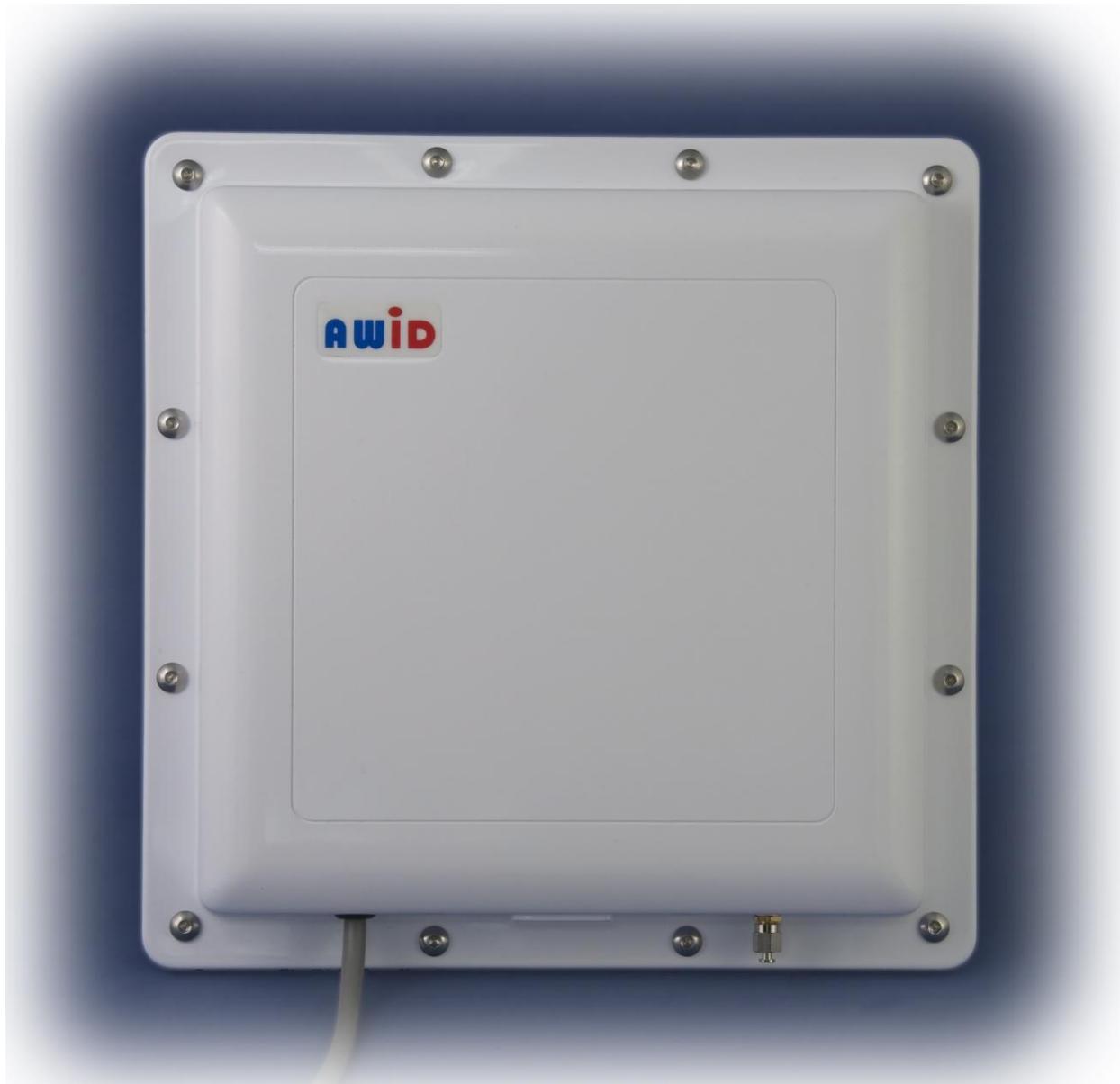


AWID LR-3000

LONG-RANGE AUTOMATED VEHICLE IDENTIFICATION READER Installation & Owner's Manual



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Applied Wireless Identifications Group, Inc.

18300 Sutter Boulevard Morgan Hill, CA 95037

<http://www.AWID.com>

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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

<u>Version No.</u>	<u>Date</u>	<u>Sections</u>	<u>Remarks</u>
1.0	June 2012	All	Initial version
1.6	September 2012	-	Misc. updates
2.0	July 2018	-	Editorial
2.1	November 2018	-	Editorial
2.2	January 2019	-	Editorial
3.0	January 2022	-	Editorial

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."

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.

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SECTION 1 - INTRODUCTION & SPECIFICATIONS

1.1 - INTRODUCTION

1.1.1 - GENERAL DESCRIPTION

AWID's LR-3000 reader is a rugged, weather resistant, long-range Radio Frequency Identification (RFID) reader that works with a selection of hands-free and vehicle mounted credentials. This reader comes with a unique combination of long read range, small size, and low power consumption. With a 12 volt DC supply, its' current consumption is less than 2.0 amperes, making it suitable for a large selection of commercial power supplies. The LR-3000 reader has simultaneous Wiegand and RS-232 outputs suitable for all Access Control Systems that have Wiegand or RS-232 Inputs.

1.1.2 - SPECIAL FEATURES

- IP-65 Rated Enclosure – Suitable for outdoor applications.
- Single small footprint for reader electronics, RF module, and antenna.
- Built-in LED indicator for power and activity.
- Easy to install using AWID's pan-and-tilt adjustable mounting bracket (LR-MB-0-0).
- Compatible with most commercial access control systems.
- Wide selection of credentials — 11 tags and cards.
- Unlimited credential life — passive; no battery.
- Can be interfaced to a PC or to a special application controller.
- Adjustable Radio Frequency (RF) attenuation* — settable RF field.
- Simultaneous Wiegand and RS-232 output.
- Reads from 26-bit to 50-bit format credentials.
- Built-in arming wire for use with vehicle ground loops.
- Flexible data output — variable read repetition rate.
- 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 (UHF).
- Passive tags assure small size, unlimited life, and easy mounting out of the driver's vision.
- Users do not need an FCC license.

1.1.3 - SUGGESTED APPLICATIONS

- Automated Vehicle Identification (AVI) for passenger cars, small trucks, big trucks and trailers, and railcars.
- Operation of vehicle gates and garage doors for authorized vehicles.
- Hands-free operation of doors and elevators for handicapped users (wheelchairs, gurneys) in ADA situations.
- Data collection using encoded cards and tags for input.

1.2 - SPECIFICATIONS

1.2.1 - LR-3000 READER

Input Voltage	Between +7 volts DC and +15 volts DC	
Input current (peak load):	At 7 volts	1.5 amperes
	At 12 volts	900 milliamperes
	At 15 volts	700 milliamperes
Read Distance	With UHF tags and cards	Up to 25' *
Frequency:	Transmitter	902 MHz to 928 MHz
	Receiver	902 MHz to 928 MHz
Frequency-hopping channels:	Number of channels	125 channels (Standard)
	Channel spacing	200 kHz
	Hopping sequence	Pseudo-random pattern
Output data interfaces:	Wiegand electrical protocol, and RS-232 serial (simultaneous transmission)	
Reader Housing:	Molded ABS plastic, on 1/8 inch aluminum back plate; white 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	IP65 rated, weather grommets

* Read distance is determined by which credential is being read. Refer to section 3.4 for more information.

1.2.2 - CABLE EXITING FROM LR-3000 READER

The cable that is integrated into the LR-3000 is 22 gauge, 10 conductors, multi-conductor wire, color-coded insulation, not twisted pairs, overall 100% shielded, 32 inches long. **(The 10-pin connector on the reader's cable is used for factory testing only. The installer removes the connector and strips the insulation.)**

Color Assignment:

Red	DC power, positive	Connect to power supply positive
Black	DC power, negative	Connect to power supply negative
Yellow	Enable RF transmission	Connect to reader's black wire for arming the RF generator.
Green	Wiegand interface, Data-0	Connect to Data-0
White	Wiegand interface, Data-1	Connect to Data-1
Blue	Data-Common	Connect to the panel's Data-Common or Common-Ground
Orange	RS-232 interface, Transmit Data	Connect to controller's Receive Data
Violet	RS-232 interface. Receive Data	Connect to controller's Transmit Data.
Brown	(not used)	Do not ground
Gray	Drain wire	Connect to shields of extended cables. Do not ground.

1.2.3 - WIRING 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 access control system, use these specifications —

- **Power cable:** 18 to 22 gauge, 2 conductors, multi-conductor wire, color-coded insulation, overall 100% shielded.
- **Data cable:** 22 gauge, 3 conductors, multi-conductor wire, color-coded insulation, not twisted pairs, overall 100% shielded. If power and data share the same cable, use these specifications —
- **Combined cable:** 18-22 gauge, 5 conductors, multi-conductor wire, color-coded insulation, not twisted pairs, overall 100% shielded.
- 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 suitable cable. **Voltage levels at the reader must be within specifications.**
- 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, or to each other, or to any other circuit.

1.2.4 - POWER SUPPLY

- The LR-3000 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 the reader to its' power supply only.
- For multiple readers, you may use a multi-section DC power supply. Note. The multi-section DC power supply must be isolated electrically from each other, have its own positive and negative terminals, and has sufficient current rating for the LR-3000 reader.
- The ideal power supply has a DC voltage and current rating of 12V at **3.0A** or more for the LR-3000 reader. This helps to assure that the current remains quiet and steady.
- The PS-123.3A plug-in power supply has been rigorously tested and is best suited for a single LR-3000 reader.
- The most common DC power supply has a nominal output voltage range of 12.0 volts to 13.8 volts (including power supplies for back-up batteries).
- Contact AWID's Technical Support for discussion of acceptable power supplies.

Voltage Applied to reader	Current Load of Reader (Max)	Current Rating of Power Supply (min)
12 Volts DC	900 mA	2.0A
15 Volts DC	700 mA	1.5A

1.2.5 - READER'S EFFECTIVE RF FIELD

- The effective RF field is a figure of rotation of this diagram about its horizontal axis. Polarity of transmitted RF is circular.
- The typical reading distance between 10 feet to 25 feet, depending upon the tag or card type and the reader mounting. The field's diameter is about 18 feet at its peak width.

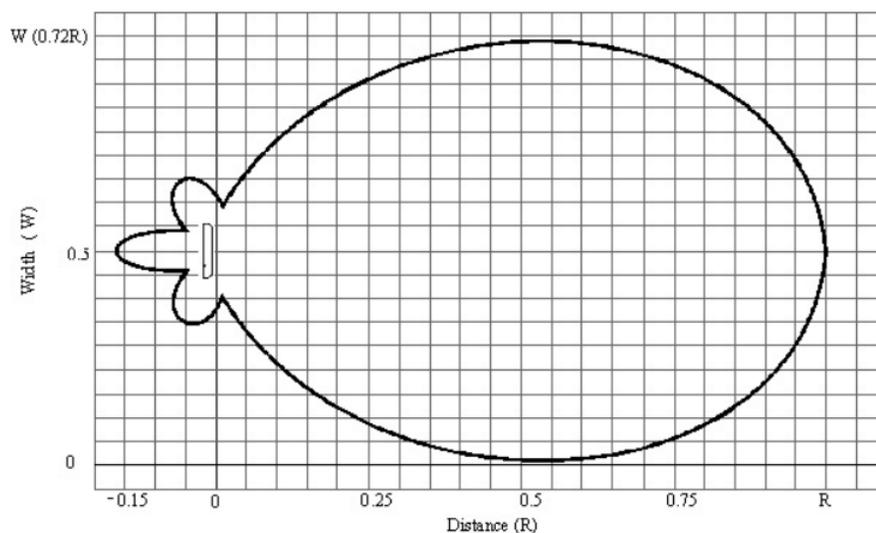


Figure 1 - RF Effective Field

SECTION 2 - PLANNING

2.1 - READER LOCATION

2.1 - INTRODUCTION

The LR- 3000 reader is designed for Automated Vehicle Identification (AVI). The main variables that must be considered in planning the readers and credentials for the system are —

- Reader location
- AC System Location
- Environmental Factors
- Lane characteristics
- Vehicle types
- Credential type

Reader location: The reader must have a minimum 2 ft clearance from metal and organic materials.

Access Control System Location: Access control systems are best installed in locations that place the system close to the reader, power source, and lane entry.

Environmental Factors: Radio-Frequency is heavily affected by metal and water. Large metal gates or garages, as well as plants or people greatly reduce the strength of the RF signal due to absorbing/reflecting the signal.

Lane characteristics: Be mindful of the lane entry location in conjunction with the readers mounting location.

Vehicle types: Determine the average type of vehicle in use, as well as, the average mounting height for credentials. Credential type: The reader may need different mounting locations or angles depending on the credential type. (Refer to section 3.4)

2.2 - PLANNING FACTORS

2.2.1 - INTRODUCTION

Preparation for the LR-3000 installation can save time during installation. The following topics cover the common questions. These topics apply generally to all forms of AWID UHF long-range readers. The environmental, electrical, interference and temperature range characteristics likewise apply to all forms of AWID UHF long-range reader.

2.2.2 - ENVIRONMENT

- **Physical obstructions:** The space around where the reader is mounted and aimed must be clear of obstructions. For best results; plan for line of sight from the reader to the credential with no obstructions in-between. (Including plants and metalized materials) Do not mount the reader within 2 feet of shrubbery or metal columns/posts.
- **Weather:** The LR-3000 has an IP65 rating. The LR-3000 reader can be installed outdoors; if ambient temperatures are very high, use a vehicle presence sensor to arm the reader.
- **Radio Frequency Interference (RFI):** Avoid sources of radio frequency emissions that might interfere with the reader.

2.2.3 - LANE LAYOUT

- **Lane geometry:** The lane should be straight for about one vehicle length in the desired read zone. Avoid sharp turns from through streets into short driveways.
- **Multiple lanes:** Locate and aim the readers so that they do not interfere with each other. For readers in parallel lanes, pointed in the same direction, keep 20+ feet apart or stagger your mounting locations. For best results in a multi-lane project, utilize vehicle presence sensors for the best performance.
- **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. This eliminates cross reader interference.

2.2.4 - VEHICLE TYPES

- All passenger car types: A single LR-3000 reader works for coupes, sedans, SUVs, trucks and motorcycles.

2.2.5 - READER MOUNTING AND POSITIONING

- If the reader is mounted **beside the lane**, choose the left side of the lane when possible, because this side is easier for the driver 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 6-8 feet.
- Either right or left side mounting locations works. Plan your project keeping in mind the location of your power source and Access Control System in reference to the gate and lane.

- 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 mounted high on the vehicles.
- Mount the reader on an adjustable bracket at the lowest height that assures safe clearance.

- Aim the reader at the tags in the desired read zone - about 15 feet from reader to credential as the vehicle approaches the reader.
- Adjustable bracket: The reader may need to be adjustable for both "pan and tilt" for proper aiming. (LR-MB-0-0) (11 inch long arm, with a two-axis adjustable head).

2.2.6 - POWERING THE READER

- For each LR-3000 reader, provide an independent DC power supply that is not used to power any other equipment.
- Quality: The power supply should be regulated, switching power supply.
- Voltage: Voltage at the reader must be between 7 volts and 15 volts DC.
- Current: For typical 12 volts to 13.8 volts supply, the current rating must be 2.0A (minimum) or more (3.0A nominal) with a switching power supply.

2.2.7 - CABLE

- Power: 2 conductors in shielded cable. Use 18 to 22 gauge wires between the reader and the power supply.
- Data: 3 conductors for either Wiegand interface or RS-232 interface. Use 18 to 22 gauge wire. For Wiegand, use multi-conductor wires — not twisted pairs.
- Other specifications: Overall 100% shielded, Stranded wire, Color-coded insulation. Maximum length — 500 feet for Wiegand data and power. Up to 75 feet for RS-232 data at 9,600 bits per second (up to 500 feet with certain terminal equipment).

2.2.8 - ACCESSORIES

- LR-TEK Support Kit: Recommended to have. LR-TEK can better support the installer if the kit is at the site.
- Documents: The complete LR-3000 Installation & Owner's Manual is preferred to be at the site with the installer.

SECTION 3 - INSTALLING

3.1 - PREPARATION

3.1.1 - GUIDELINES FOR THE INSTALLATION

- 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.
- Select a reader location where the vehicle can move in a straight line for one vehicle length as the tag is read.
- Use an adjustable mount or bracket for pan and tilt-down aiming of the reader at the desired read zone where most of the credentials will be located in and on the vehicles. (See LR-MB-0-0)
- Select a reader height that matches the location of credentials in and on the vehicles.
- Position the reader and credentials so that they are facing and *parallel* to each other when credentials are in the desired read zone.
- 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.

3.1.2 - WIRING — BEST PRACTICES

- Use only *shielded cable* in conjunction with the LR-3000. Unlike proximity readers, do not ground the LR-3000 readers' 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. (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's 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 LR-3000 reader's *bare silver* wire for cable shield drain must **NOT BE** connected to a ground terminal.
- Unused wires from the reader's cable must be taped or capped separately.

3.2 - INSTALLING THE READER

These installation instructions are for the LR-3000 reader's Wiegand interface, using Data-0 and Data-1 wires.

Note: LR-3000 wiring is not the same as a 125 kHz proximity reader. Follow the instructions in Section 3.2.2. 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
- Power supplies, cables, and other material
- UHF long-range credentials
- LR-TEK Support Kit
- "LR-3000 Installation and Operation Manual"

3.2.1 - MOUNTING THE LR-3000 READER

- Keep the reader assembled. Do *not* remove the aluminum plate behind the reader. Do not drill holes through the aluminum plate. Do *not* remove the plastic cover of the reader. Do *not* tighten or loosen the screws through the cover. This preserves your Warranty.
- Attach the LR-MB mounting bracket to the reader's metal plate using 2 screws (1/4"- 20, supplied).
- 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. For best results, clear line of sight is needed between with the reader's effective RF field and the credential's location.
- Measure the mounting height. It must relate to the location of the credentials when they are read in the desired read zone. For passenger vehicles it is typically at a height of 6-8 feet.
- Be aware of the environment. Aim neighboring readers so that their effective RF fields do not overlap.
- Fasten the reader's adjustable bracket or housing to the pole, post, pedestal, wall, beam or ceiling.

3.2.2 - WIRING THE READER (FOR WIEGAND INTERFACE)

The cable between the LR-3000 reader and the access control panel should be (see complete specs in Section 1.2)

- 5 conductors for data & power
- 18 gauge for 2 power wires:
- 22 gauge for 3 Wiegand data wires
- Stranded Wire
- Multi conductor (not twisted pair)
- Color-coded insulation
- High 100% shielded
- High quality
- Maximum length — 100ft

1. From reader to power supply — Black wire for DC negative (first connection) Each reader needs its own dedicated power supply. (see specifications in Section 1.2.4)
2. Arming circuit — if you are not using a ground loop system, **connect the 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), do not connect yellow wire.
3. From reader to panel's Wiegand 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. You may wire the blue to where the black wire goes/ground port would be for a 125 kHz reader.
4. Drains for shields — remove the insulation from the grey wire, exposing the shielded cable. Tie the reader's bare silver wire to the shields of the power and data cables. Do not ground the drain.
5. Grounds —the LR-3000 and its power supply have no ground connection. Do not connect black, blue and drain wires together.
6. Unused wires — keep the reader's orange wire available to connect the LR-Sounder during set-up and testing. Cap the unused violet and brown wires separately.
7. Testing — while the cable terminations and junctions are still accessible, test the system for full function and performance. Then seal the terminations.

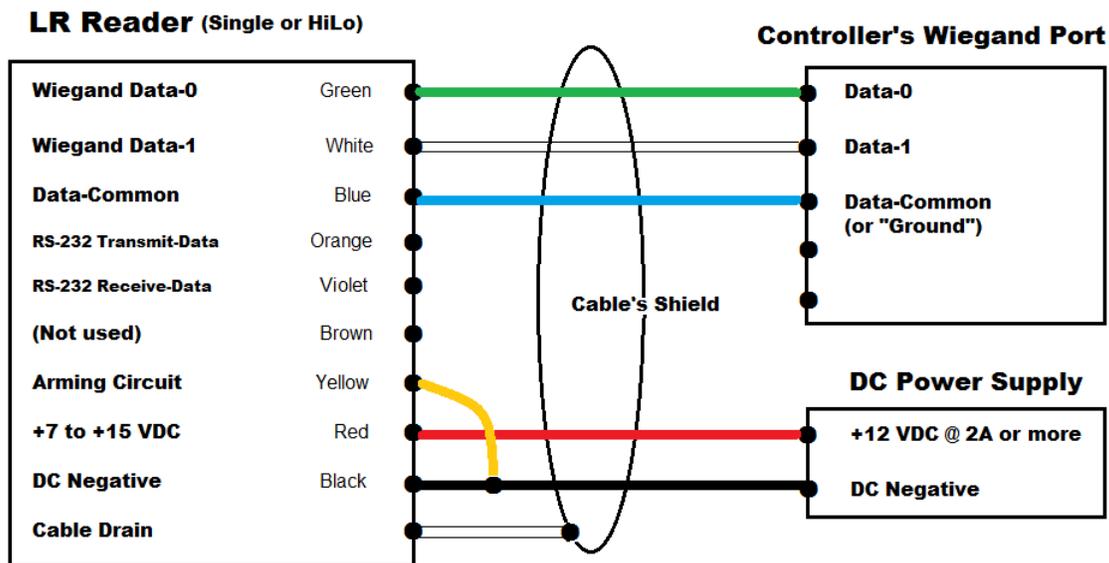


Figure 2 Wiring for LR-3000 Installation

3.2.3 - AIMING THE READER

This step should be taken before the credentials are installed in or on the vehicles. The reader does not have to be interfaced with the host system (but they may be connected together).

1. With no vehicle present, hold a test credential at arm's length and walk the entry lane to the gate. Take note of your first successful read, as well as, consistent reads (performance) from the credential.
2. Hold the test credential in your desired read zone (10ft-15ft), adjust the pan and tilt angles of the reader until the test unit indicates best performance. Occasional reads will be missed normally because of the frequency-hopping feature of the LR-3000 reader.
3. Map the outer limits of the effective RF field by moving the tag up-and-down and side-to-side through the RF field.
4. Once you have mapped out the effective RF field, proceed to installing the credentials.

3.3 - INSTALLING THE CREDENTIALS

3.3.1 - GUIDELINES FOR INSTALLING CREDENTIALS

1. The relationship between the *reader's* location and aiming, and the location of the *credentials* 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-TEK's LR-Sounder 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 credentials in or on the vehicles.
3. In the desired read zone, 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 this location.
4. Keep your hand and your body away from the credentials to avoid blocking or reducing the RF field.
5. Credentials may be attached to fixed side windows. Align tags with a reader at the side.
6. Prepare instructions for the user's staff member who will oversee tag installation. Copy the suggestions in the sub sections below for the appropriate card or tag.

3.4 - VEHICLE-MOUNTED CREDENTIALS

WS-UHF-0-0 WINDSHIELD TAG

- Mounting: Ideal location is top center of windshield on either side of the rear view mirror (on top of / inside the black dots)
- How to use: WS-I.FIF will automatically read when vehicle enters the read-zone

SV-UHF-0-0 SPECIAL-VEHICLE TAG

- Mounting: Ideal location is on non-metalized materials, on a leading edge of the exterior body facing toward the reader. (Ex. headlight, plastic grill, side-view mirror)
- How to use: SV-UHF will automatically read when vehicle enters the read-zone.

RV-UHF-0-0 REARVIEW MIRROR TAG

- Mounting: Peel off the label that covers the tags' adhesive backing. Attach the tag to the housing of the inside rear-view mirror, facing the windshield, at the either side of the stem that supports the mirror.
- How to use: RV-UHF will automatically read when vehicle enters the read-zone.

MT-UHF-0-0 METAL-MOUNT TAG

- Mounting: Ideal location is adhered to metal (Horizontal preferred for over-head reader mount)
- How to use: MT-UHF will automatically read when vehicle enters the read-zone.

PT-UHF-0-0 PORTABLE TAG

- Mounting: Peel the paper that protects the adhesive from the tags' hook-and-loop strip. Press the tags' adhesive strip firmly against the windshield glass. Allow the hook-and-loop strips' adhesive to cure for a day.
- How to use: MT-UHF will automatically read when vehicle enters the read-zone.

HT-UHF-0-0 HANG-TAG

- Mounting: Hook the hang-tag over the stem that fastens the inside rear-view mirror to the windshield. Either side of the hangtag may face the windshield.
- How to use: The hang-tag may be read either by leaving the tag hanging from the mirrors' stem, or by holding the tag from the top, with the tag facing the reader.

VT-UHF-0-0 VISOR TAG

- Mounting: With the visor raised, clip the tag over the upper edge of the visor. The tag faces downward.
- How to use: As the vehicle approaches the reader, lower the visor so the tag faces the reader and is parallel to the reader.

ST-UHF-0-0 SUPER TAG

- Mounting: Ideal location is mounted on a flat surface (metal or non-metal is okay)
- How to use: ST-UHF will automatically read when vehicle enters the read-zone.

3.5 - HAND-HELD CREDENTIALS

CS-UHF-0-0 CLAMSHELL CARD

- Mounting: For use on a lanyard, use slot on the Clamshell card to attach lanyard.
- How to use: Present the card to the reader. Keep the fingers at the edge of the card or hold from the lanyard or at the punch-slot. Hold the card parallel to the face of the reader.

GR-UHF-0-0 GRAPHICS CARD

- Mounting: For use on a lanyard, use the provided guide to help assist creating a punch-hole.
- How to use: Present the card to the reader. Keep the fingers at the edge of the card or hold from the lanyard or at the punch-slot. Hold the card parallel to the face of the reader.

KT-UHF-0-0 KEY TAG

- Mounting: Ideal location is on a lanyard or key-ring.
- How to use: Present the key tag to the reader by hold it between your fingertips at the metal tab. Your fingers should not extend over the face of the key tag. Keep keys away from the key-tag.

SECTION 4 - TESTING & TROUBLE-SHOOTING

4.1 - BENCH-TESTING READER AND CREDENTIALS

4.1.1 - INTRODUCTION

Careful preparation is important for successful installation of AWID's long-range readers and credentials. Simple testing gives the installer confidence in the performance of the reader and the credentials, after the products are installed. This testing ensures the reader and credentials are working as expected prior to final assembly.

4.1.2 - GENERAL RULES

- Bench-test the LR-3000 in an open environment, free from metalized materials.
- When testing credentials, try all orientations and positioning in relation to the reader for best results.
- Be aware of RF emitting devices that may interfere with the testing.
- Range Testing — Must be done outside with open-free space around the reader for best results.
- Functionality Testing — Can be done indoors or outdoors.

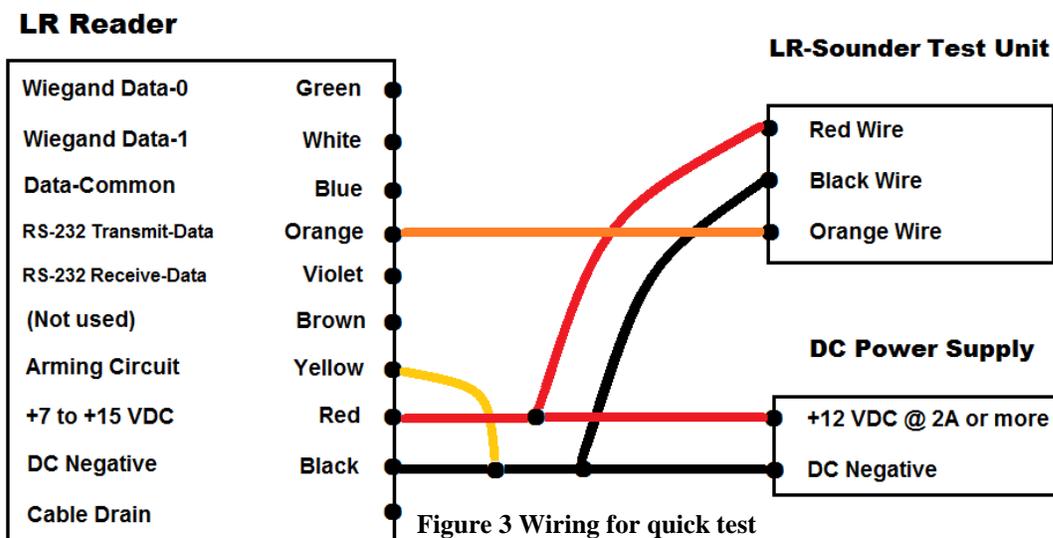
4.1.3 - ITEMS FOR TESTING

AWID's long-range reader and credentials can be tested easily using the built-in LED and the items listed below. It is not necessary to interface the reader to an access control panel or reader-input module while conducting this test.

- LR-3000 reader
- PS-123.3A power module, cable with 2 clips
- WS-UHF windshield tag (On-Glass) or UHF tag
- Wiring diagram - Figure 2
- LR-Sounder - (If applicable)
- Component of the LR-TEK

4.1.4 - WIRING FOR QUICK TEST

- Connect the wires as shown in the wiring diagram, Figure 3 (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.
- Black wire from Reader and LR-Sounder to power supply for DC negative (Black)
- Arming circuit — Connect the Yellow wire to the **Black** wire at the reader.
- LR Sounder — Connect the Sounder's **Orange** wire to the readers Orange wire.
- +12 VDC — Connect Red wire from reader and LR-Sounder to Power supply positive
- Plug in DC Power Supply



4.1.5 - TESTING FUNCTIONALITY

- Hold the test credential by the finger tips. Hold the tag at arm's length, to the side or extended away from your body.
- 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, side to side, or diagonal.)
- If the credential remains in the reader's effective RF field, reads repeat at about 3 per second (factory default).
- Proper operation of the reader and credential is indicated by a signal from the LR-TEK's LR-Sounder each time that the credential is read. The LED (on the sounder) changes briefly from Standby red to green, and a short beep (4 kHz tone) is heard.
- If the LR-TEK is not available, utilize the Green LED on the bottom of the LR-3000 for confirmation of functional testing. (There are two LEDs; **Red** for power, **Green** for activity)

4.1.6 - TESTING RANGE

- Hold the test credential by the fingertips. Hold the tag at arm's length, to the side or extended away from your body.
- Attach the test credential to a non-metal slick. Stand to the side of the reader 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 through the effective RF field in front of the reader.
- Observe the edges of the zone and the point of maximum read range.
- If the credential remains in the reader's effective RF field, reads repeat at about 3 per second (factory default rate).
- By moving the test credential in the space in front of the LR-3000 reader, the installer can map the extent of the effective RF field that is plotted in **Figure 1**. The maximum diameter of the field's cross-section, at half of the maximum range, should be about 18 feet.
- Proper operation of the reader and credential is indicated by a signal from the LR-TEK's LR-Sounder each time that the credential is read. The LED (on the sounder) changes briefly from Standby red to green, and a short beep (4 kHz tone) is heard.
- If the LR-TEK is not available, utilize the Green LED on the bottom of the LR-3000 for confirmation of functional testing. (There are two LEDs; Red for power, Green for activity)

4.2 - TROUBLE-SHOOTING

4.2.1 - INTRODUCTION

- 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.

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.

1. Bench-testing your reader: Test the reader using the instructions from Figure 3 in Section 4. Follow all steps.

Goal: To be confident that the LR-3000 works by itself, 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 a Windows serial terminal 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 2, using all components of the system. Goal: To confirm proper operation of the system in its final form.

4.2.2 - PRODUCTS AND TOOLS:

AWID Products	Required Tools	Desirable Tools:
LR-3000 Long-Range Reader	Common Hand Tools	Digital Multi-meter (testing)
PS-12-3.3A DC Power Module*	Wire Cutters	Oscilloscope, dual-trace
LR-Sounder*		Back-up battery – 12V, 7.5AH
UHF Credential for LR-3000*		
RS-232 Adapter Cable *		
LR-3000 Installation Manual		* Component of LR-TEK

Do not connect other readers and other devices to the LR-3000 reader's power supply.

- 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 12 volt switching power supply, at least 2.0A.
- AWID's PS-12-3.3A plug-in power module (in the LR-TEK) is recommended for a single LR-3000 reader.

Calculate voltage drop between the power supply and the reader: The 4-point test is —

- Measure voltage at the power supply with nothing connected to the supply (No-Load Test)
- Connect the cable-run to the power supply (but with the reader not connected). Measure voltage at the power supply.
- Measure voltage at the reader end of the power cable before the reader is connected.
- Measure voltage at the reader when it is connected to the power supply (black and red wires)
- Measure voltage at the reader when it is connected to the power supply (black/yellow and red wires) (Full-Load Test)
- Voltage drop is a combination of power supply regulation. This should not exceed a few tenths of a volt. Check the reader's current draw, 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 550 milliamperes in standby (no tag present), and about 900 milliamperes momentarily when the reader is processing and transmitting a credential's code.

To test 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).
- A charged 7.5AH back-up battery has perfect DC voltage quality and plenty of current rating.

4.2.3 - CABLE-RUN

Check the specifications of the cable between reader and panel and reader and power supply. They should be -

- Stranded wires, color-coded insulation, overall 100% shielded, outside plastic sheath, high quality.
- For power: 18-22 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.
- Maximum length for RS-232 serial interface is 75 feet at 9,600 bits per second.

If existing cable is twisted-pair, wire 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.

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.

4.2.4 - 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. Refer to the wiring diagram for additional support.

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 not be any 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 cable's shield wire must be connected together, but they must not be grounded. These shields must be floating. (Induced noise is drained inside the LR-3000 reader.)

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-I, and **blue** to Data Common on the *same reader port*. If there is no terminal labelled "Data Common" on that reader port, connect the blue wire to the electrical Ground or Common terminal on that reader port.
- Use an independent DC power supply that meets AWID's specifications fully (**Section 1.2.4**). 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.

For best results, 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.

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 not used for standard installations. They should be separately taped or capped.
- The orange wire is used by the LR-TEK Kit's LR-Sounder. Keep this wire continually accessible for testing.

For RS-232 serial interface, see Technical Reference "RS-232 Interface". Download it from www.awid.com/support

4.2.5 - 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 2**. 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.

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.)

4.2.6 - 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 (AVI). 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.

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
- Using a multi-meter, connect the leads to Data-0 (green and blue wires) and for Data-1 (white and blue wires).

Wiegand lines both need to have the same voltages and no less than 3.5V each. (Commonly between 4.8V-5.0V) if your data voltages are more than a tenth of a volt off from each-other, contact AWID support for further troubleshooting assistance.

- If you meter your data lines and they both are within specifications, present a tag to the reader, continue metering the data lines and observe the fluctuation of the voltage. If the voltage fluctuates but does not drop lower than 3.5V per line, then we can confirm correct Wiegand functionality.
- Use a dual-trace oscilloscope suitable for AWID's data output (100 microseconds pulse width, 2,000 microseconds inter-pulse spacing). Connect the oscilloscope's leads for Data-0 (green and blue wires) and for Data-1 (white and blue wires).

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 Sounder from AWID's LR-TEK 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 serial-interface 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.

4.2.7 - BENCH-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 systems 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 received from the reader is correct and functional, proceed to close up any remaining connections as the system is working.

If the system's monitor indicates that data is received from the reader is and 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 to the controller's reader port, bypassing the cable and junctions.
- Test the system's input substituting a different reader and a compatible credential.

4.2.8 - 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-TEK Installation 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.

4.2.9 - 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 well previously with a different reader.

4.2.10 - 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 8 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 LR-Sounder. Carry them 5 to a remote site away from interfering devices. Test the reader's performance under these conditions.

4.2.11 - 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 panel.
- 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.
- Watch the "Access denied: ..." message. The listed reason for denying access may point to the cause 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 cardholder's 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 cannot 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.

4.2.12 - METALIZED WINDSHIELDS

Metalized windshields protect the interiors of vehicles against harmful ultraviolet rays from the sun. They also keep interiors cooler by reflecting the infrared heat of the sun. Another benefit these windshields provide is reduced glare while driving. However, vehicles with metalized windshields may experience poor performance with windshield mounted credentials.

- If you are experiencing issues or have concerns your vehicle might be affected, proceed to temporarily adhere the credential using tape or holding it with a foam block during testing.
- For most new vehicles, there is a communication port that was designed and embedded into the windshield to allow Radio-Frequency transmission. This area is indicated by the small black dots (frit dots) surrounding your rear view mirror.
- To determine your vehicle's windshields specifications, refer to your vehicle's Owner's manual or your local dealer.

4.2.14 - POINTERS

- Keep the screws that fasten the aluminum plate to the reader's plastic housing in place. Do not drill holes in the plate.
- 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.

4.2.15 - TESTING TOOLS AND TECHNIQUES

- Digital Multi-Meter: Necessary for voltage checks, and for current measurements at the reader.
- Oscilloscope: Useful for observing digital data output at the reader and analyzing the pulse.
- 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.

4.3 - GLOSSARY

Access Control 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, a board near the reader, gate operator, or a reader input module (RIM).

Attenuation -

An adjustment that reduces the power of a signal without appreciably distorting its waveform.

Credential -

A token, such as a card, 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.

Desired Read Zone -

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.

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.

Metalized Windshield -

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.

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. This extends from the LR-3000 reader's face to the maximum distance typically between 10 feet and 25 feet, depending upon the tag. (See Figure 1, "Effective RF field".)

Serial-Interface Program -

A program that allows you to interface with the LR-3000 via Serial cable (RS-232)
LR-Reader-Settings-Program (Available at Awid.com) - Putty - (Free/open source)

Substitution -

A trouble-shooting technique that replaces a component of uncertain performance with a similar component that you know functions properly.

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.