NDIR CO_2 Gas Sensor Calibration

This calibration procedure described in this document applies to all NDIR Carbon Dioxide (CO_2) sensors (both dual channel and single channel) manufactured by SemeaTech.

1. **Baud rate**：19200bps，8 bytes，first byte is stop，no check byte

2. **CO_2 concentration READ and RETURN in HEX code**

ASCII format for automatic upload CO_2 concentration:

32	32	x	x	x	x	x	32	p	p	m	\r	\n

For example, if the CO_2 concentration is 12345 ppm, the ASCII format should be

		1	2	3	4	5		p	p	m
0x20	0x20	0x31	0x32	0x33	0x34	0x35	0x20	0x70	0x70	0x6d

3. **Zeroing (Zero Calibration) using Nitrogen (N_2)**

STA	Command		CheckSum		END
0x23	0x57	0x31	0x36	0x36	0x21

STA：0x23, and 0x23 means START;

Command: 0x57, and 0x57 means WRITING;

Command: 0x31, and 0X31 means Zeroing in N_2 ;

CheckSum: 0x36, and 0x36 is the CheckSum that is the ASCII code of a sum of XOR of all data except STA and END;

END: 0x21, and 0x21 means CLOSE.

Caution: *The command of zero calibration should be sent after the module stays in N2 for 5 minutes.*

4. **SPAN Calibration**

STA	Command		Gas Cctn					CheckSum		END
0x23	0x57	0x32	GC1	GC2	GC3	GC4	GC5	H	L	0x21

STA: 0x23, and 0x23 means START;

Command: 0x57, and 0x57 means WRITE;

Command: 0x32, and 0x32 means SPAN calibration;

Gas Cctn: the concentration of the span CO_2 gas. The value of concentration should be a percentage of the full scale. For example, if the span CO_2 gas is 500ppm, and the full scale of the sensor is 5,000 ppm, it turns out Gas Cctn=500/5000=10%. In this scenario the command should be:

STA	Command		Gas Cctn					CheckSum		END
0x23	0x57	0x32	0x30	0x30	0x30	0x31	0x30	0x35	0x34	0x21

Here, CheckSum 0x35 and 0x34 is the CheckSum that is the ASCII code of a sum of the XOR of all data except STA and END. END 0x21 means CLOSE.

Caution: *The command of SPAN calibration should be sent after the module stays in the span gas for 5 min.*

5. **Clean Air Calibration**

Clean air calibration should be done only when the output is quite different from the true value. There are two ways to calibrate in clean air, manual calibration and CW calibration.

5.1 Manual calibration:

To perform manual calibration, set the value to default value at 420 ppm. Connect PIN9 and PIN12 together and then wait for more than 5 seconds. After that, the display will show 420.

5.2 CW calibration

CW calibration is a single-point calibration. The CO_2 concentration can be randomly set. In general CO_2 concentration of outside fresh air is between 390 ppm and 450 ppm, we pick 400 ppm to conduct a single point calibration as an example. The command consists of 16 numbers in the format：

235735 3X3X3X3X3X 3Y3Y 21

Here,

235735 is start of command, in which 23 means Command, 57 means Write, and 35 means Clean Air Calibration;

21 is the end of this command;

XXXXX in 3X3X3X3X3X means the optional concentration. The unit is ppm. For example, if the chosen CO_2 concentration is 517 ppm, it will be written as 3030353137. If it is 89,321 ppm, it will be written as 3839333231.

YY in 3Y3Y is XOR of 57353X3X3X3X3X. For example, if XOR of 350ppm is 54, 3Y3Y should be 3534.

Here comes more examples:

235735303033303035312 1 means 300 ppm
235735303033353035342 1 means 350 ppm
235735303033383035392 1 means 380 ppm
235735303034303035362 1 means 400 ppm
235735303034323035342 1 means 420 ppm
235735303034353036332 1 means 450 ppm
235735303036303035342 1 means 600 ppm
235735303130303035332 1 means 1,000 ppm
235735303135303035362 1 means 1,500 ppm

Caution：*For better accuracy, do not breath closely to the air inlet of the sensor during calibration.*