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## Application Note: Outputs for COZIR & SprintIR Sensors

### Comparing Serial I/O and Linear Analog Voltage Output in GSS COZIR and SprintIR Carbon Dioxide Sensors

#### Serial vs. Analog Output

By default, all GSS COZIR and SprintIR carbon dioxide sensors use serial I/O (input/output) suitable for direct connection to a UART as described in the respective documentation on each sensor's page. In general, this I/O uses 4 pins: 3.3V, GND, Rx and Tx, and follows the standard format 9600,8,N,1 with hardware flow control.

However, on closer inspection one will see a linear/analog voltage output pin on each of the sensors. In general, this output-only pin will report a voltage from 0-3.3V proportional to the 0 to Max CO<sub>2</sub> levels that can be read by the sensor. For example, on a 2,000ppm CO<sub>2</sub> sensor calibrated to 0ppm in nitrogen, 1.15V would be half the voltage, or approximately 1,000ppm.

#### Why Serial Output is Recommended

When at all possible, we recommend the default serial I/O be used to communicate with all GSS sensors. There are 4 reasons why:

1. Serial communication is required for error code checking, calibration, etc. Even if you plan to use analog output, you should still implement serial communication for command input and data output.
2. Sensors with CO<sub>2</sub>, temperature and % relative humidity options cannot share all 3 outputs on a single analog line. To read RH/T in addition to CO<sub>2</sub>, you must use serial communication. In addition, if you start with a CO<sub>2</sub>-only sensor and later want to add RH/T, the new feature set is easy to implement.
3. The sensor's internal resolution is limited by the analog output, and further degraded after processing by an ADC. A 14 or 15 bit value converted to 10-bit in the ADC cripples the ppm precision of the sensor.
4. SprintIR sensors are fast. At 20 readings per second, it is unlikely your circuit will be able to measure the change in voltage accurately.

#### Do You Really Need Analog Output?

1. Most of the time we see clients trying to use the analog output to work with legacy analog applications or for conversion to a 4-20mA current for very long transmission or for use in a very electrically noisy environment. In these instances, we may be able to recommend a different sensor.
2. Clients using Arduino or Raspberry Pi may believe analog output is easier. However, there are tested, free libraries of functions that allow you to quickly implement serial I/O.

While all GSS sensors have analog output, you should think carefully before using it.