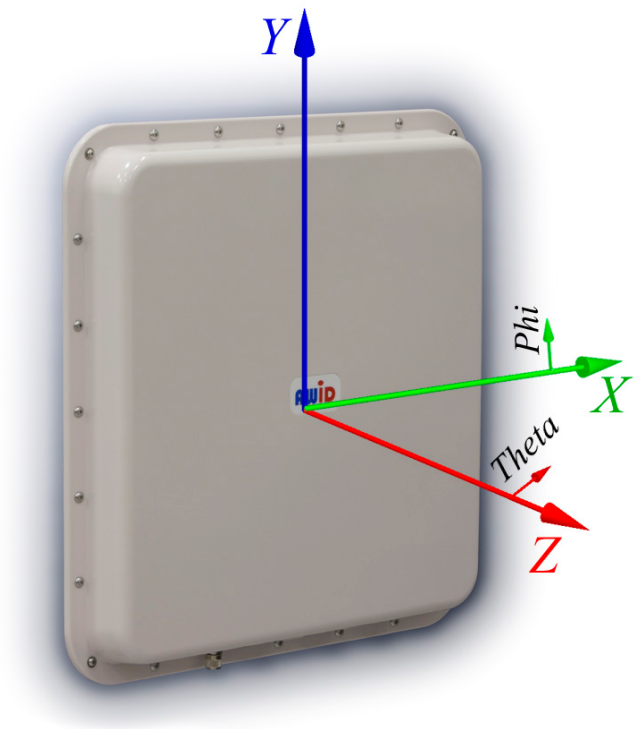
- Any conductive objects have to be position 1in/25mm away from the back surface of the antenna.
- Any conductive objects have to be position 2in/50mm away from sides of the antenna.
- Any conductive objects have to be position 4in/100mm away from the front surface of the antenna.

This antenna is covered by US patent 8106846.

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ANT-915-LA2x2 rev.2b – Data Sheet
Linear Polarized Antenna for RFID

Document rev.1.3, 04/04/2012



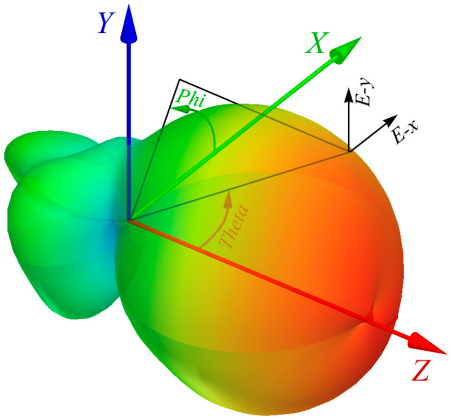
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Deviation of the Maximum Gain is less than ±0.12dB in Z direction within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 882-954MHz.
- It provides very low reflection of the transmitter signal into receiver. The return loss is more than 23dB.
- Weight is 3480g or 123oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year design experience of RFID hardware.
Antenna provides uniform electromagnetic field within narrow cone, which guaranties the stability of tag interrogation at horizontal position in required direction.
High realized gain with horizontal polarization and low VSWR increase the interrogation range for semi-passive RFID tags at reduced transmitter power.
Size, weight and gain of the antenna are optimized for stationary outdoor applications.
It is optimized for USA frequency band 902-928MHz.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	HLP		Horizontal Linear Polarization
Peak of Linear Polarized Realized Gain	+12.43 +10.28	dBi dBd	E-x Component (for RFID application) Without coaxial cable
Deviation of Maximum Gain	+12.43 to +12.20 Δ=0.23	dBi dB	within Phi angle =0^O and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	882.4 – 953.6 Δ=71.2	MHz MHz	Free or Open Space condition.
Front to Back Ratio of Radiation	16.1	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	22^O ($\pm 11^O$)	degree	E-x Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	36^O ($\pm 18^O$)	degree	E-x Component Free or Open Space condition.
Variation of Maximum Gain	+12.43 to +9.42 Δ=3.0	dBi dB	*E-theta* componet. Tag is tilted within Phi angle $\pm 45^O$ and the frequency band 902 - 928MHz Free or Open Space condition.
Maximum input VSWR	1.15		Reference impedance is 50 Ohm. Within the frequency band 902 – 928 MHz
Minimum Return Loss	23.1	dB	Reflection of the transmitter signal into receiver within the frequency band 902-928MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	71.0 21.6	feet m	Transmitter Power is 2.0 Watt. FCC Part 90 subpart M. RFID Tag requires Field Strength 1.5 [V/m] for activation: as Alien Squiggle Inlay, ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Deviation of Maximum Read Range	69.1 – 71.0 21.1 – 21.6	Feet m	With Phi angle = 0^{O} (tag in horizontal position) and within the frequency band 902 - 928MHz. Free or Open Space condition.
Frequency Bandwidth of ±5% Read Range Variation	882.4 – 953.6	MHz	Free or Open Space condition.
Width of the Cone with ±5% Read Range Variation	$\pm 11^{O}$	degree	Free or Open Space condition.
Width of the Cone with ±15% Read Range Variation	$\pm 18^{O}$	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	7.8	times	Free or Open Space condition.
Tilt angle *Phi* of tag relative to horizontal position at what the read range drops 30% from the maximum	$\pm 45^{O}$	degree	Within the frequency band 902 – 928MHz. Free or Open Space condition.
Reflection Coefficient	1/200	times	Reflection of the transmitter signal into receiver within the frequency band 902-928MHz.

Environmental Specifications

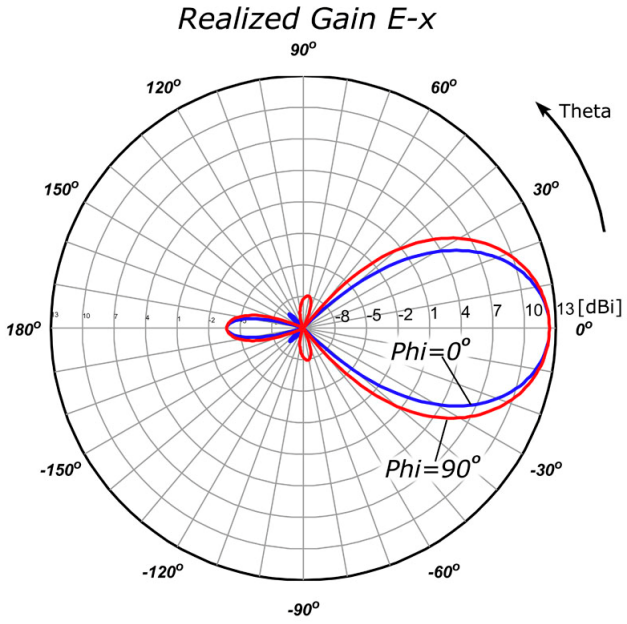
Parameter	Value	Units	Notes
Operation temperature	-30 +70	^{O}C	Ambient
Humidity	5-98	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	IP66		Antenna may be employed for outdoor and indoor installations.

Mechanical Specifications

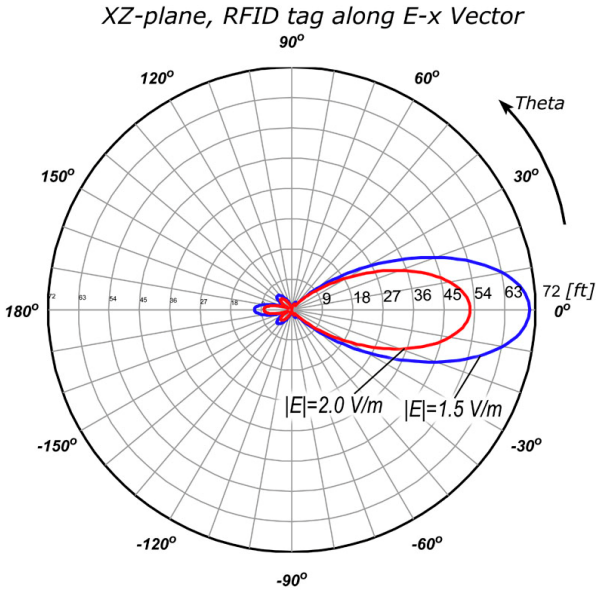
Parameter	Value	Units	Notes
Dimension	18.7 x 18.7 x 2.04 475 x 475 x 52	in mm	Details on mechanical drawing
Weight	123 3480	oz g	Without mounting components and RF cable
RF Connector	TNC		50 Ohm, Reverse Polarity
Enclosure Material	Plastic UV Resistant Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

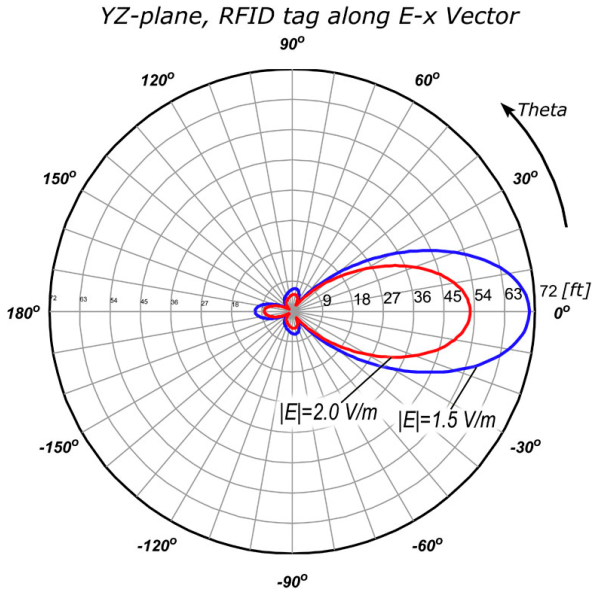
2-D Radiation Patterns in free space

- Frequency is 915 MHz.
- Free space condition.



2-D Read Range Patterns

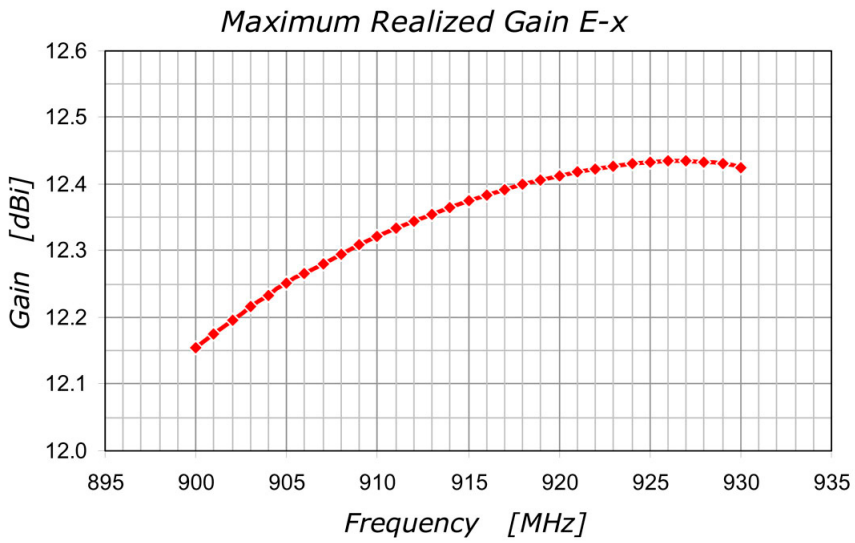




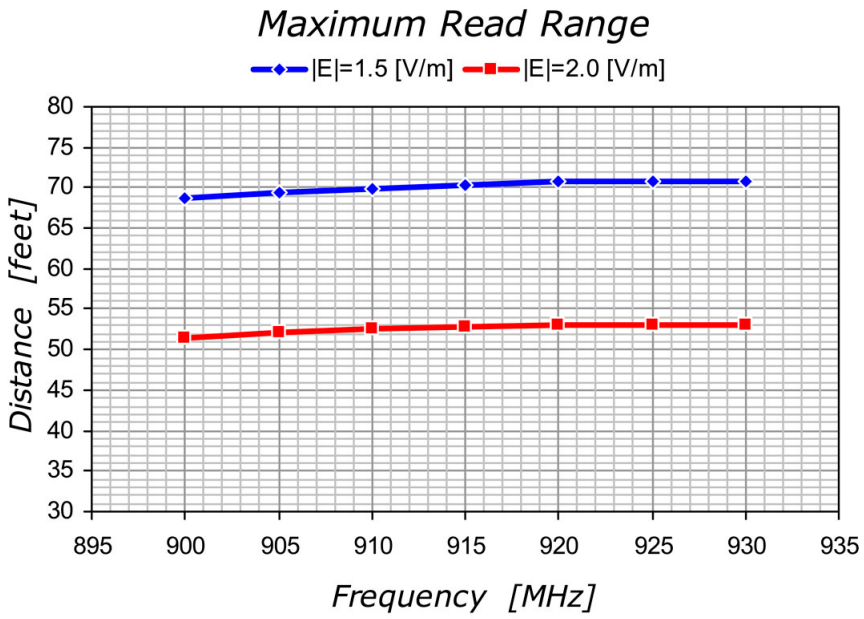
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 2.0 Watt or +33dBm, Radiated power 21.3Watt or +43.3dBm ERP.
- Frequency is 915 MHz
- Free Space

Frequency Response Diagram

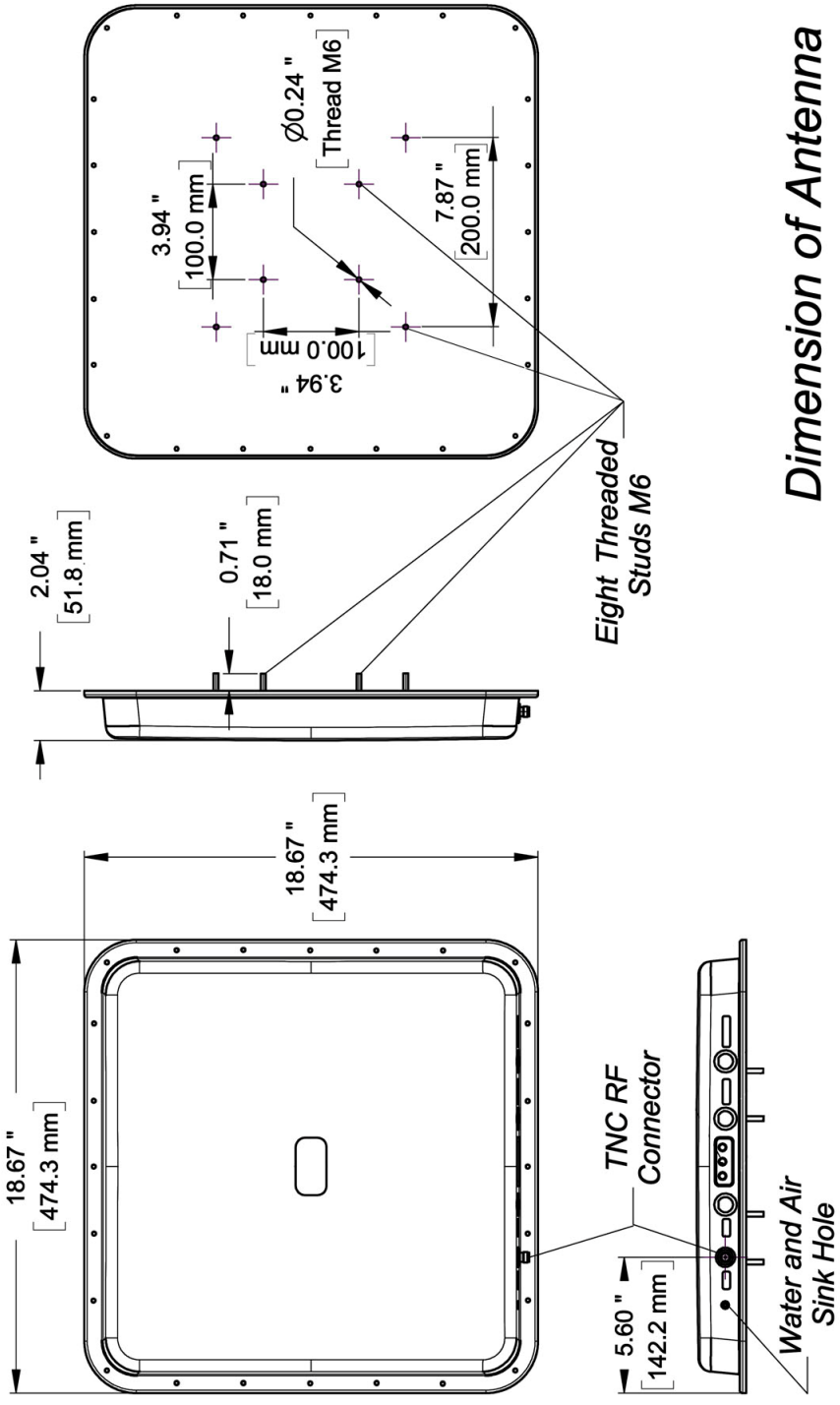


Angle Phi is 0^{O}, angle Theta is 0^{O}.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 2.0 Watt or +33dBm, Radiated power 21.3Watt or +43.3dBm ERP.
- FCC Part 90 subpart M.
- Free Space


Dimension of Antenna
Ø0.24 "
[Thread M6]
3.94 "
[100.0 mm]
7.87 "
[200.0 mm]
100.0 mm
3.94 "
Eight Threaded
Studs M6
2.04 "
[51.8 mm]
0.71 "
[18.0 mm]
18.67 "
[474.3 mm]
18.67 "
[474.3 mm]
TNC RF
Connector
5.60 "
[142.2 mm]
Water and Air
Sink Hole

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR with range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20 or the return loss more than 20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss by 10-20 dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +10dBm only.

Note for installation to prevent the degradation of antenna performance.

It is based on Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for the plastic enclosure with certain shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different or additional plastic enclosure, but may require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.4in/10mm away from sides of the antenna.
- Any nonconductive objects have to be position 1.0in/25mm away from the front surface of the antenna.

2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

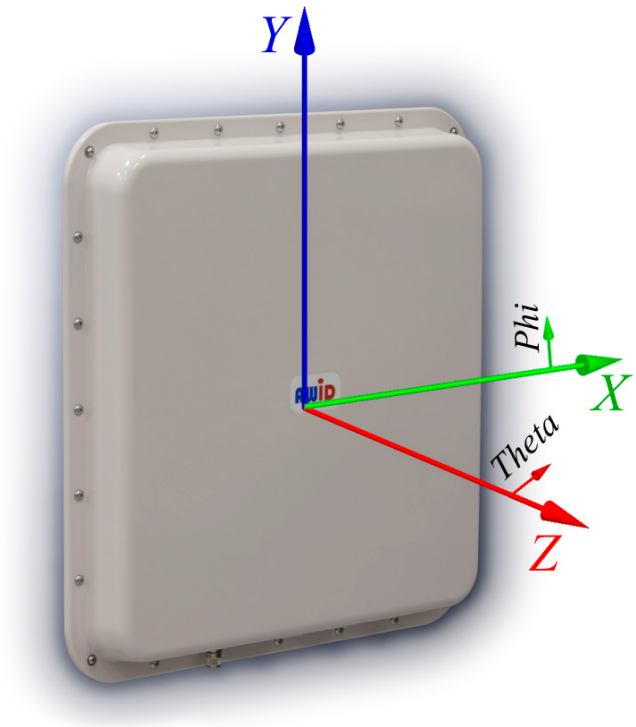
- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

This antenna is covered by US patent 7403158.

Applied Wireless Identifications Group, Inc.
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ANT-915-CA2x2 rev.1.17a – Data Sheet
Circular Polarized Antenna for RFID

Document rev.1.3, 04/03/2012



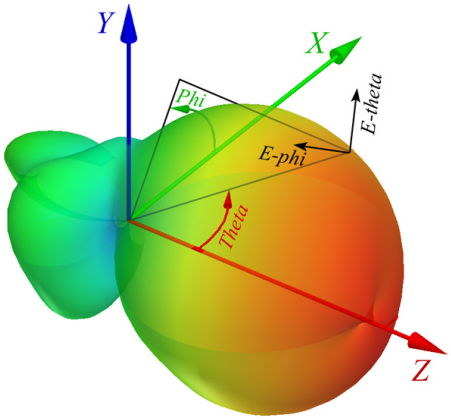
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Variation of the Maximum Gain is less than ±0.18dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 886-953MHz at the fixed Phi angle.
- It provides very low reflection of the transmitter signal into receiver. The return loss is more than 23dB.
- Weight is 3480g or 123oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year design experience of RFID hardware.
Antenna provides very uniform electromagnetic field within narrow cone which guaranties the stability of tag interrogation at any position in required direction.
High realized gain and low VSWR increase the interrogation range for semi-passive RFID tags at reduced transmitter power.
Size, weight and gain of the antenna are optimized for stationary outdoor applications.
It is optimized for USA frequency band 902-928MHz.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	RHCP		Right hand circular polarization
Peak of the Linear Polarized Realized Gain	+9.54	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+9.54 to +9.18 Δ=0.36	dBi dB	within Phi angle ±180^{O} and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	886-953 Δ=67	MHz MHz	Free or Open Space condition. Fixed Phi angle.
Front to Back Ratio of Radiation	16.8	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	22^{O} (±11^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	38^{O} (±19^{O})	degree	E-theta Component Free or Open Space condition.
Peak of the Circular Polarized Realized Gain.	+12.48	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	0.06	dB	within frequency band 902 – 928MHz
Maximum Axial Ratio within Cone with Theta=±30^{O}	2.0	dB	within frequency band 902 – 928MHz
Maximum input VSWR	1.15		Reference impedance is 50 Ohm. Within frequency band 902 – 928 MHz
Minimum Return Loss	23.1	dB	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	23.5 7.2	feet m	Transmitter Power is 0.446 Watt. FCC part 15.247 requirements. RFID Tag requires Field Strength 1.5 [V/m] for activation: as Alien Squiggle Inlay, ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	22.7 – 23.5 6.0 – 7.2	Feet m	within Phi angle ±180^{O} and the frequency band 902 - 928MHz
Frequency Bandwidth of ±5% Read Range Variation	876-973	MHz	Free or Open Space condition.
Width of the Cone with ±5% Read Range Variation	±11^{O}	degree	Free or Open Space condition.
Width of the Cone with ±15% Read Range Variation	±19^{O}	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	7.8	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±0.3	%	In the bore-sight direction within frequency band 902 – 928MHz. Free or Open Space condition.
Reflection Coefficient	1/200	times	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.

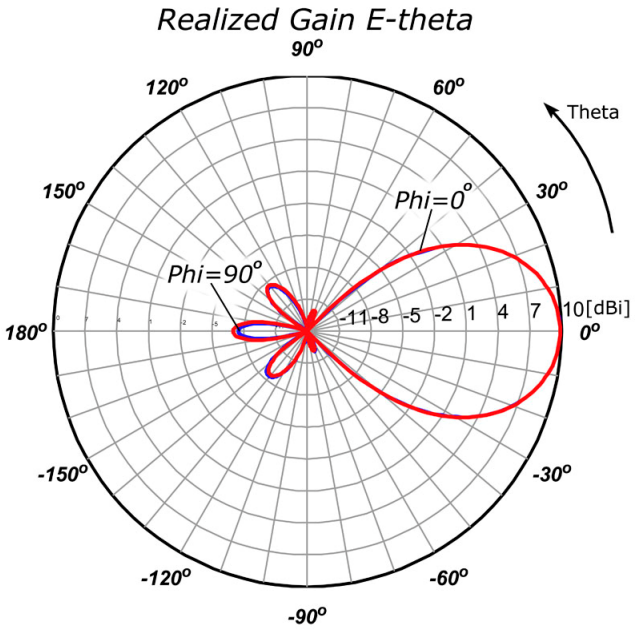
Environmental Specifications

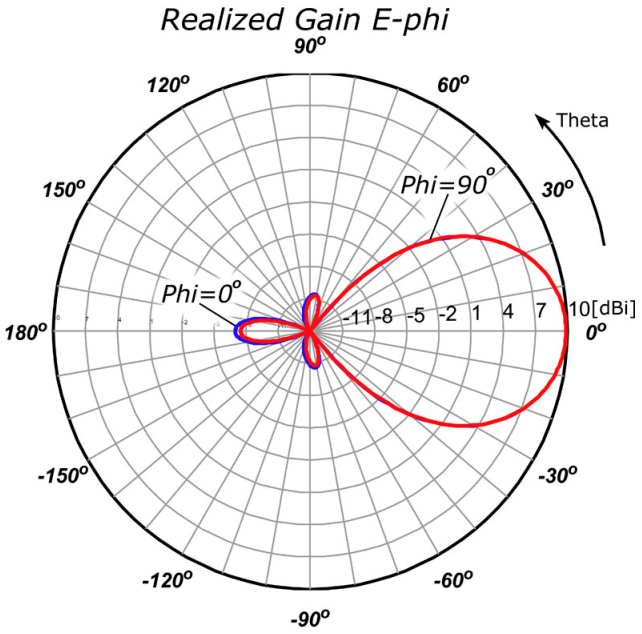
Parameter	Value	Units	Notes
Operation temperature	-30 +70	^{O}C	Ambient
Humidity	5-98	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	IP66		Antenna may be employed for outdoor and indoor installations.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	18.7x18.7x2.1 475 x 475 x 52	in mm	Details on mechanical drawing
Weight	123 3480	oz g	Without mounting components and RF cable
RF Connector	TNC		50 Ohm, Reverse Polarity
Enclosure Material	Plastic UV Resistant Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

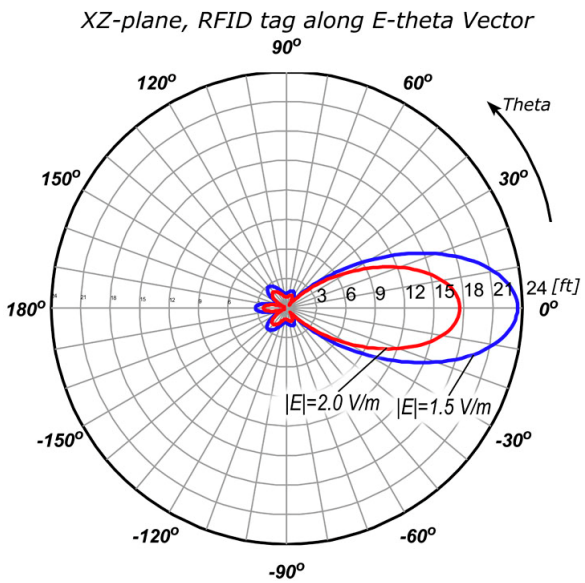
2-D Radiation Patterns in free space

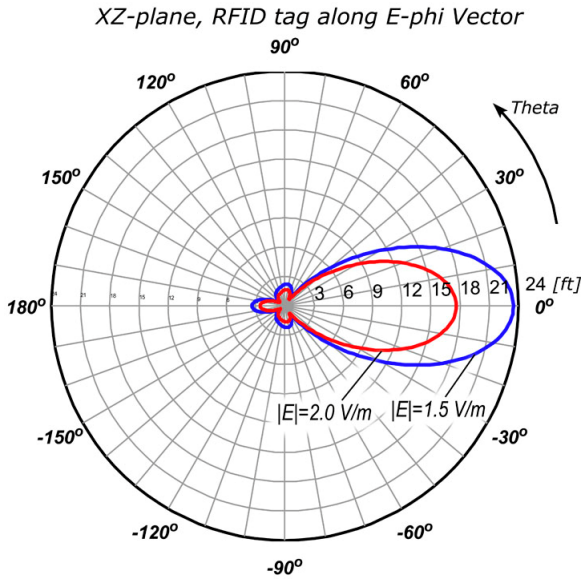


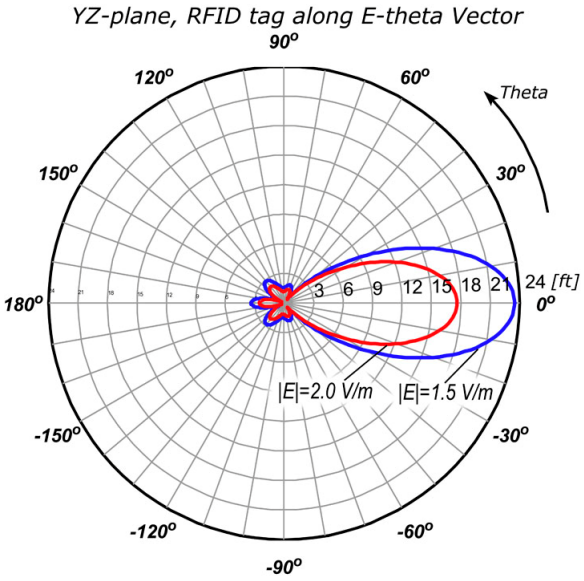


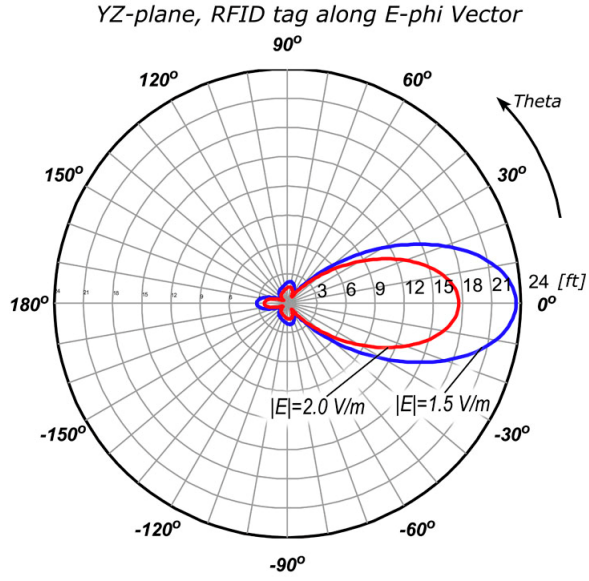
- Frequency is 915 MHz.
- Free space condition.

2-D Read Range Patterns





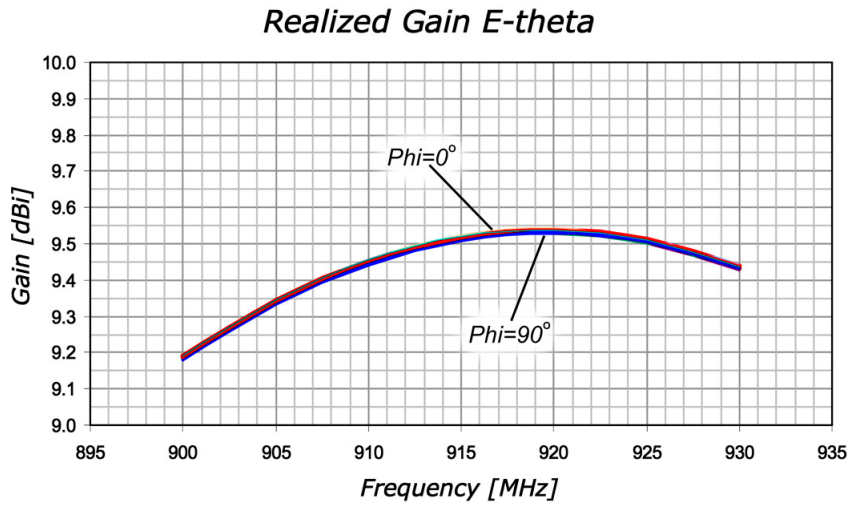




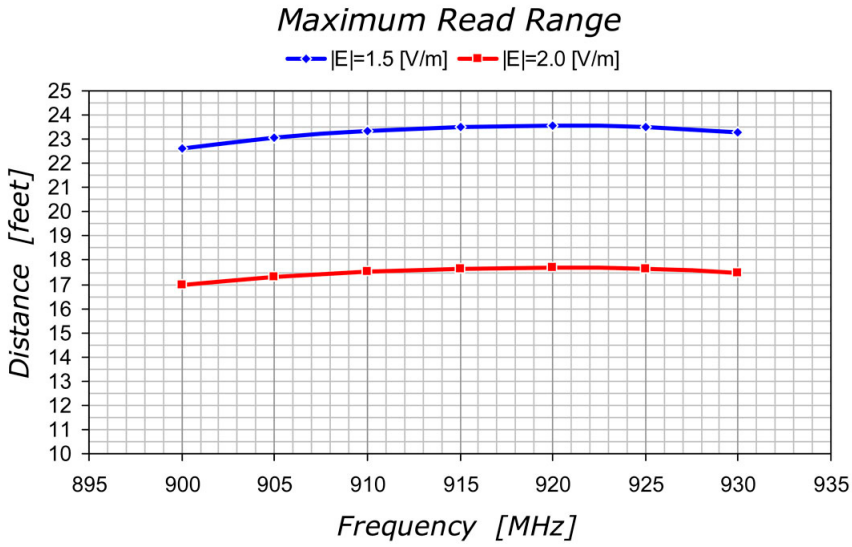
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 0.446 Watt or +26.5dBm (FCC part 15.247 requirements).
- Frequency is 915 MHz
- Free Space

Frequency Response Diagram

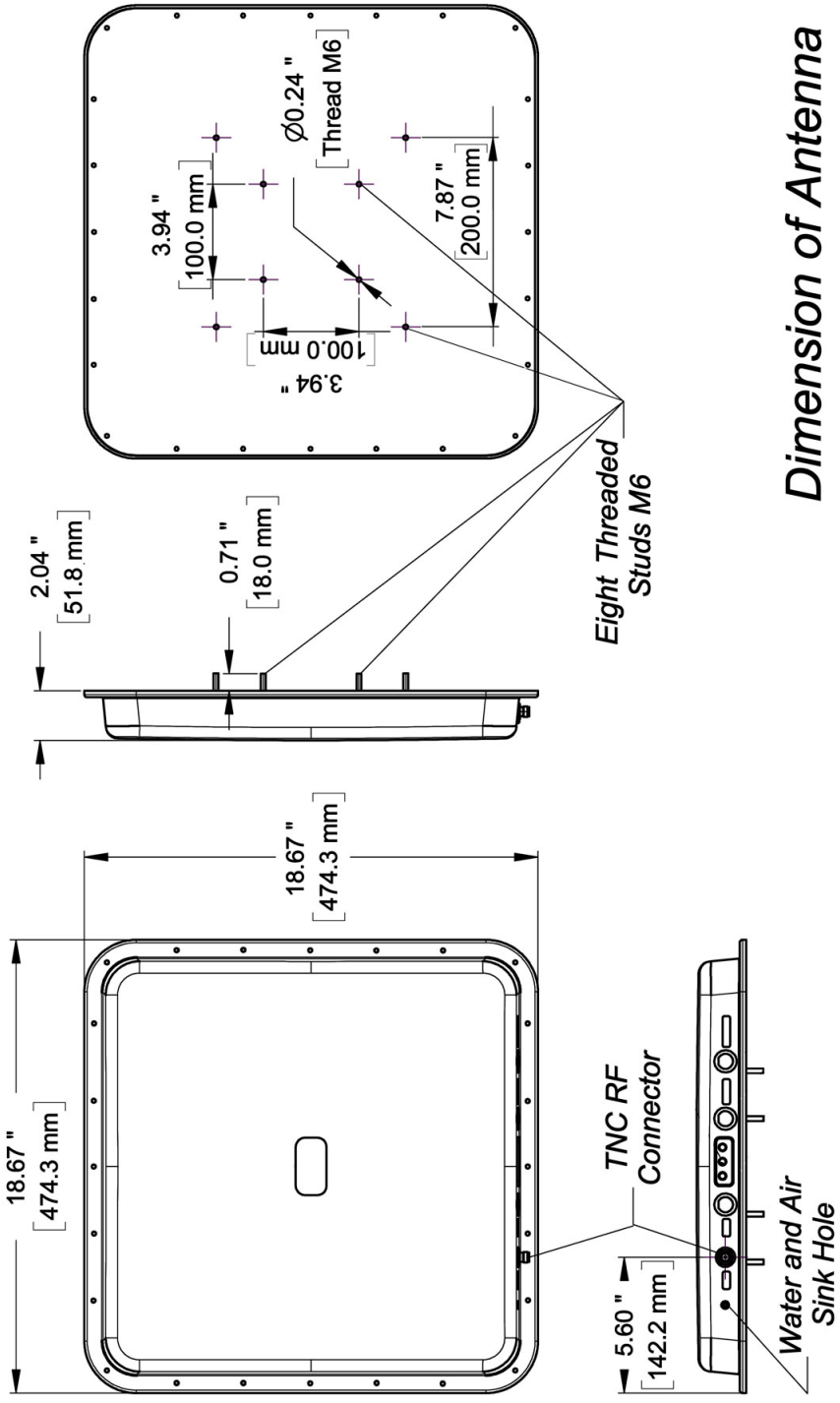


Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 0.446 Watt or +26.5dBm (FCC part 15.247 requirements).
- Free Space


Dimension of Antenna
Ø0.24 "
Thread M6
3.94 "
100.0 mm
7.87 "
200.0 mm
100.0 mm
3.94 "
Eight Threaded
Studs M6
2.04 "
51.8 mm
0.71 "
18.0 mm
18.67 "
474.3 mm
18.67 "
474.3 mm
TNC RF
Connector
5.60 "
142.2 mm
Water and Air
Sink Hole

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR within range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 23dB to 20dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +10dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for plastic enclosure with certain shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.3in/8mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

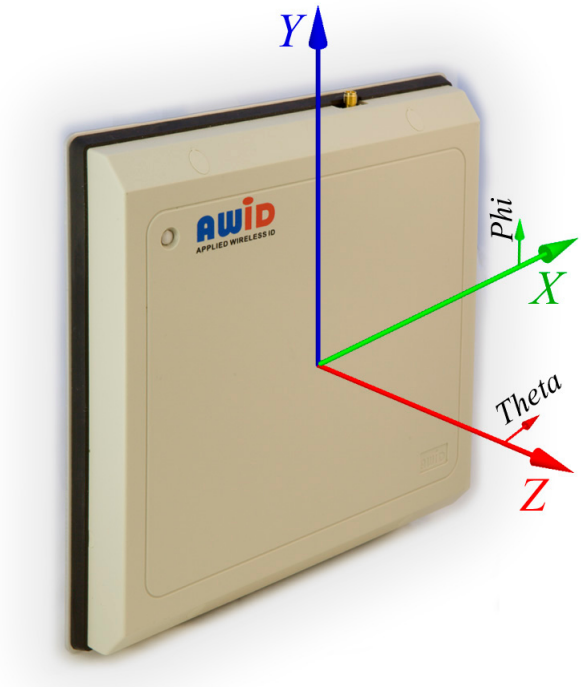
- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

This antenna is covered by US patent 7403158.

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Document rev.1.2, 04/19/2012



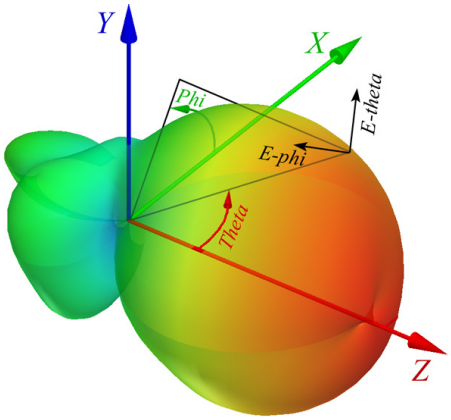
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Variation of the Maximum Gain is less than ±0.32dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 888 - 950MHz at the fixed Phi angle.
- It provides very low reflection of the transmitter signal into receiver. The return loss is more than 23dB.
- Moderate light – weight is 790g or 28oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year experience with design of RFID hardware.
Antenna provides uniform electromagnetic field which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for stationary and mobile applications.
It may be employed for outdoor installations with additional enclosure for protection against rain, snow and sun radiation.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	RHCP		Right hand circular polarization
Peak of Linear Polarized Realized Gain	+5.40	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+5.40 to +4.78 Δ=0.62	dBi dB	within Phi angle ±180^{O} and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	888.4 - 949.6 Δ=61.2	MHz MHz	Free or Open Space condition. Fixed Phi angle.
Front to Back Ratio of Radiation	13.4	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	38^{O} (±19^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	66^{O} (±33^{O})	degree	E-theta Component Free or Open Space condition.
Peak of the Circular Polarized Realized Gain.	+8.30	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	0.53	dB	within frequency band 902 – 928MHz
Maximum Axial Ratio within Cone with Theta=±30^{O}	3.5	dB	within frequency band 902 – 928MHz
Maximum input VSWR	1.15		Reference impedance is 50 Ohm. Within frequency band 902 – 928 MHz
Minimum Return Loss	23.0	dB	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	22.3 6.8	feet m	Transmitter Power is 1.0 Watt. RFID Tag is Alien Squiggle Inlay ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	20.8 – 22.3 6.3 – 6.8	Feet m	within Phi angle ±180^{O} and the frequency band 902 - 928MHz. Free or Open Space condition.
Frequency Bandwidth of ±5% Read Range Variation	888-950	MHz	Free or Open Space condition.
Width of the Cone with ±15% Read Range Variation	±30^{O}	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	4.6	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±3	%	In the bore-sight direction within frequency band 902 – 928MHz. Free or Open Space condition.
Reflection Coefficient	1/200	times	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.

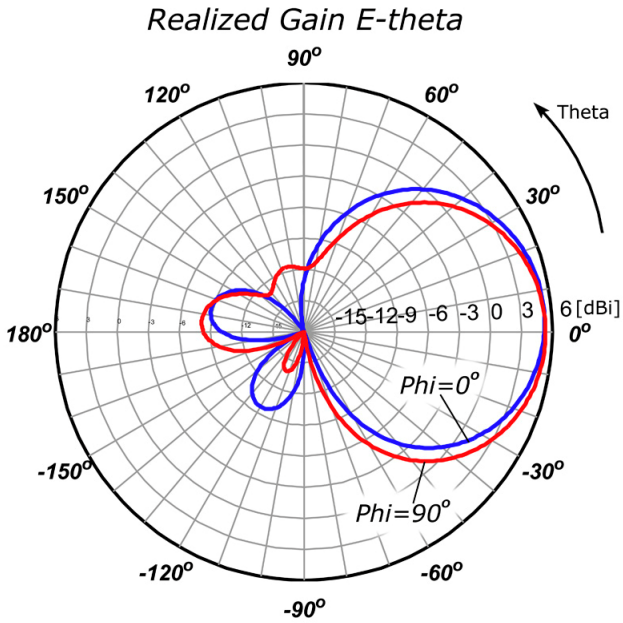
Environmental Specifications

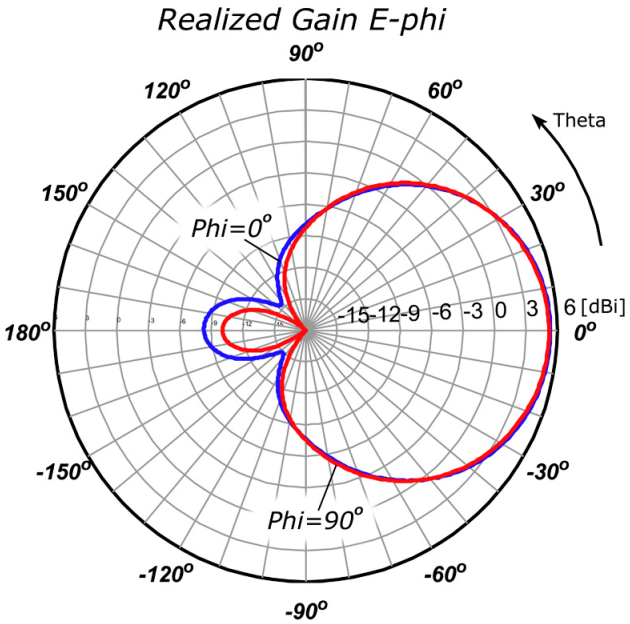
Parameter	Value	Units	Notes
Operation temperature	-30 +70	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	IP51		Antenna may be employed for outdoor installations with additional enclosure for protection against rain, snow and sun radiation.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	8.50 x 8.40 x 1.28 216 x 213 x 32.5	in mm	Details on mechanical drawing
Weight	29 790	oz g	Without mounting components and RF cable
RF Connector	SMA		Reverse Polarity
Enclosure Material	Plastic ABS Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

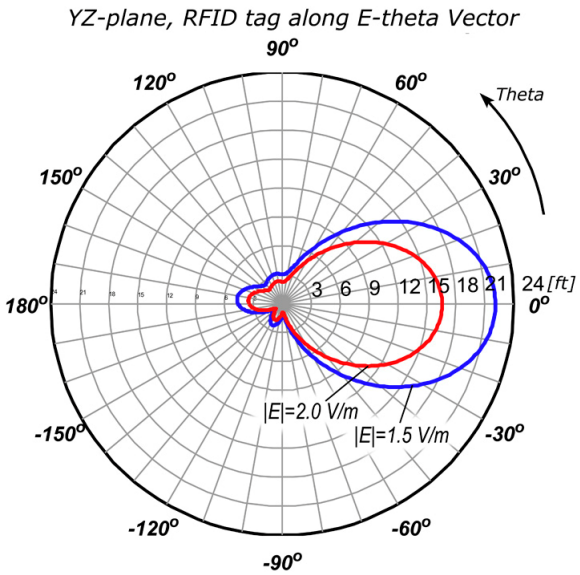
2-D Radiation Patterns in free space

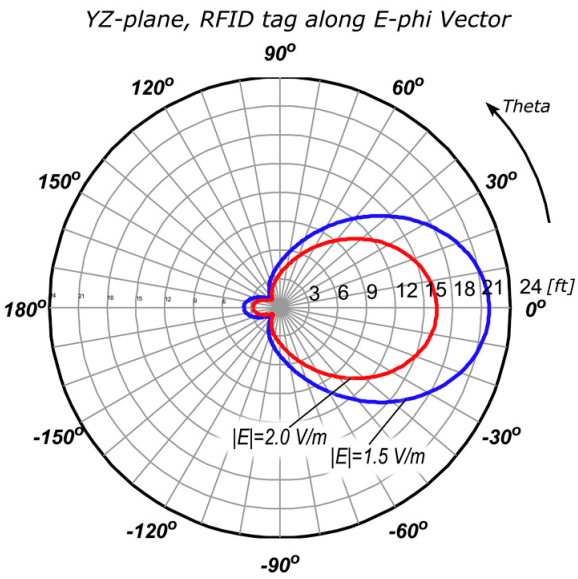


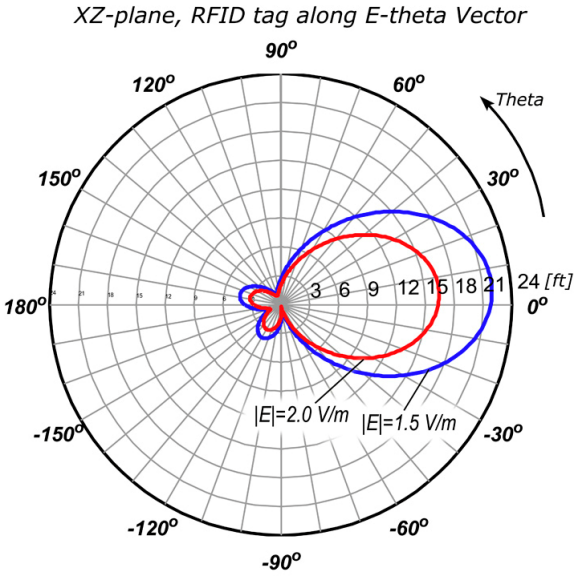


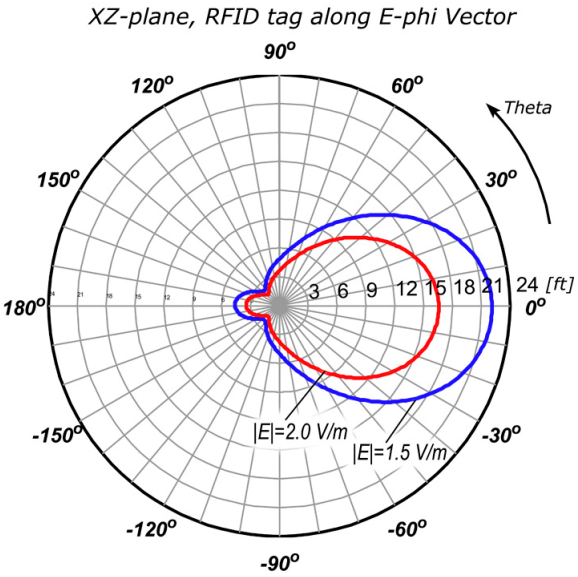
- Frequency is 915 MHz.
- Free space condition.

2-D Read Range Patterns





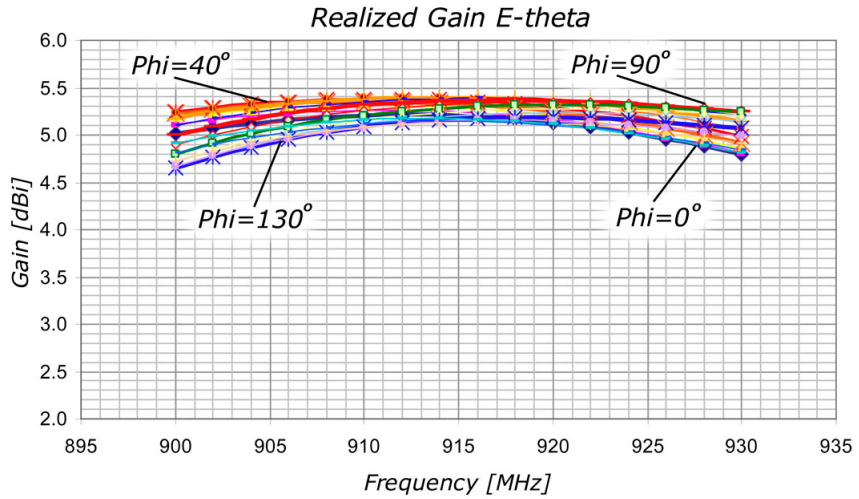




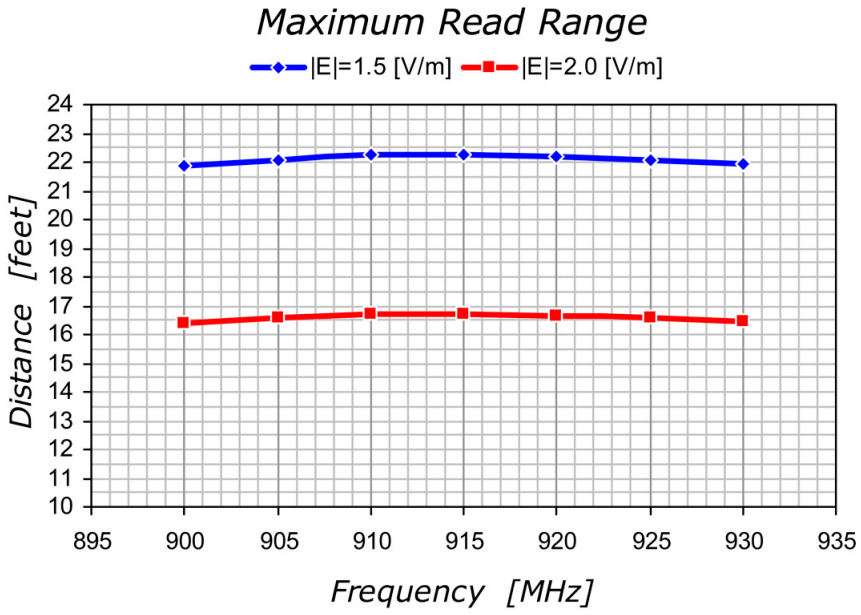
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 915 MHz
- Free Space

Frequency Response Diagram

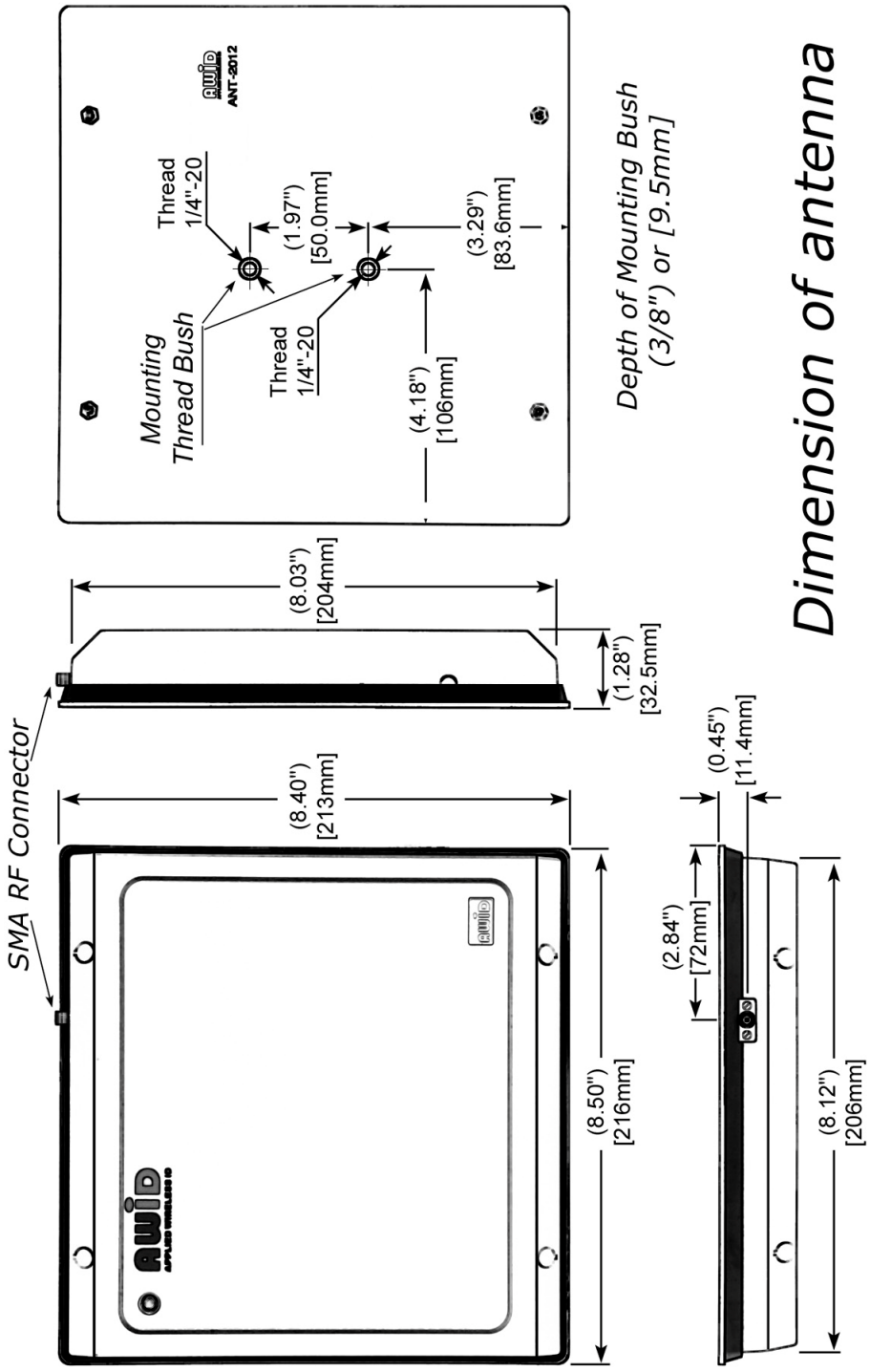


Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space


Dimension of antenna
Depth of Mounting Bush
(3/8") or [9.5mm]
Mounting
Thread Bush
Thread
1/4"-20
(1.97")
[50.0mm]
(3.29")
[83.6mm]
Thread
1/4"-20
(4.18")
[106mm]
SMA RF Connector
(8.03")
[204mm]
(1.28")
[32.5mm]
(8.40")
[213mm]
(8.50")
[216mm]
(0.45")
[11.4mm]
(2.84")
[72mm]
(8.12")
[206mm]

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR within range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 23dB to 10dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +20dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on the Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for plastic enclosure with certain shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different or additional plastic enclosure, but may require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.3in/8mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

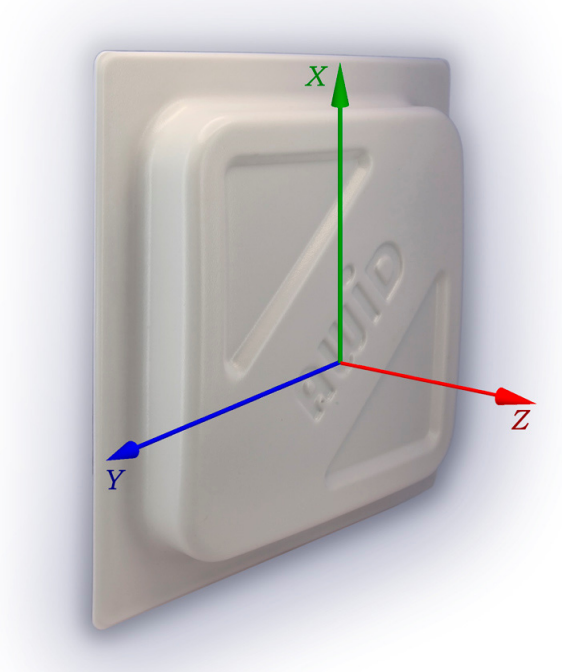
2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

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ANT-915-CPS rev.1.4a – Data Sheet
Circular Polarized Antenna for RFID

Document rev.1.3, 04/04/2012



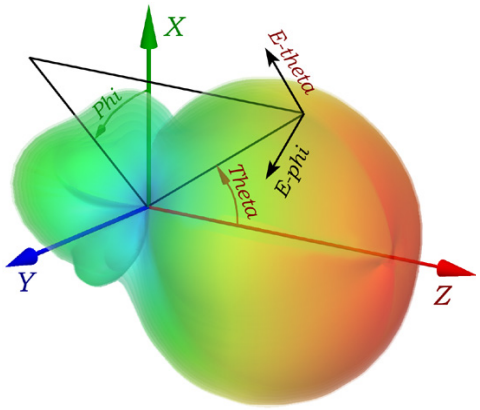
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Variation of the Maximum Gain is less than ±0.8dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 876-973MHz at the fixed Phi angle.
- It provides very low reflection of the transmitter signal into receiver. The return loss is more than 24dB.
- Light – weight is 482g or 17oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year experience with design of RFID hardware.
Antenna provides uniform electromagnetic field which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for stationary indoor applications.
It is optimized for USA frequency band 902-928MHz, but may be employed for European 865-869MHz and Japanese 950-955MHz frequency bands with some degradation of the gain and VSWR.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	RHCP		Right hand circular polarization
Peak of Linear Polarized Realized Gain	+5.84	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+5.84 to +4.32 Δ=1.52	dBi dB	within Phi angle ±180^{O} and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	876-973 Δ=97	MHz MHz	Free or Open Space condition. Fixed Phi angle.
Front to Back Ratio of Radiation	16.0	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	36^{O} (±18^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	64^{O} (±32^{O})	degree	E-theta Component Free or Open Space condition.
Peak of Circular Polarized Realized Gain.	+8.35	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	1.52	dB	within frequency band 902 – 928MHz
Maximum Axial Ratio within Cone with Theta=±30^{O}	3.0	dB	within frequency band 902 – 928MHz
Maximum input VSWR	1.12		Reference impedance is 50 Ohm. Within frequency band 902 – 928 MHz
Minimum Return Loss	24.9	dB	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Electrical Specifications
within extended operational frequency

Parameter	Value	Units	Notes
Frequency Band	865 – 869	MHz	European countries
Variation of Maximum Linear Polarized Realized Gain	+4.8 to +2.6 Δ=2.1	dBi dB	E-theta or E-phi Component (for RFID application)within Phi angle ±180^{O} and the frequency band 865 - 869MHz Free or Open Space condition.
Maximum of the Circular Polarized Realized Gain.	+7.0	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	1.99	dB	within frequency band 865 – 869MHz
Minimum Return Loss	21.3	dB	Reflection of the transmitter signal into receiver within frequency band 865-869MHz.
Maximum input VSWR	1.19		Reference impedance is 50 Ohm. Within frequency band 865 – 869 MHz

Parameter	Value	Units	Notes
Frequency Band	950 – 955	MHz	Japan
Variation of Maximum Linear Polarized Realized Gain	+5.62 to +3.38 Δ=2.24	dBi dB	E-theta or E-phi Component (for RFID application)within Phi angle ±180^{O} and the frequency band 950 - 955MHz Free or Open Space condition.
Maximum of the Circular Polarized Realized Gain.	+7.92	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	2.18	dB	within frequency band 950 – 955MHz
Minimum Return Loss	21.7	dB	Reflection of the transmitter signal into receiver within frequency band 950-955MHz.
Maximum input VSWR	1.18		Reference impedance is 50 Ohm. Within frequency band 950 – 955 MHz

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	23.5 7.2	feet m	Transmitter Power is 1.0 Watt. RFID Tag is Alien Squiggle Inlay ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	19.7 – 23.5 6.0 – 7.2	Feet m	within Phi angle $\pm 180^{O}$ and the frequency band 902 - 928MHz
Frequency Bandwidth of ±5% Read Range Variation	876-973	MHz	Free or Open Space condition.
Width of the Cone with ±15% Read Range Variation	$\pm 30^{O}$	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	5.9	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±7	%	In the bore-sight direction within frequency band 902 – 928MHz. Free or Open Space condition.
Reflection Coefficient	1/309	times	Reflection of the transmitter signal into receiver within frequency band 902-928MHz.

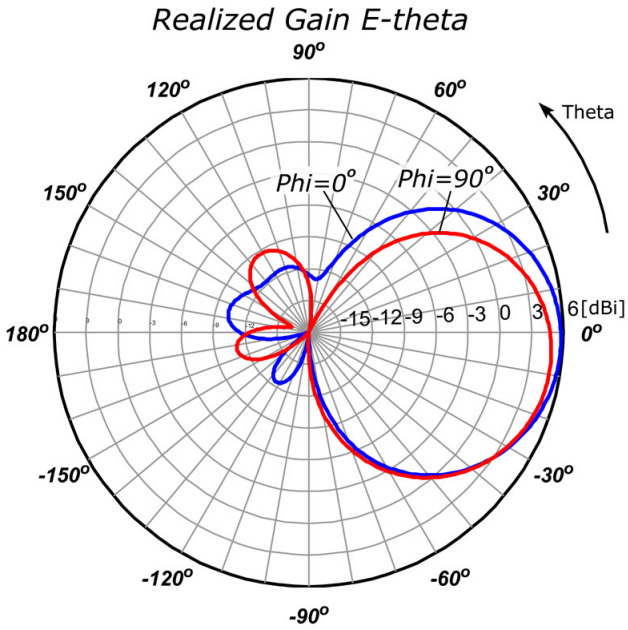
Environmental Specifications

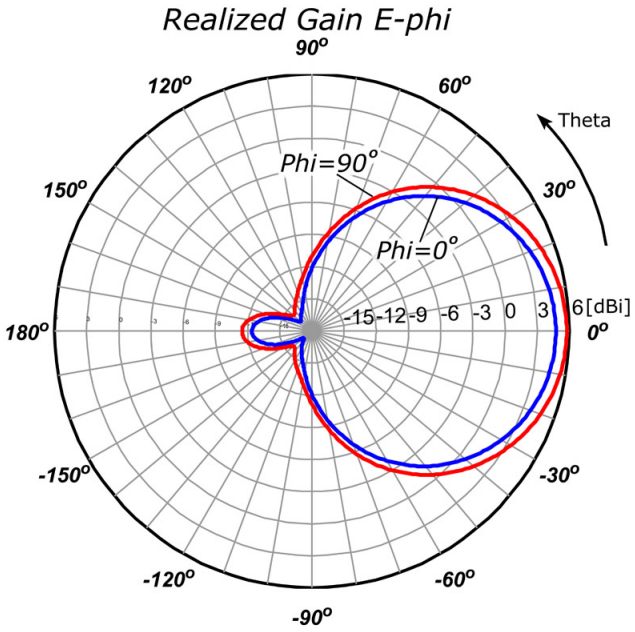
Parameter	Value	Units	Notes
Operation temperature	-10 +70	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	IP50		Antenna may be employed for indoor installations.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	10.25 x 10.25 x 1.42 260 x 260 x 36	in mm	Details on mechanical drawing
Weight	17 482	oz g	Without mounting components and RF cable
RF Connector	TNC		50 Ohm, Reverse Polarity
Enclosure Material	Plastic Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

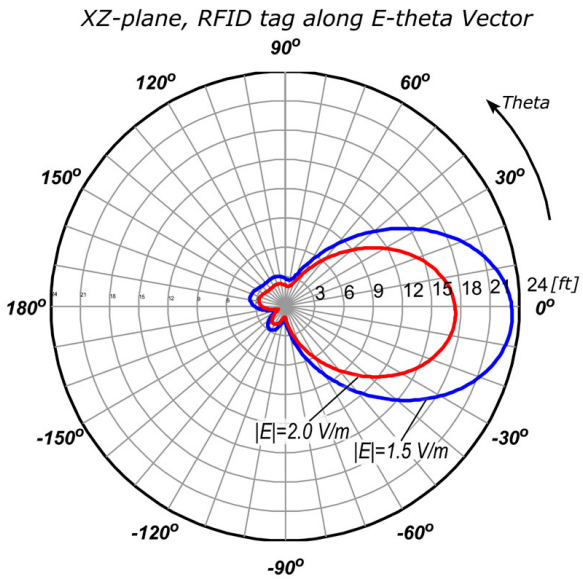
2-D Radiation Patterns in free space

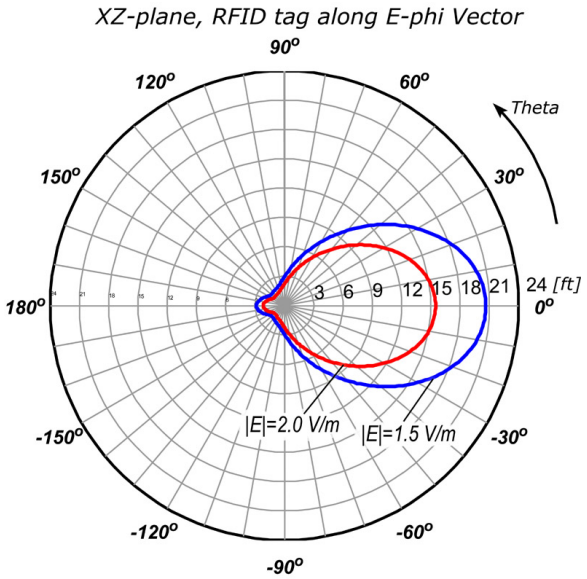


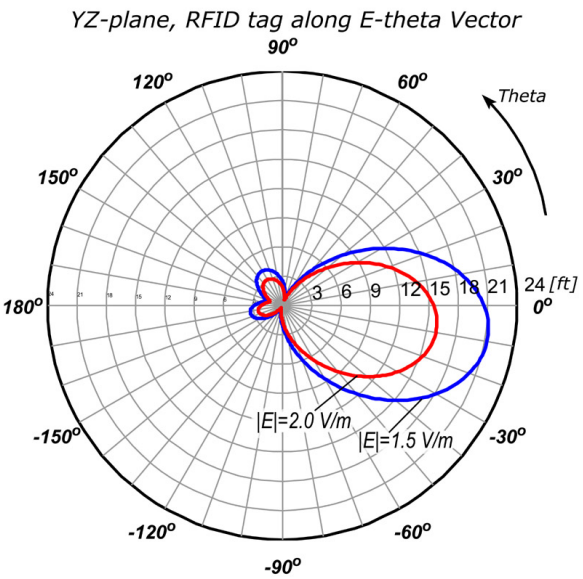


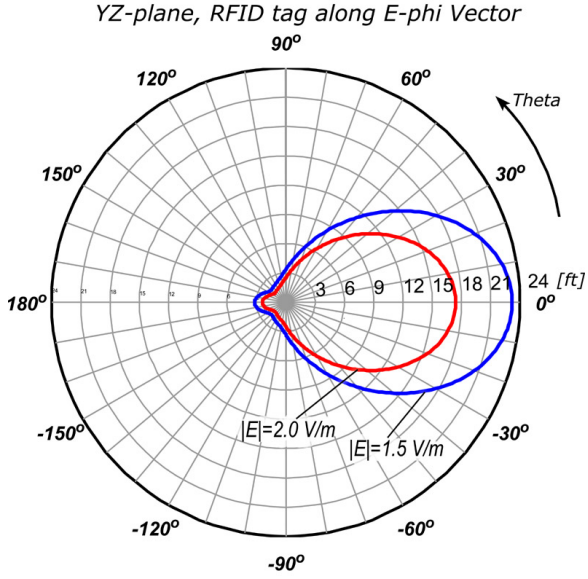
- Frequency is 915 MHz.
- Free space condition.

2-D Read Range Patterns





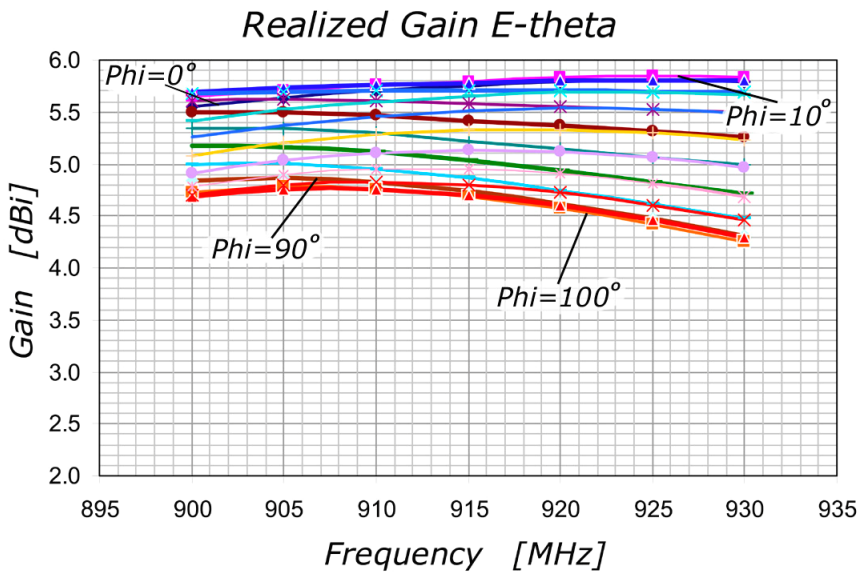




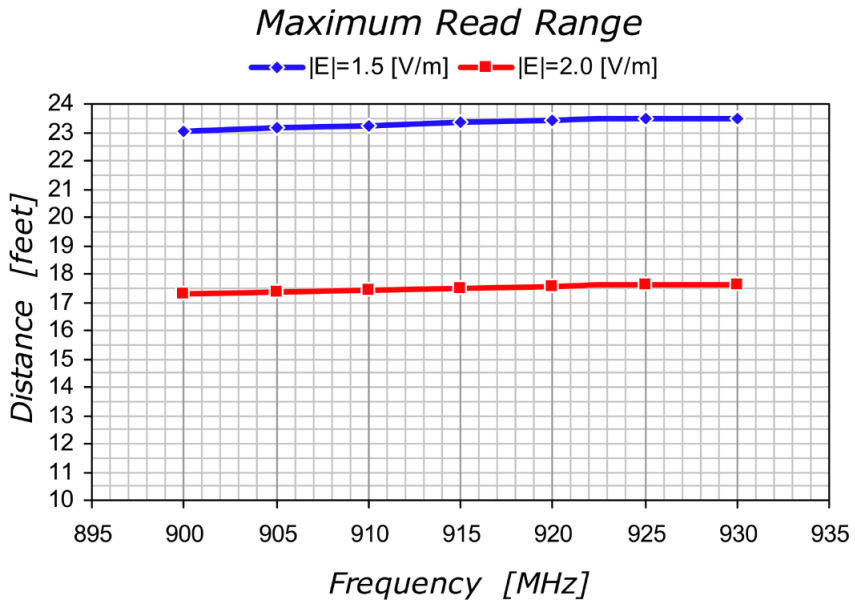
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 915 MHz
- Free Space

Frequency Response Diagram

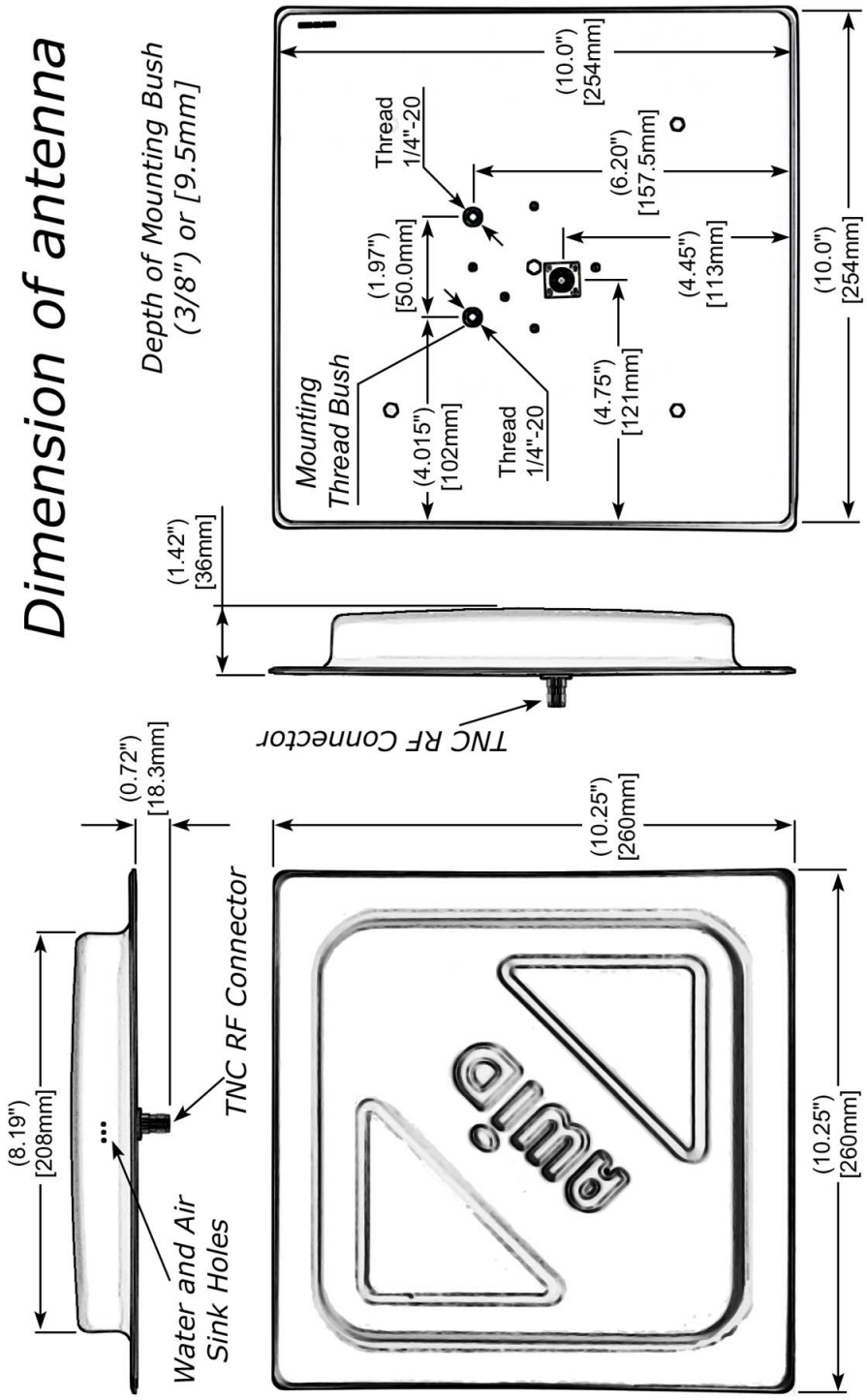


Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space


Dimension of antenna
Depth of Mounting Bush
(3/8") or [9.5mm]
(10.0")
[254mm]
Thread
1/4"-20
(6.20")
[157.5mm]
(1.97")
[50.0mm]
(4.45")
[113mm]
(10.0")
[254mm]
Mounting
Thread Bush
(4.015")
[102mm]
Thread
1/4"-20
(4.75")
[121mm]
(1.42")
[36mm]
TNC RF Connector
(0.72")
[18.3mm]
(10.25")
[260mm]
(8.19")
[208mm]
TNC RF Connector
Water and Air
Sink Holes
(10.25")
[260mm]

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR with range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 25dB to 20dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +10dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on Near Electric and Magnetic Fields distribution.

1. Requirement to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for plastic enclosure with certain shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different or additional plastic enclosure, but may require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.3in/8mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

2. Requirement to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

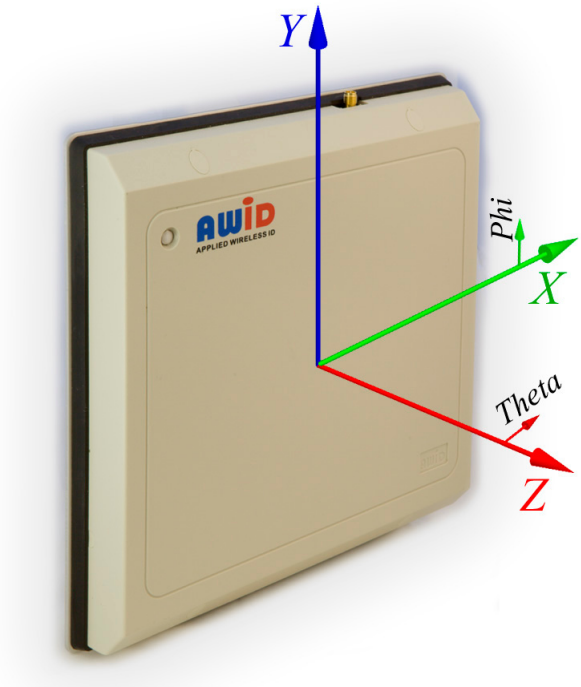
- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

This antenna is covered by US patent 7403158.

Applied Wireless Identifications Group, Inc.
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ANT-2082 rev.2.16a2 – Data Sheet
Circular Polarized Antenna for RFID

Document rev.1.1, 03/29/2012



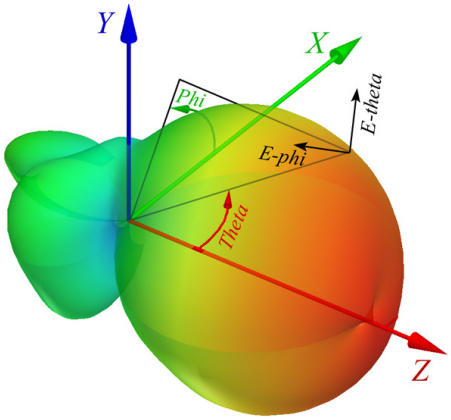
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Variation of the Maximum Gain is less than ±0.25dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 847-886MHz at the fixed Phi angle.
- It provides very low reflection of the transmitter signal into receiver. The return loss is more than 23dB.
- Moderate light – weight is 790g or 28oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along 10 year experience with design of RFID hardware.
Antenna provides uniform electromagnetic field which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for stationary and mobile applications.
It may be employed for outdoor installations with additional enclosure for protection against rain, snow and sun radiation.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	863 – 869	MHz	EU, Armenia, Croatia, Iceland, India, Iran, Jordan, Macedonia, New Zealand, Norway, Russian Federation, South Africa, Switzerland, Tunisia Turkey, United Arab Emirates.
Polarization	RHCP		Right hand circular polarization
Peak of Linear Polarized Realized Gain	+5.11	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+5.11 to +4.61 Δ=0.50	dBi dB	within Phi angle ±180^{O} and the frequency band 863 - 869MHz Free or Open Space condition.
-1dB radiation bandwidth	847-886 Δ=39	MHz MHz	Free or Open Space condition. Fixed Phi angle.
Front to Back Ratio of Radiation	14.2	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	38^{O} (±19^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	68^{O} (±34^{O})	degree	E-theta Component Free or Open Space condition.
Peak of the Circular Polarized Realized Gain.	+7.93	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	0.47	dB	within frequency band 863 – 869MHz
Maximum Axial Ratio within Cone with Theta=±30^{O}	2.4	dB	within frequency band 863 – 869MHz
Maximum input VSWR	1.15		Reference impedance is 50 Ohm. Within frequency band 863 – 869 MHz
Minimum Return Loss	23.1	dB	Reflection of the transmitter signal into receiver within frequency band 863-869MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	21 6.4	feet m	Transmitter Power is 1.0 Watt. RFID Tag is Alien Squiggle Inlay ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	20 – 21 6.1 – 6.4	Feet m	within Phi angle ±180^{O} and the frequency band 863 - 869MHz
Frequency Bandwidth of ±5% Read Range Variation	847-886	MHz	Free or Open Space condition.
Width of the Cone with ±12% Read Range Variation	±30^{O}	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	3.5	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±3	%	In the bore-sight direction within frequency band 863 – 869MHz. Free or Open Space condition.
Reflection Coefficient	1/200	times	Reflection of the transmitter signal into receiver within frequency band 863-869MHz.

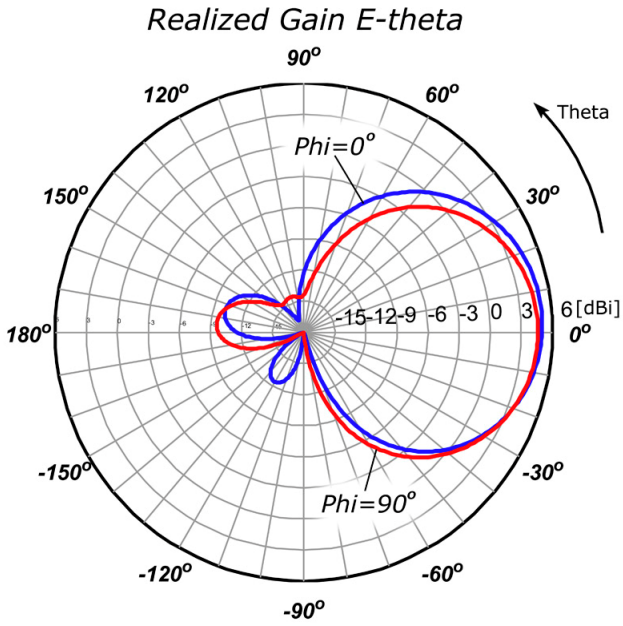
Environmental Specifications

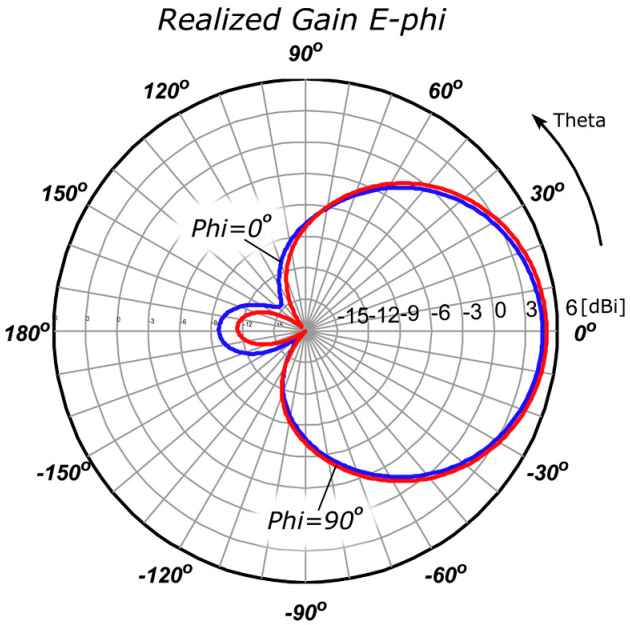
Parameter	Value	Units	Notes
Operation temperature	-30 +70	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		EU
IP Rating	IP51		Antenna may be employed for outdoor installations with additional enclosure for protection against rain, snow and sun radiation.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	8.50 x 8.40 x 1.28 216 x 213 x 32.5	in mm	Details on mechanical drawing
Weight	28 790	oz g	Without mounting components and RF cable.
RF Connector	SMA		Reverse Polarity
Enclosure Material	Plastic ABS Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

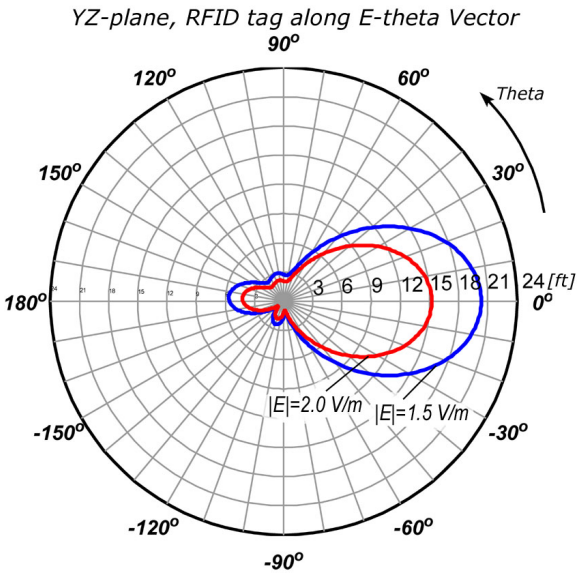
2-D Radiation Patterns in free space

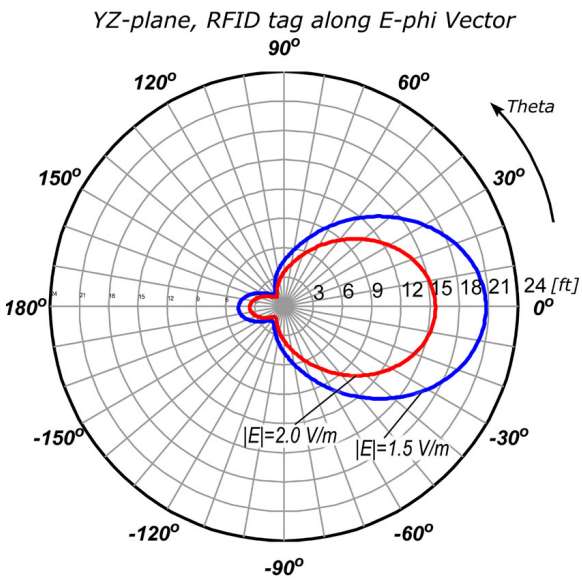


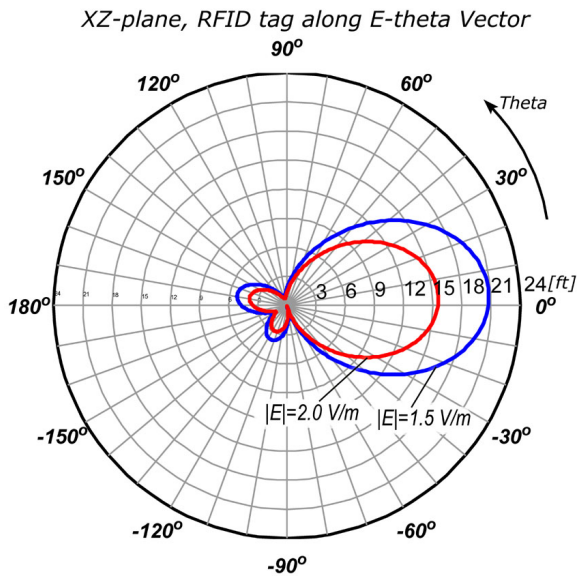


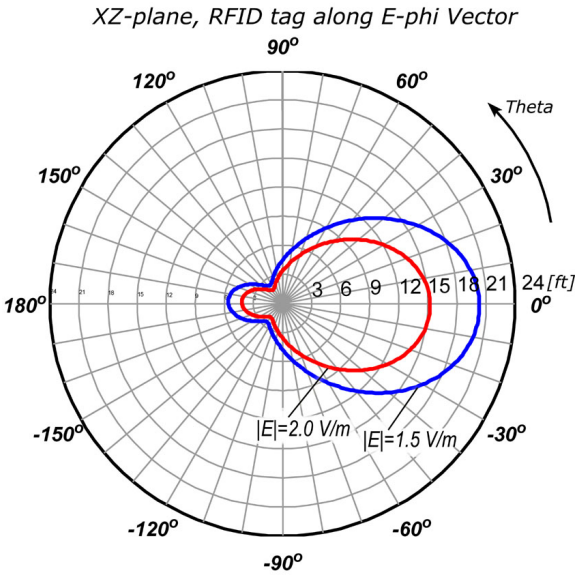
- Frequency is 866 MHz.
- Free space condition.

2-D Read Range Patterns





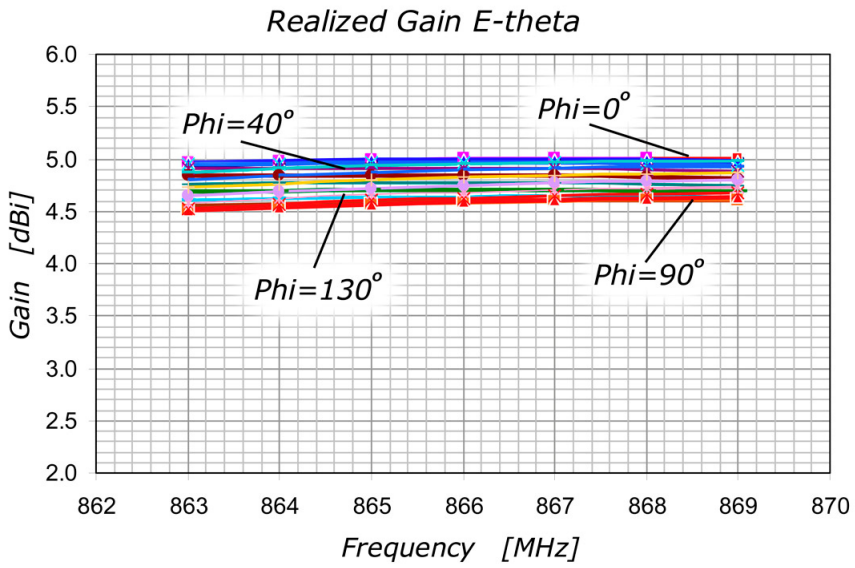




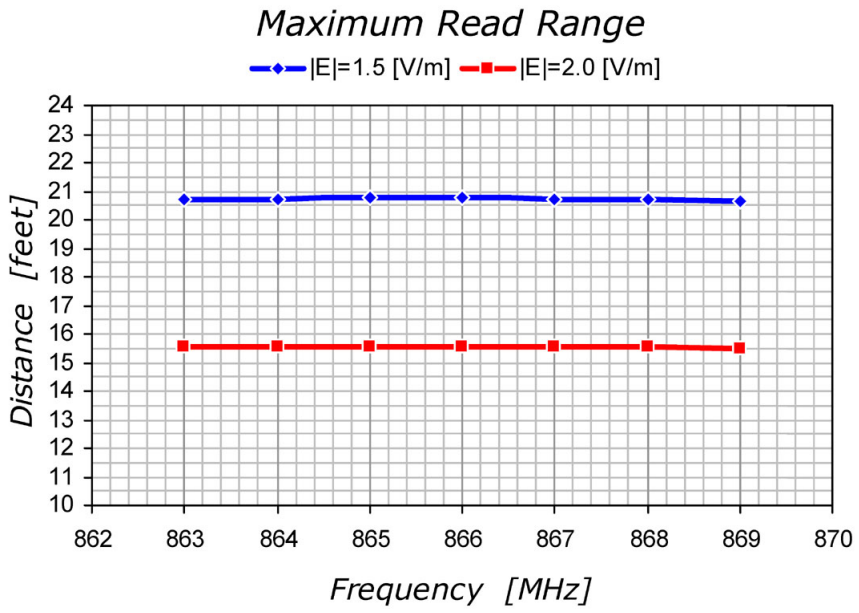
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 866 MHz
- Free Space

Frequency Response Diagram

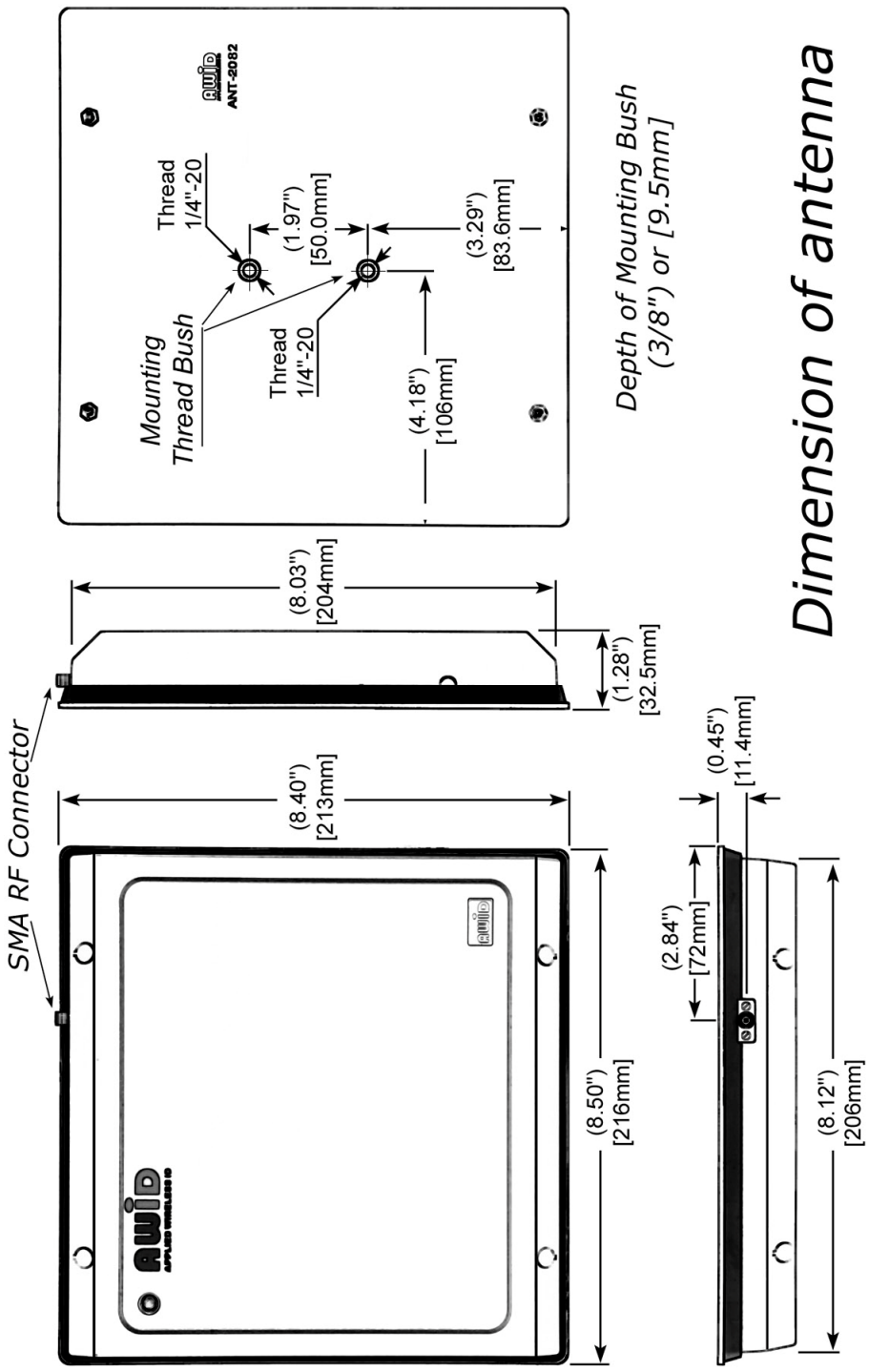


Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space


Dimension of antenna
Depth of Mounting Bush
(3/8") or [9.5mm]
Mounting
Thread Bush
Thread
1/4"-20
(1.97")
[50.0mm]
(3.29")
[83.6mm]
Thread
1/4"-20
(4.18")
[106mm]
ANT-2082
SMA RF Connector
(8.03")
[204mm]
(1.28")
[32.5mm]
(8.40")
[213mm]
(8.50")
[216mm]
(0.45")
[11.4mm]
(2.84")
[72mm]
(8.12")
[206mm]

Notes

Return Loss parameter requirements

The RFID transceiver transmits the signal to the antenna. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will be reflected back from the not perfectly matched input port of antenna back to the receiver of the RFID transceiver. The amount of this reflected energy is defined by return loss, or VSWR of the antenna.

Conventional wireless communication systems, in which the transmitted signal and the received signal are separated in time or/and by the frequency of the carrier, may employ antennas with VSWR with range 1.5-2.0 as good or tolerable, because more than 90% of transceiver power will be accepted by antenna.

For RFID system such value of VSWR is too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, “leaked” into the receiver. In some cases, high level of reflection may damage the receiver components.

Antenna has to have VSWR less than 1.20-1.30 or the return loss more than 18-20dB for RFID applications. For instance, the reduction of antenna VSWR from 2.0 to 1.2 may improve the signal to noise ratio in the receiver by 11.3dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the return loss from 23dB to 10dB. Users should be sure that the RFID transceiver is able to tolerate the signal at the receiver up to +20dBm.

Note for installation to prevent the degradation of antenna performance.

It is based on Near Electric and Magnetic Fields distribution.

1. Requirements to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for plastic enclosure with certain shape and dielectric constant and loss tangent of plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different or additional plastic enclosure, but may require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of antenna.

- Any nonconductive objects have to be position 0.3in/8mm away from sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

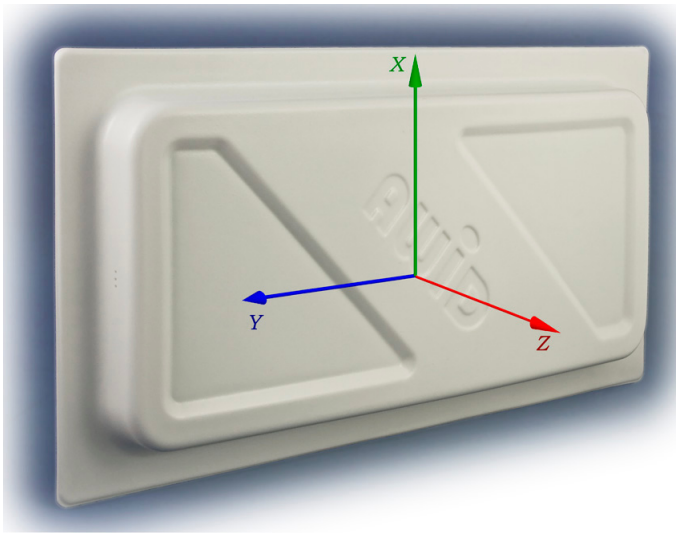
2. Requirements to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

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ANT-915-CPD rev.1.4a – Data Sheet
Bi-Static Circular Polarized Antenna for RFID

Document rev.1.3, 04/19/2012



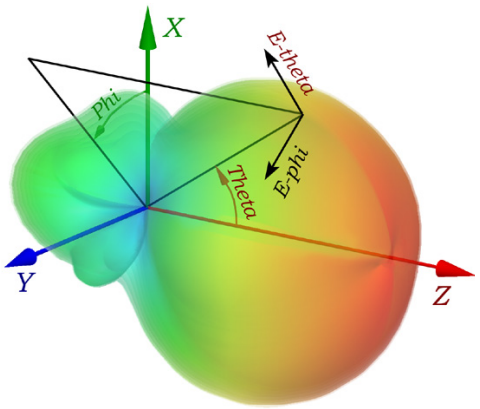
Features

- Maximum achieved realized gain and frequency bandwidth within moderate volume.
- Variation of the Maximum Gain is less than ±0.88dB in Z direction at any Phi angle within operational frequency band.
- Variation of the Maximum Gain is less than ±0.5dB within the frequency band 876 - 973MHz at the fixed Phi angle.
- Very low coupling of the transmitter signal into receiver. The isolation is more than 29dB.
- Moderate light – weight is 943g or 33.3oz.

Overview

This antenna is designed by RFID company for RFID applications. Requirements for parameters of the antenna were formulated along more than 10 year experience with design of RFID hardware.
It is intended for application with RFID interrogator architecture with separate transmitter and receiver RF ports to provide better interrogation rate and range.
Antenna provides uniform electromagnetic field, which guaranties the stability of tag interrogation at any position.
Size, weight and gain of the antenna are optimized for stationary applications.
It may be employed for indoor installations.

Radiation Pattern Definition



Electrical Specifications

Parameter	Value	Units	Notes
Operational Frequency Band	902 – 928	MHz	North America, China, Taiwan, Singapore, Korea, Australia
Polarization	RHCP		Right hand circular polarization
Peak of Linear Polarized Realized Gain	+5.77	dBi	E-theta or E-phi Component (for RFID application) Without coaxial cable
Variation of Maximum Gain	+5.77 to +4.02 Δ=1.75	dBi dB	within Phi angle ±180^{O} and the frequency band 902 - 928MHz Free or Open Space condition.
-1dB radiation bandwidth	876 - 973 Δ=97	MHz MHz	Free or Open Space condition. Fixed Phi angle
Front to Back Ratio of Radiation	17	dB	Free or Open Space condition.
Width of the radiation pattern at -1dB from the maximum	36^{O} (±18^{O})	degree	E-theta Component Free or Open Space condition.
Width of the radiation pattern at -3dB from the maximum	64^{O} (±32^{O})	degree	E-theta Component Free or Open Space condition.
Peak of Circular Polarized Realized Gain.	+8.28	dBic	RHCP component. Free or Open Space condition.
Maximum Axial Ratio at the bore-sight direction	1.75	dB	within frequency band 902 – 928MHz
Maximum Axial Ratio within Cone with Theta=±30^{O}	4.0	dB	within frequency band 902 – 928MHz
Minimum Isolation between Ports	29	dB	within frequency band 902 – 928MHz
Maximum input VSWR	1.15		Reference impedance is 50 Ohm. Within frequency band 902 – 928 MHz
Minimum Return Loss	23.1	dB	Reflection of the transmitter signal back to transmitter within frequency band 902-928MHz.
Maximum Input Power	5.0	Watt	In Operational Frequency Band

Parameters for RFID Applications

Parameter	Value	Units	Notes
Maximum Read Range	23.1 7.1	feet m	Transmitter Power is 1.0 Watt. RFID Tag is Alien Squiggle Inlay ALN-9540, Higgs-2 RFID IC Free or Open Space condition.
Variation of Maximum Read Range	18.9 – 23.1 5.8 – 7.1	Feet m	within Phi angle $\pm 180^{O}$ and the frequency band 902 - 928MHz
Frequency Bandwidth of ±5% Read Range Variation	876-973	MHz	Free or Open Space condition. Fixed Phi angle
Width of the Cone with ±15% Read Range Variation	$\pm 30^{O}$	degree	Free or Open Space condition.
Front to Back Ratio of Read Range	7.1	times	Free or Open Space condition.
Maximum Axial Ratio of the Read Range	±11	%	In the bore-sight direction within frequency band 902 – 928MHz. Free or Open Space condition.
Coupling Coefficient	1/631	times	Coupling of the transmitter signal into receiver port within frequency band 902-928MHz.

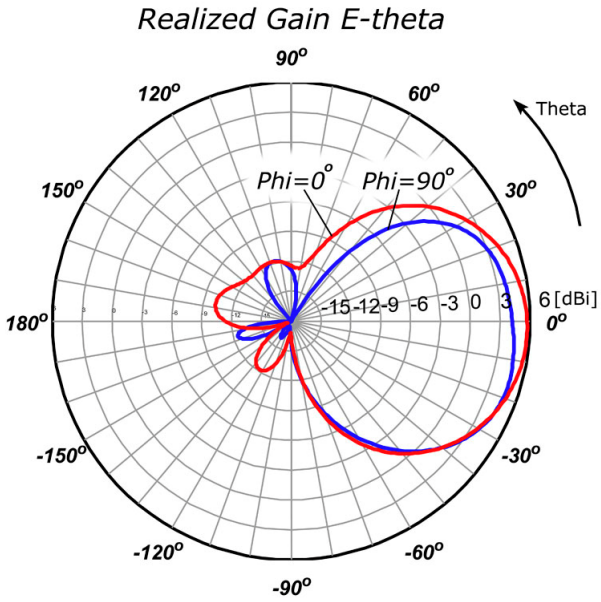
Environmental Specifications

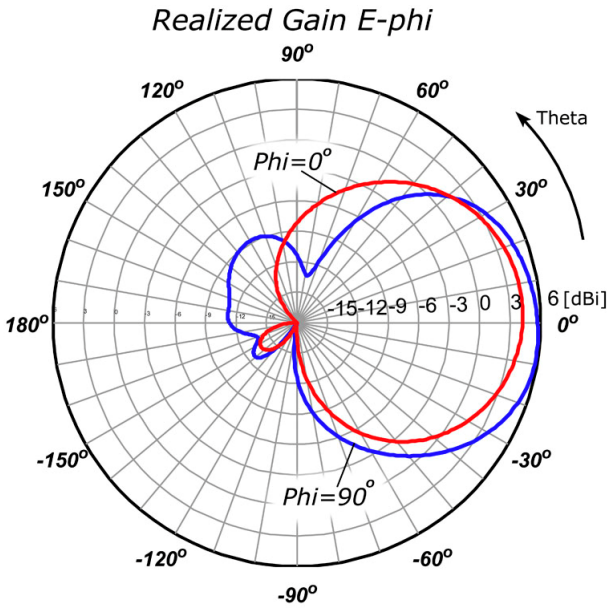
Parameter	Value	Units	Notes
Operation temperature	-10 +70	^{O}C	Ambient
Humidity	5-90	%	Relative, non-condensing
RoHS	Yes		North America, China, Taiwan
IP Rating	IP50		Antenna may be employed for indoor installations.

Mechanical Specifications

Parameter	Value	Units	Notes
Dimension	20.25 x 10.25 x 1.54 514 x 260 x 39	in mm	Details on mechanical drawing
Weight	33.3 943	oz g	Without mounting components and RF cable
RF Connector	TNC		Reverse Polarity
Enclosure Material	Plastic Aluminum Alloy		Electrical parameters of antenna depend on Dielectric Constant and Loss of material and dimension of enclosure.

2-D Radiation Patterns in free space

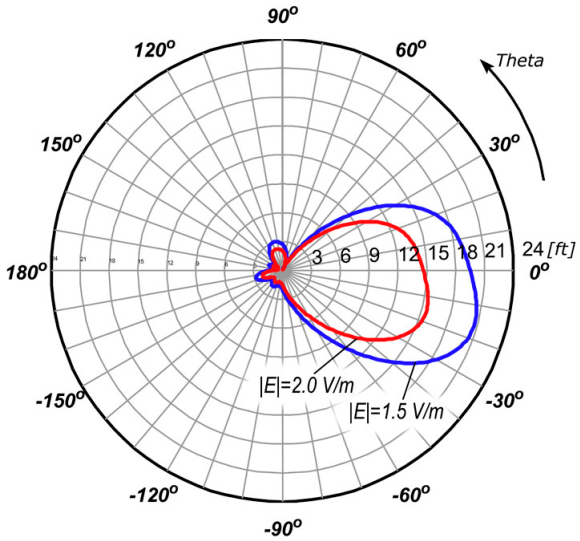




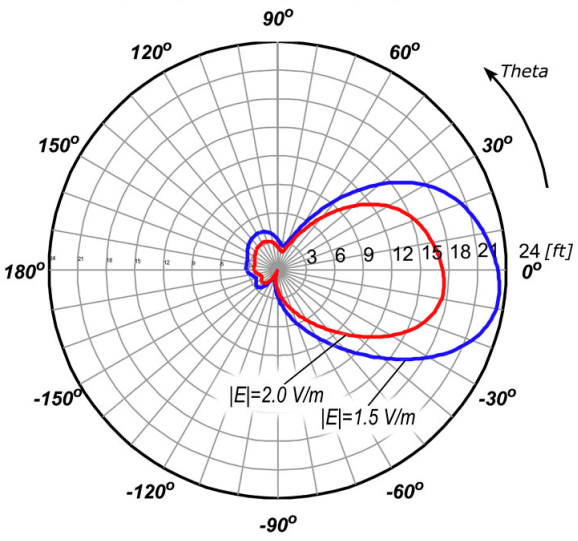
- Frequency is 915 MHz.
- Free space condition.

2-D Read Range Patterns

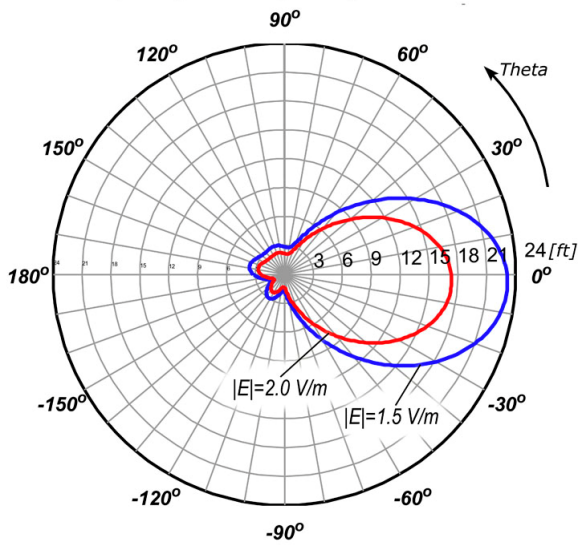
YZ-plane, RFID tag along E-theta Vector



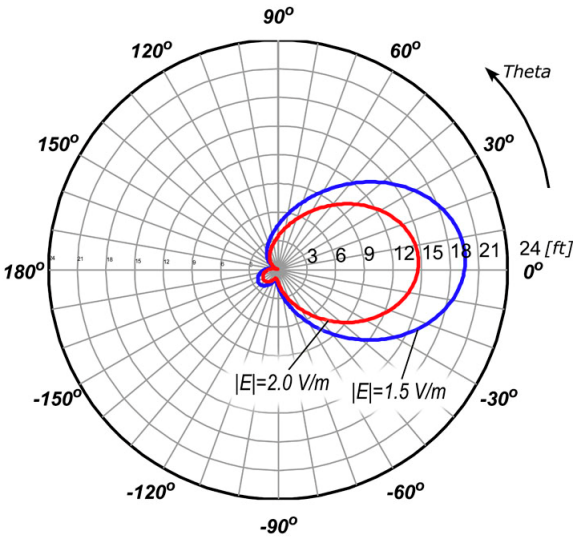
YZ-plane, RFID tag along E-phi Vector



XZ-plane, RFID tag along E-theta Vector



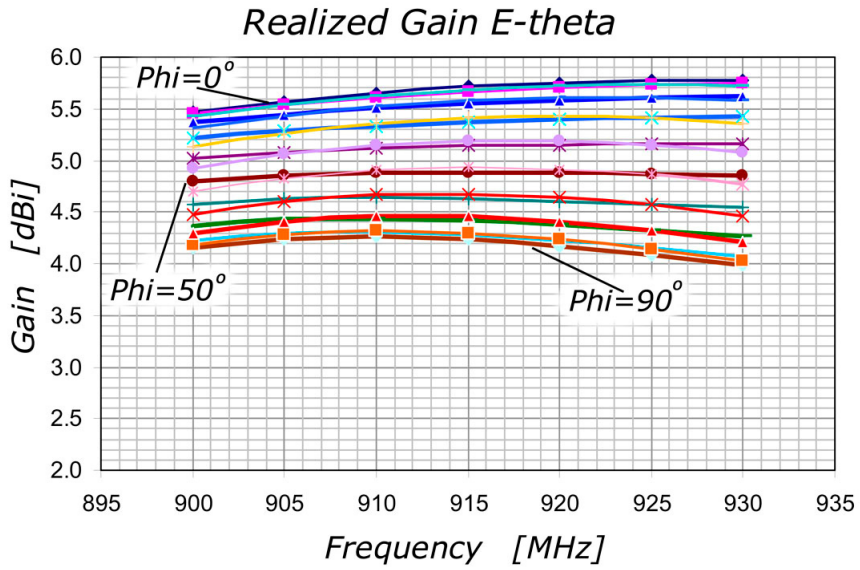
XZ-plane, RFID tag along E-phi Vector



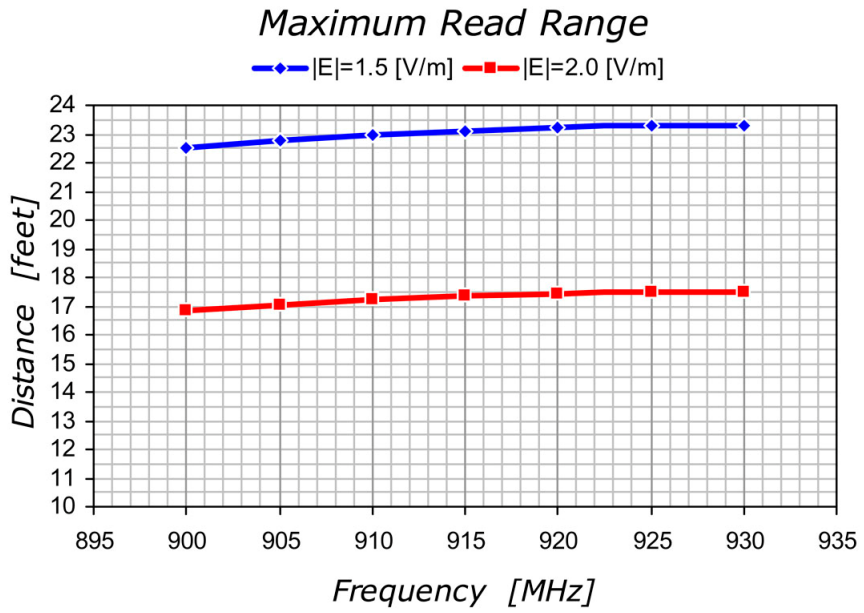
The Read Range Patterns illustrate the reading zones for two tags. One zone is for the tags require the activation field strength 1.5 [V/m]. It corresponds approximately to the Alien Squiggle Inlay "ALN-9540" with Higgs-2 RFID IC or NXP SL3ICS1202. Second zone is for tags require the activation field strength 2.0 [V/m]. It corresponds approximately to the tag with Impinj "Monza-2" RFID IC.
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Frequency is 915 MHz
- Free Space

Frequency Response Diagram

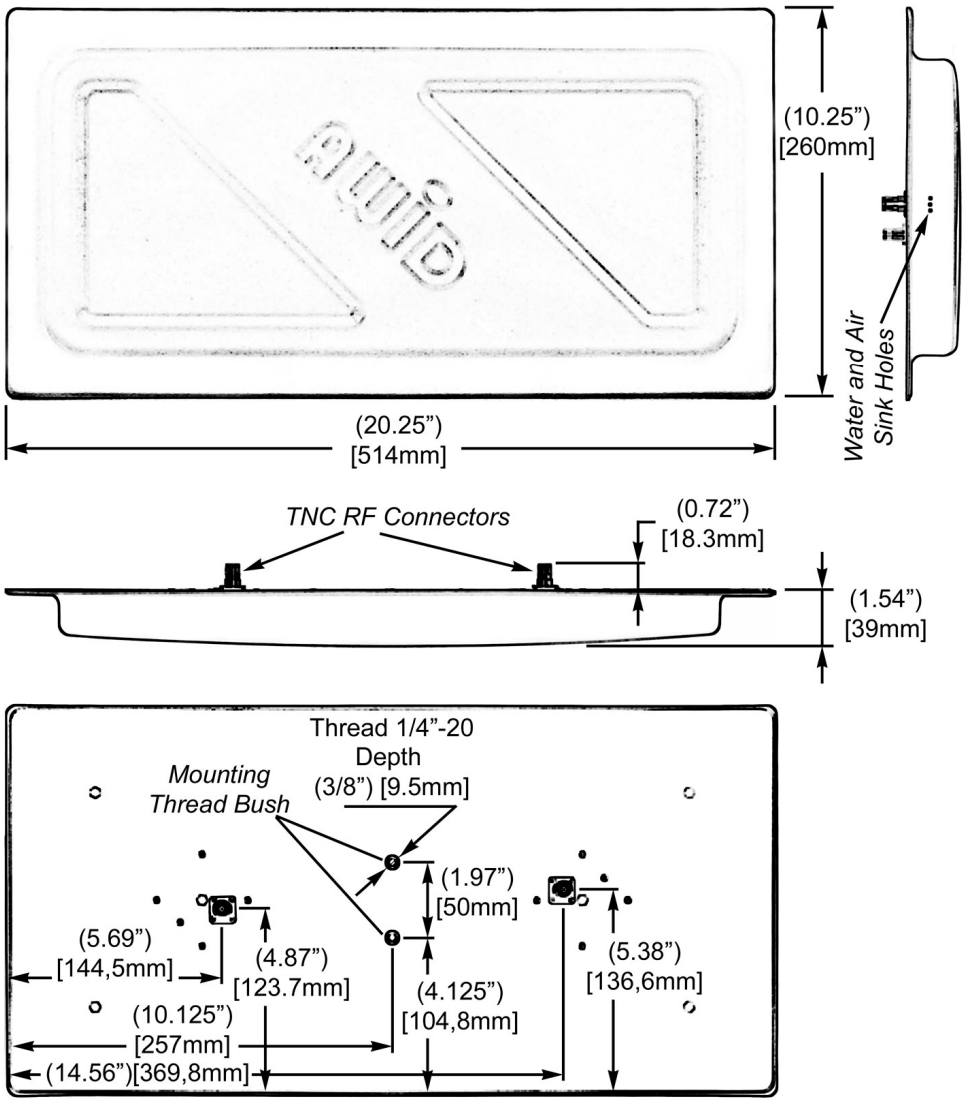


Angle Phi variation is from 0^{O} to $+180^{O}$, angle Theta is 0^{O}.



The Blue Curve corresponds to the tags require the activation field strength 1.5 [V/m]. The Red Curve corresponds to the tags require the activation field strength 2.0 [V/m].
Radiation conditions are:

- Transmitter Power is 1.0 Watt.
- Free Space



Dimension of Antenna

Notes

Ports Isolation parameter requirement.

The RFID transceiver transmits the signal to the antenna port. Most of the transmitted energy will be radiated from the antenna into the space. Small portion of the transmitted energy will couple to the receiver port of the RFID bi-static transceiver. The "Ports Isolation" of the antenna defines the amount of this coupled energy.

For RFID systems, the value of coupled energy has to be not too high, as the part of the noisy and strong transmitted signal is coming back to the sensitive receiver. This will degrade the performance of RFID system, which noise floor is defined not by the noise figure of the receiver LNA or the mixer, but by the portion of the noisy signal from the transmitter, "leaked" into the receiver. In some cases, high level of coupling may damage the receiver components.

Antenna has to have Ports Isolations more than 20dB for RFID applications. For instance, by increasing the antenna Ports Isolation VSWR from 17 to 29 may improve the signal to noise ratio in the receiver by 12dB. This will significantly reduce the errors of decoding of the signals coming from the tags and increase the speed of interrogation.

Objects, positioned close to this antenna at the distance few inches away, may reduce the Ports Isolation from 29dB to 17dB. Users should be aware that the RFID transceiver is able to tolerate the signal at the receiver up to +10dBm only.

Note for installation to prevent the degradation of antenna performance.

It is based on the Near Electric and Magnetic Fields distribution.

1. Requirement to the position of nonconductive objects (plastics, ceramic, glass etc.).

This antenna is designed for plastic enclosure with certain shape and dielectric constant and loss tangent of the plastic material. Any deviation from the dedicated enclosure will affect the performance of the antenna. Antenna may be installed into different or additional plastic enclosure, but may require minor correction of the tuning components.

The following statements are applicable for additional objects in vicinity of the antenna.

- Any nonconductive objects have to be position 0.3in/8mm away from the sides of the antenna.
- Any nonconductive objects have to be position 0.8in/20mm away from the front surface of the antenna.

2. Requirement to the position of conductive objects (metals, conductive solutions, conductive paints etc.).

- Any conductive objects have to be position 6in/150mm away from sides of the antenna.
- Any conductive objects have to be position 12in/300mm away from the front surface of the antenna.

This antenna is covered by US patent 7403158.