

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