User’s Guide for ARS Gateway and Node Wireless Data Logging Firmware with Acclima Inc. Hardware

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# Serial Terminal Communication

A serial application is required to enable communication between a PC, laptop, or tablet and the gateway/node hardware via a USB cable. Free applications available for download include the [Arduino IDE](https://www.arduino.cc/en/Main/Software_) and [Termite](https://www.compuphase.com/software_termite.htm). Images in this document were generated using the Arduino IDE.

## Settings

* Baud rate: 57600
* Input termination: No line ending (Arduino IDE)

## Arduino IDE Serial Monitor Setup

Graphical user interface, application

Description automatically generated

Graphical user interface, application

Description automatically generated

# Node Menu

## Sensor Depths

Chart, box and whisker chart

Description automatically generated

Application

Description automatically generated with low confidence

# Gateway Menu

# Data String Format

## Gateway

## Node

A picture containing chart

Description automatically generated

# Field Installation

## Gateway

Placement of the Gateway in the field is of utmost importance to its successful operation. **The Gateway** controls two things:

1. Compiling data from all Nodes. For the Nodes to send data to the Gateway by LoRaⓇ (Long Range) radio transmission, they must be within **“line-of-sight”, meaning you should be able to see one from the other either with the naked eye or binoculars**. Obstructions like hills or buildings will block the radio transmissions, but plant structures like corn will not interfere much.
2. The data transfer to the cloud for real time data collection.  The Gateway needs good cellular reception to send data and receive accurate time data from the NIST server.

The Gateway and Node system relies on cellular connectivity for real-time data access and management. The system has built-in data backup redundancy in case of connectivity issues. Taking time to locate cellular reception and identify the best location for the Gateway enables remote system monitoring and will save time in the long run.

### Signal Strength

The cellular module on the Gateway is compatible with 2G and 3G networks. Since 2G networks are being phased out, your Gateway will most likely be connecting to a 3G network. Most mobile phones operate on the newer 4G/LTE network. This means that being able to place a phone call or access the Internet on your phone **DOES NOT** mean that the Gateway will also be able to connect.

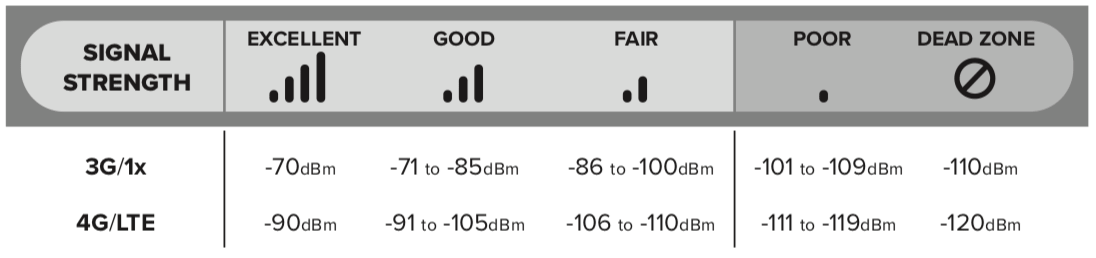
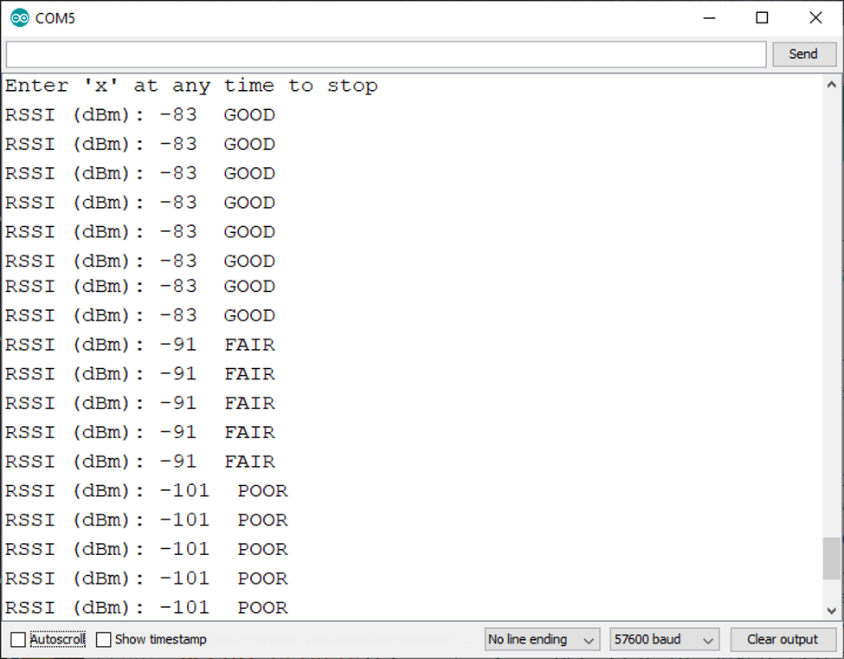


Image from signalbooster.com

The Cellular Signal Scouting Mode accessed by the Gateway’s menu over the Arduino Serial Monitor, measures the current signal strength every second and gives a rating of EXCELLENT, GOOD, FAIR, or POOR according to the chart above.

To access the Cellular Signal Scouting Mode, connect the Gateway to your tablet and open the **Serial USB Terminal** app. Enter option “1” to enter scouting mode.

After the cellular module turns on and connects to the network, it will query the signal strength every second.



The Signal Scouting mode requires a connection to the network in order to measure the signal strength. If the Gateway cannot connect to the network, you will see the following error message in the Serial Monitor window:

ERROR: could not connect to network

### Locating the Gateway

Use the Signal Scouting mode to choose a location for the Gateway.  Scout the field and surrounding area for possible locations to install the Gateway. Ideal conditions are:

* Highest signal rating achievable in scouted area
* Within line-of-sight of the nodes (you can see the nodes with your naked eye or with binoculars)
* At a higher elevation than the test plots (on top of a hill if possible)
* Accessible
* In full sun

To select a location for installing the Gateway:

1. Identify 3 to 5 locations that satisfy the criteria above.

**→ Tip**: Flagging prospective locations will help you keep track of them.

1. Connect the Gateway to the tablet.
2. Select and stand at the first prospective location for the Gateway.
3. Open the **Serial USB Terminal** app.
4. Select menu option “1” to enter the Signal Scouting mode.
   1. If the rating is EXCELLENT, enter “x” into the input bar to exit Scouting mode and turn off the Gateway. Disconnect the Gateway from the tablet. Install the Gateway but do not turn it back on until after you have installed the Nodes.
   2. If the Gateway successfully connects to the network, note the signal strength rating at that location. Move on to Step 6.

**→ Tip**: Write the rating on the flag with a permanent marker.

* 1. If the Gateway does not connect to the network, enter “x” into the input bar to exit Scouting mode. Do not turn off the Gateway. Move on to Step 6.

1. Proceed to the next location you marked and repeat step 5 until you find the location with the highest signal strength rating.
   1. If the Gateway fails to connect to the network at all locations, choose the most convenient location and install the Gateway there. Plan to manually download data every two weeks after installation (see Manual Data Collection).

To install the Gateway you will need a 1-1/2” flight auger to dig a one to two foot deep hole. Insert the 1-1/4” PVC pipe into the hole but do not mount the Gateway on top. Ensure the conduit opening in the enclosure is plugged with duct seal and that there are desiccant packets and a humidity indicator inside.

# Manual Data Collection