AGM Config Utility v1.0.0 User Manual

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ONE

OVERVIEW

The AGM Configuration Utility is used to interface with a collection of AGM electronic humidity sensors (Gen 1.1, Gen 2.1, and Gen 3.0). The application allows the user to read sensor manufacturing details, adjust settings, read device telemetry, test basic functionality, and offload measurements. The application is designed to be used for sensor provisioning, diagnostics, and end-of-life data download. The sensors communicate via IrDA, an infrared serial connection standard. A configuration tool is required to translate PC serial communications over IrDA at the different (and non-standard) baud rates supported by the sensors.

This document details the usage of the application.

CHAPTER

TWO

USAGE

2.1 Requirements

Version 1.0 of this utility is compatible with sensor firmware versions >= v2.0.

The configuration utility targets a Windows 10 PC with USB or native serial ports.

The utility was designed and tested on the following systems:

- **Dell Latitude 5420 Rugged Laptop**
  - Windows 10 Pro, 64-bit
  - Intel Core i5-8350U 1.7GHz CPU
  - 16GB RAM
- **Custom PC:**
  - Windows 10 Pro, 64-bit
  - AMD FX-8350 4GHz Processor
  - 8GB RAM

The application is designed with cross-platform frameworks and should operate on any Mac or Unix-like system. However, only Windows executables are automatically built and tested. See the PyInstaller Documentation for details.

2.2 User Interface

The interface is broken into five main sections: *Serial Connection*, *Sensor Settings*, *Commands*, *Diagnostics*, and the logging window.

The sensor status, firmware version control information, and software version information are shown in the status bar at the bottom of the interface.

Additional commands are available in the *Options* menu.

2.2.1 Serial Connection

The serial connection pane allow the user to select a serial device and attempt a connection to the sensor. The connection process is described in *Sensor Connection*. Sensor manufacturing information, such as serial number, hardware version, and firmware version are listed under this section.

2.2.2 Sensor Settings

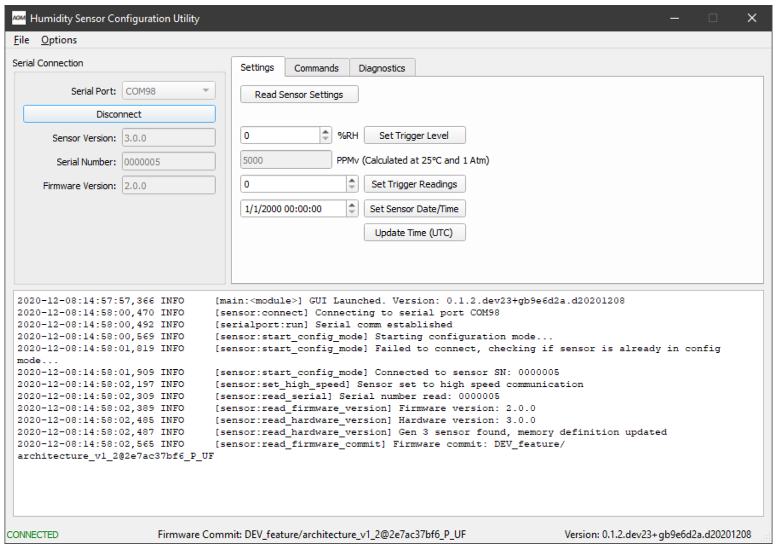

Fig. 1: Sensor settings tab pane.

The settings tab allows the user to adjust configurable parameters related to data logging. This includes:

- Set Trigger Level: sets the level that indicates a bad humidity reading,
- Set Trigger Readings: sets the number of consecutive readings needed for a sensor to flag a humidity error, and
- Set Date/Time: sets the current sensor time in UTC.

The user should first read the sensor settings before updating any values.

The trigger level is stored in the sensor in %RH with a resolution of 1%. The PPMv shown is the level calculated by the sensor when making a determination on each measurement. If the %RH is set to 0, the threshold is set to the default of 5000 PPMv. The PPMv calculation is detailed in *Download Logged Data*.

Serial Number

The serial number can be adjusted via *Update Serial* in the *Options* menu.

The serial number must be a numeric value between 0 and 1,048,575. A prompt is provided to prevent accidental changes. If the serial number is changed and must be reverted, the log file will contain the serial number read on device connection.

2.2.3 Commands

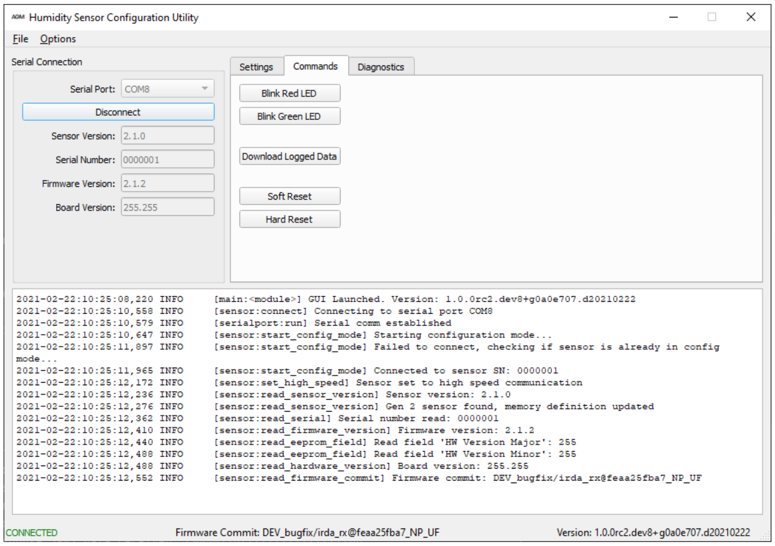

Fig. 2: Sensor commands tab pane.

The commands tab allows the user to execute basic LED diagnostics, download data, and perform hard and soft resets.

Each of the LED commands will light the corresponding indicator for 1 second unless interrupted by another command.

Download Logged Data

This command exports all logged measurements to a comma-separated-values (CSV) file. Only the EEPROM memory needed to parse available data will be downloaded. If the contents are sufficiently large, a progress bar will display with the option to abort the download. Once the download completes, the user can choose a filename and the measurements are written out.

If the measurement is aborted or interrupted, the user will be presented with the option to continue the previous download operation on the next attempt. Keep in mind that if the sensor changes between downloads or additional measurements are taken, the data may be corrupt. When in doubt, the safest method is to restart the download.

The CSV includes the following data: Date, Time, Humidity (%RH), Temperature (°C), and Humidity (PPMv).

The first measurement timestamp in the export is calculated as the sensor initial timestamp rolled over to the next hour. If the sensor initial timestamp is at 0 minutes and 0 seconds, the next hour is still used since the first recording would not have occurred until the next hour rollover.

The final measurement timestamp in the export is calculated as the sensor current time truncated to hours - that is, the minutes and seconds are zeroed.

Note: Note that the sensor does not make measurements while in configuration mode. If the user enters configuration mode during one hour and downloads data after an hour rollover, the final measurement time will be inaccurate.

All values between the final and initial timestamps are interpolated based on the number of measurements. This allows the user to re-adjust the current sensor time (see *Sensor Settings*) to account for sensor time drift over many years, which may be hours over the 20 year span of the Gen 1.1 and Gen 2.1 sensors.

Humidity measurements are 8-bit unsigned values ranging from 0 to 100 with units of %RH. Temperatures are 11-bit signed values ranging from -450 to 1300 with units of tens of degrees Celsius.

The PPMv values calculated for the export and displayed under *Sensor Settings* are calculated using the same method as the sensor. They are derived from Dalton's law and Richards equation, described in the article "A Simple Procedure for Calculating Atmospheric Water Vapor Concentration" by Gregory J. McRae. The calculation assumes standard pressure and is valid to ±0.5% over a temperature range of -50 to 50°C:

$$H_2O(\text{ppmv}) = 10^4 RHe^{13.3185-1.9760t-0.6445t^2-0.1299t^3}$$

$$t = 1 - \frac{373.15}{T_a}$$

where RH is percent relative humidity and T_a is ambient temperature in Kelvin.

Resets

The soft reset command clears the number of consecutive bad humidity readings.

The hard reset command performs the following in addition to a soft reset:

- Clears the reading counter, resetting the measurement pointer to start over in memory, and
- Clears the first-time flag, forcing the user to perform an activation trigger with a flashlight to initialize the sensor before recordings will commence.

Once the device hard resets, it will exit configuration mode and the configuration utility will then reconnect to the sensor.

Dump EEPROM

The entire sensor EEPROM can also be captured via *Dump EEPROM* under the *Options* menu. The EEPROM dump work similarly to the data download in that a progress bar with optional abort will be shown and the user will be provided the option to save values to a hex file once complete.

The EEPROM dump will pull up to the memory available on the sensor. For Gen 1.1 and 2.1 sensors, this is 524,288 bytes, and for the Gen 3 this is 262,144 bytes.

2.2.4 Diagnostics

The diagnostics tab allows the user to read sensor telemetry (humidity, temperature, battery voltage, etc) as well as displays debug information stored on the device.

To read the touch window status, it is recommended to use a small IR-transparent plastic to push the window in without interfering with the link between the sensor and configuration tool.

The debug table is populated when the user presses "Read Debug Data". An additional description of each data point is available by hovering over it's name.

2.3 Connection

2.3.1 Sensor Connection

Connection is a two-step process. The application must first connect to the configuration tool via native serial or USB serial. If native serial is used, then power must be provided via a USB wall wart.

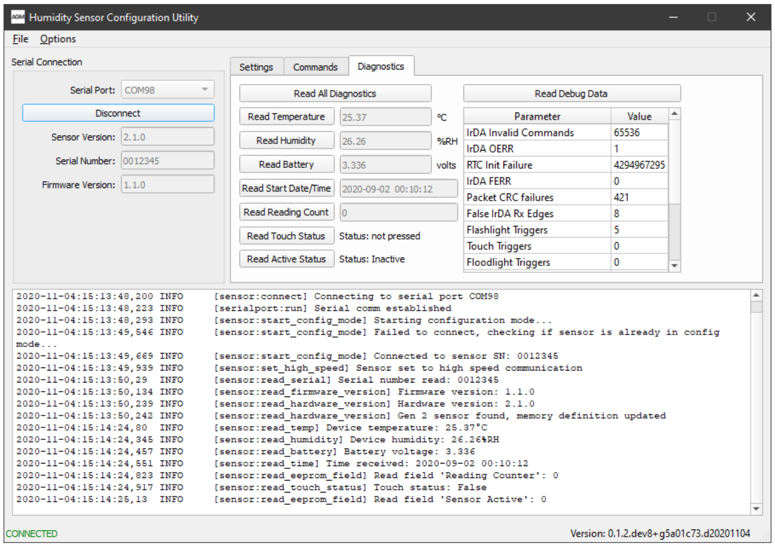

Fig. 3: Sensor diagnostics tab pane.

Note: The serial connection requires a DB9F-DB9F null modem cable.

The application then places the sensor into configuration mode by sending 1 second of periodic start config bytes (`0x44`). If the sensor responds appropriately, basic sensor information is queried and the user may begin interacting with the device. The configuration routine will also check whether the sensor is already in configuration mode in either standard or high speed mode.

A heartbeat is sent every 10 seconds to maintain a connection with the sensor. This heartbeat may be inserted during longer running tasks, such as an EEPROM dump. The heartbeat will attempt a simple command 3 times - on failure, the utility will disconnect and alert the user of the connection loss.

The user should place the configuration tool in close proximity to the sensor. The maximum link distance is nominally 50cm with a 15 degree cone, but will depend heavily on the lighting environment.

If the user loses connection with the sensor, the sensor will timeout and exit configuration mode.

2.3.2 Communication Speed

The sensor normally communicates over IrDA at 9600 baud. To decrease download time for sensors with many years of measurements, the device is placed into a high speed mode operating at 111.1k baud. The serial communication between the PC and the configuration tool is fixed at 115.2k baud.

2.4 Logging

Log messages are written to a rotating log file in the same directory as the executable. Messages are also written to the log pane of the main window so the user is aware of communications or interruptions to commands.

The granularity of messages logged to a file is DEBUG, while only messages of level INFO or higher are logged to the pane. The log file will include all transmissions to and from the sensor as well as UI interactions, in addition to errors and exception tracebacks.