

UHF Long-Range Reader

Support 4 – Trouble-Shooting

These notes are for AWID's LR-2000, LR-2200, LR-3000 and LR-911 reader models, and the oHiLo sets.

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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 oSupporto 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) o a **required** first-time purchase for every installing company.
- **Camera tripod** o supports the long-range reader up to 6 ft high. (The tripod's 1/4"-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 client's 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 technicians's supplies).

C. REFERENCE DOCUMENTS

- oQuick Installation Guideo for the AWID UHF long-range reader model to be installed.
- oInstallation & Operation Manualo for AWID's UHF long-range reader model (from AWID's Web site).
- Technical Reference issues for special applications o installing the reader inside a protective housing, tags on big trucks or forklifts, and others. See Technical References in AWID's Web site.
- Instructions for the UHF tags and cards.
- oQuick Installation Guideo and product sheet for the LR-Installation Kit.
- oTags í RF Blocking by Vehicle Featureso

D. CHECK LIST

AWID recommends this plan when trouble-shooting an installation ó

1. Start with the **Installation Kit**: Does the ProHunter detect the reader's RF field to 60 feet? Do the clip-on Test Unit's beeper & LED show steady reads to rated distance? SEE the Kit's Quick Installation Guide.
2. Break the task into defined **steps**; for example ó (a) reader's RF generation (use KIT); (b) reader's tag reading (use KIT); (c) power supply; (d) cable; (e) wire connections; etc.
3. **Isolate** the parts of the system ó 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 panel's 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 ó 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 reader's field at any time.
4. **Head-end system's monitor**: What helpful message is on the monitor? "Access denied í (why?)".
5. **Isolation ó 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 Kit's 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 reader's performance, test it alone at a distant location.
12. **Power supply**: Check AWID's power supply specs. Measure DC voltage at power supply and reader.
13. **Substituted battery**: Disconnect the power supply at the reader's black & red wires. Clip on a battery.
14. **Truck battery**: In absence of a charged back-up battery, clip on your truck's battery. Turn off the engine!
15. **Cables**: Check AWID's cable specs. Do all cables meet AWID's requirements?
16. **Wire hook-up**: Are 7 reader wires connected? ó correctly? Are cable drains tied together and *floating*?
17. **Tag tests**: Do the Kit's test tags read OK on EVAL and installed readers? Do customer's 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 tag's 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? ó aligned? ó 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 installation's 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 reader's 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:** AWID's Warranty on Material and Workmanship accepts that the installer will remove the 10-pin connector that protects the individual wires of the reader's cable. But *ó 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 reader's circuits. Repair for this kind of event is not covered by the Warranty.
5. **Isolation ó Substitution ó 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 óProHunterö RF Signal Detector from the LR-Installation Kit, test for background radiation. The ProHunter óchirpsö 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 reader's 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 óEVALö 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 Kit's Test Unit to the EVAL reader.
 - If the EVAL reader's performs at AWID's 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 Kit's Test Unit (small box with 3 clip leads) and a back-up battery to the isolated reader. Follow instructions in the Kit's 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 ó 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 reader's 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 ó 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 vehicle's 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 tag's 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 ó
 - Check: DC Power, Voltage Level, Voltage Drop, Cable, Wire Connections, Controlling Arming.
- If the reader reads a card **intermittently** or inconsistently ó
 - Check: All above. Also ó Environmental RF, Panel Substitution, Data Rate, Matching Conditions.
- If the reader's card reading can be **restarted** by cycling its DC power off and on ó
 - 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 card's code correctly but only at **short distance** ó
 - 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 ó
 - Test (except LR-3000): Shade the reader with an umbrella. If the reader recovers in a short time í
 - 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 ó
 - Check: Cable, Wire Connections, Grounding, Reader Substitution, Panel Substitution.
 - Test: Code pulses on interface data lines (Wiegand or RS-232) ó contact AWID for test procedure.
- If the reader reads the card, but the host system **rejects the code** and the gate does not open ó
 - Check: Cable, Wire Connections, Grounding, Data Processing Rate.
- If the reader was reading OK and then **failed completely** ó
 - Check: DC Power, Voltage Level, Voltage Drop, Cable, Wire Connections, Grounding, Controlling Arming, Reader Substitution, Panel Substitution.
 - Add: Surge and spike protection in the reader's wires (all wires).
- If the reader reads hand-held tests for testing at rated distance, but not some or all **tags in vehicles** ó
 - Check: RF Blocking, Accommodating RF, Matching Conditions.

G. THINGS TO CHECK

DC Power: Each long-range reader must have its own power supply ó separate, independent, dedicated to that one reader. The reader's power lines (**red** and **black**) must be connected only to that power supply. That reader's power supply must be connected only to that reader. DC power source must *float* ó no ground connection. . . . **IF** the reader's 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 AWID's 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 supply's terminals ó black to negative; red to positive. Measure voltage at the power supply's 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 reader's power wires to the power cable's wires ó 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 supply's terminals when all power wires remain connected, and the reader's **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 ó 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 be able to carry the reader's 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 meter's 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 ó
 - (a) Disconnect the reader's red and black wires from the power cable. Clip the battery to the reader's black and red wires. Measure the voltage on these wires, and compare it with the battery's 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 cable's 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 panel's 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 reader's DC power supply or the Wiegand data lines or the cable shields are grounded anywhere, **THEN** the reader's performance may be affected and its life may be shortened!

- (a) Both negative and positive DC power lines must not be grounded anywhere. The reader's black and red wires go to the power supply's terminals, but they are not grounded.
- (b) The reader's green and white wires are like all other Wiegand-interfaced readers ó to Data-0 and Data-1. The reader's BLUE wire is Data-Common. It must go the panel's reader port terminal that serves that purpose. Connect to the "Common" terminal, if any. If not, the blue wire usually connects to the reader port's "Ground" terminal, not because it is grounded, but because it is that port's Data-Common, in addition to DC power negative for other reader types.
- (c) All cables' shields or drains must be connected together. Then they float ó 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 reader's yellow wire. Do *not* switch the reader's data lines or power lines.

Reader Substitution: . . . **IF** the problem could be the reader itself, **THEN** substitute a different reader ó

- (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 panel's reader port, and then at the "gate" end of the data cable. Program that card's code into the system, and watch for "Access granted" 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 "working" (interfaced) reader is not available for substitution, use the Installation Kit's "EVAL" reader. Power it normally, and clip the Kit's SP-6820-LR test unit to the EVAL reader's black, orange and red clips. Reading by the EVAL reader is indicated by the test unit's beeps and LED color changes.

Panel Substitution: . . . **IF** everything listed above tests normal, **THEN** the problem may be the host system ó a reader input port, or the controller, or the application system's software or firmware ó

- (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 system's inability to process the credential's 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 ó for only 1/3 second every few seconds. Does the system now see correct codes? If so ó
- (b) Reduce the long-range reader's read repetition rate, using AWID's downloaded LRReaderSettings program in the Web site's "Support" 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 cables' and power supply's 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 reader's and tag's 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** ó

- 1. Remove power or disarm the long-range readers.
- 2. Test for spurious RF in the reader's area, using the Installation Kit's "ProHunter" RF Signal Detector.
- 3. Connect the Kit's 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 Kit's 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** ó

- (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 ó change the vehicle's roadway (straighter, closer to the reader); reduce vehicle's speed 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** ó

- (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 reader's repetition rate. If the host needs *one* input for each event, assure a single read. SEE AWID's solutions.

H. AWID'S SUPPORT PEOPLE

Sales	Please contact your AWID supplier or the Regional Sales Manager.
Customer Support	Please contact AWID's corporate offices ó 408-825-1100, option 3.
Technical Support	Please contact AWID's corporate offices ó 408-825-1100, option 1.

I. HOOK-UP DIAGRAMS

LR Reader

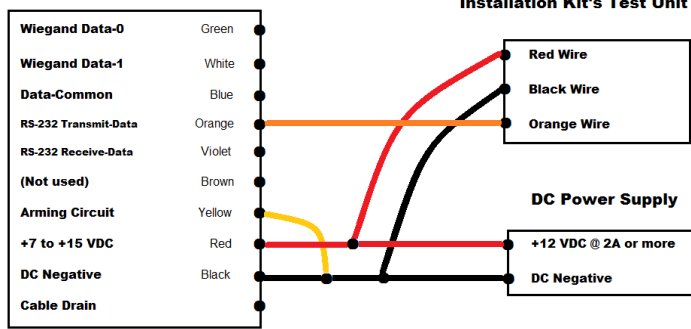


Figure 1. Test Unit Wiring.

LR Reader

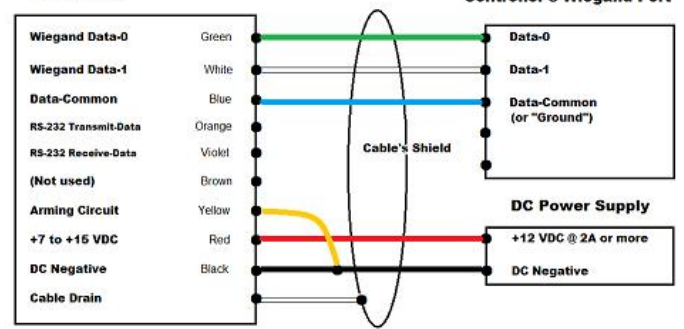


Figure 2. Installation Wiring (Wiegand).

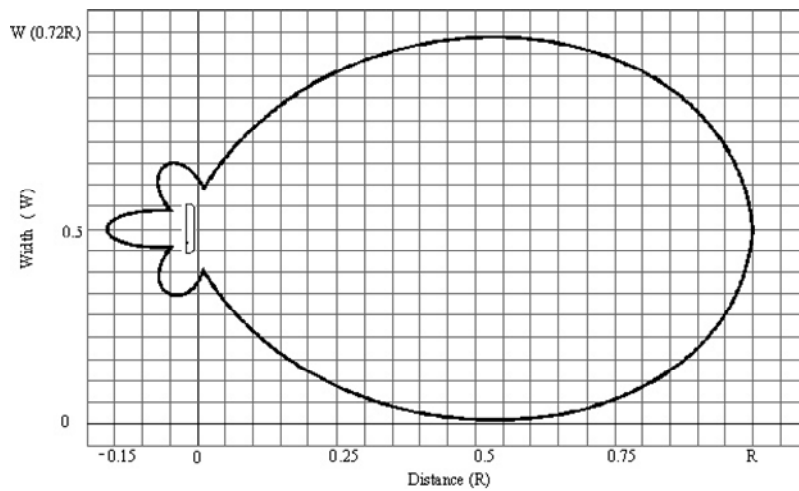


Figure 3. Effective RF Field for UHF Long-Range Readers.