SPECSENSORS

IOT_CO_1000

IOT_CO_1000 Digital Sensor Module

The small form-factor, IOT_CO_1000 combines the novel sub-millimeter thin electrochemical sensor technology from SPEC Sensors, Inc. with an ultra-low power potentiostat circuit and microprocessor with digital UART output.

Printed Sensor Features:

- Sub-millimeter thin electrochemical sensor technology

- Low-cost and high-performance

- Available for a variety of target gases

- Additional sensors and configurations may be available, please contact us to discuss your application

Target Gas	Max Range
Carbon Monoxide – CO	1000 ppm
Hydrogen Sulfide – H2S	20 ppm
Nitrogen Dioxide – NO2	20 ppm
Ozone – O3	20 ppm
Sulfur Dioxide – SO2	20 ppm
Ethanol – CH6O	1000 ppm
Indoor Air Quality – IAQ	
Respiratory Irritants – RESP-IRR	

IOT_CO_1000 Features:

- Ultra-low power consumption

- Small form-factor gas sensor:
  0.82" W x 1.75" L x 0.35" H

- Digital UART communication protocol and simple command library

- Low-cost and easily replaceable module

- Standard 8-pin connector allows easy integration with your development platform or product.

- On-board temperature & relative humidity sensors

- Gas concentration output is calibrated and temperature compensated output

- Includes a USB to UART Bridge adapter for getting started quickly on a PC.
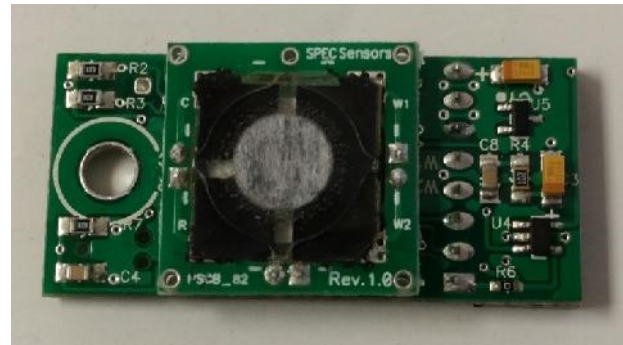
Top View
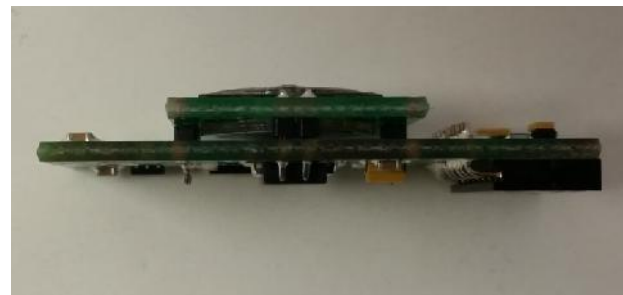
Side View

Top View with Adapter and UART-to-USB

IOT_CO_1000 Quick Start Guide

1. **Download and install a terminal program, such as Tera Term.**

2. **Connect the IOT_CO_1000 to the USB to UART Bridge via the adapter board.**

3. **Connect the USB to your computer**
   a. If device drivers are not automatically downloaded and installed, you can find device drivers for your operating system by searching www.silabs.com for: "CP210x USB to UART Bridge VCP Drivers".

4. **Determine the COM port that is associated with the module**
   a. On Windows operating systems, locate and open the Device Manager.
   b. The IOT_CO_1000 device should be listed under the heading, "Ports (COM & LPT)", as "Silicon Labs CP210x USB to UART Bridge (COMXX)", where XX is the unique port number associated with the device.
   c. Make a note of the unique port number.

5. **Open Tera Term and establish a serial connection with the module**
   a. In the "New Connection" window, select the "Serial" radio button.
   b. In the drop down list, select the appropriate COM port, identified above, then Select "OK".
   c. On the Menu bar, select "Setup", then select "Serial port…"
   d. Use serial parameters: 9600 baud, 8 data bits, 1 stop bit, no parity, no flow control, then Select "OK"

6. **In the terminal window**
   a. Type any key to TRIGGER a measurement. The response time is about 3.5 seconds.
   b. To start a continuous data output stream, type 'cc' (lower-case, without quotation marks).
   c. The terminal prompts for an interval time. Type any of the 4 choices (5, 10, 30, or 60s) and then press "Enter" on your keyboard.
   d. The format of the output is: [Serial Number, Gas Concentration (ppb), Temperature, Relative Humidity]
   e. Type 'r' at any time to reset the module and stop the continuous data output stream.

Normal Startup

The electrochemical sensor output has the normal startup profile pictured here. When powering the sensor, its output will rapidly increase followed by a gradual decrease. Once this process is complete, the sensor output will be the most accurate and stable. The time and magnitude of this response may vary depending on the sensor type and the length of time the sensor has been unpowered.

For the best results, it is recommended that the module remains always on power. The IOT_CO_1000 module automatically enters a low-power state between TRIGGER measurements.
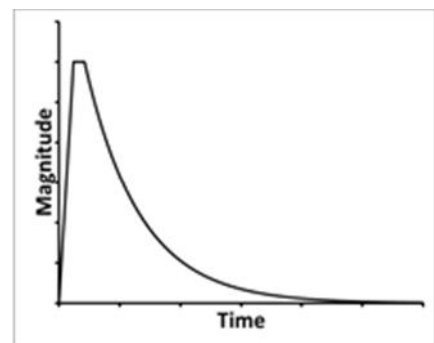
Device Connection & Pin Description:

Electrical connections to the D-ULPSM are made via a rectangular female socket connector (Sullins Connector Solutions P/N: PPPC041LGBN-RC. The recommended mate for the host board is P/N: PBC08SBAN). This connector also provides mechanical rigidity on one end of the board. A through-hole is located on the opposite end of the board to provide additional mechanical connection.
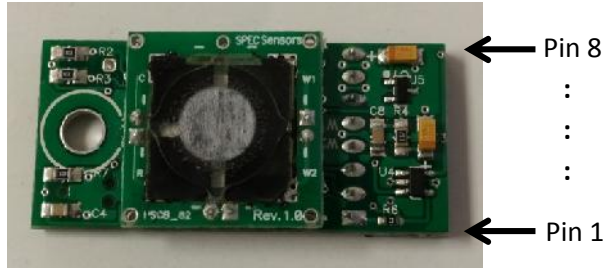
Pin #	D-ULPSM Function
8	V+
7	N/C
6	GND
5	N/C
4	N/C
3	TXD
2	RXD
1	N/C

V+: Supply voltage: 2.6 V < *V+* < 3.6 V

GND: Ground

N/C: No connection. Leave these pins floating.

TXD: UART transmit. Connect to UART RXD on the host device.

RXD: UART receive. Connect to UART TXD on the host device.

USB to UART Bridge Settings:

Voltage level: 3.3 V

Baud: 9600

Data bits: 8

Stop bits: 1

Parity: None

Flow Control: None

Operation:

When the IOT_CO_1000 is connected to V+ and GND:

The module's microprocessor will automatically configure the sensor and circuit for operation, output a measurement, delay for 1.5 seconds and then enter a low power stand-by mode. While in stand-by mode, critical sensor circuitry remains active to ensure the highest accuracy for future sensor measurements.

If the module is powered and in low-power stand-by mode:

Any data received on the UART interface will TRIGGER a measurement that is transmitted via UART. Due to the high-accuracy ADC sampling method, there is a 3.5 second delay between when the module receives a command and when the module transmits a response. This is followed by a 1.5 second delay, after which the module will re-enter the low-power stand-by mode.

If the module receives a recognized command within 5-seconds of a TRIGGER:

The command will be executed. Refer to the *Command Library* for more information on recognized commands.

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Command Library:

To execute one of the following commands, send the corresponding case-sensitive ASCII character via UART, within 5-seconds of a TRIGGER:

c   CONTINUOUS data output

> The user is prompted to enter a measurement period (5, 10, 30, or 60 seconds)
>
> NOTE: In this mode, the module does not enter low power stand-by between measurements.

r   RESET the module

> This stops the continuous data output. After a 1.5 second delay, the module will enter the low power stand-by mode.

z   ZERO user calibration

> The sensor calibration is recalculated such that the module output is 0 ppm.

d   DEFAULT factory calibration factors are restored.

v   VERBOSE mode is toggled.

> Disabled (default):
>
> > Output header: Serial Number, Gas Concentration (ppb), Temperature (°C), Relative Humidity (%)
> >
> > Value Range: SN [XXXXXXXXXXXX], PPB [0 : 999999], TEMP [-99 : 99], RH [0 : 99]
>
> Enabled:
>
> > Appends the time elapsed since the module was powered on (in days, hours, minutes, & seconds).
> >
> > Output header: Serial Number, Gas Concentration (ppb), Temperature (°C), Relative Humidity (%), Days, Hours, Minutes, Seconds
> >
> > Value Range: SN [XXXXXXXXXXXX], PPB [0 : 999999], TEMP [-99 : 99], RH [0 : 99], D [0 : 99], H [0 : 23], M [0 : 59], S [0 : 59]

e   EEPROM

> Stored module parameters are output for diagnostic purposes.
>
> Example output:
>
> ```
> **********************************EEPROM**********************************
>                     User Values
> User_ADC_Zero = 65535
> User_T_Zero = 65535
> User_RH_Zero = 65535
> Operation_Mode = 1
> ```

SPEC Sensors   IOT_CO_1000   5
www.spec-sensors.com   User Manual, Rev. 1.0
(510) 574-8300