

CO₂ Sensor Module - HX-105N

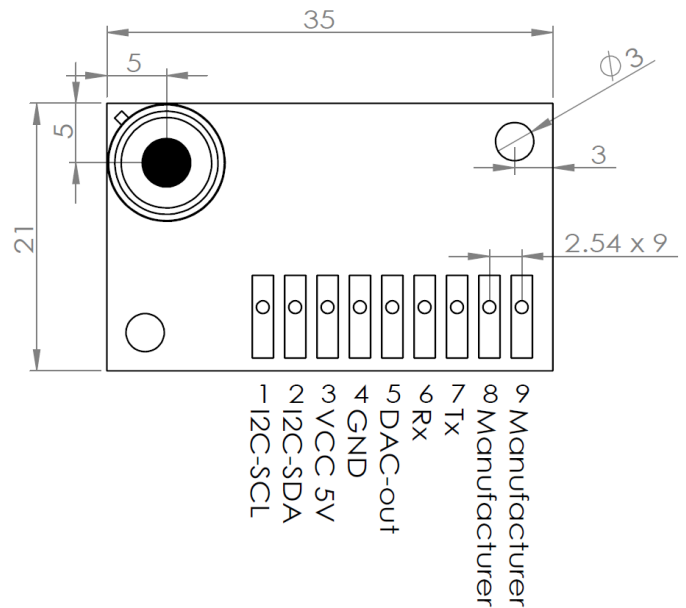
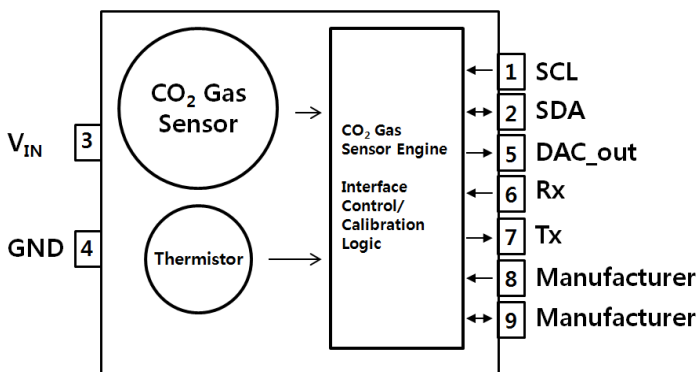
Features

- Electrochemical type CO₂ gas sensor
- High reliability performance
- Long life time, 10 years
- Fast response time
- Compatible with 5V and various communications (I2C, UART, Vout)
- Super compact size module
- Auto calibration
- Low power consumption
- Maintenance free
- Suitable to indoor environment.
- 9 Pin module

Applications

- Indoor air quality maintenance system
 - Home net room panel
 - Air conditioner
 - Air cleaner
 - Diffuser
 - Climate control system
 - Total heat exchanger
- IOT based indoor watching system
 - Security
 - Home automation
 - Set-top box
 - Lighting

CO₂ sensor overview



CO₂ Sensor Module

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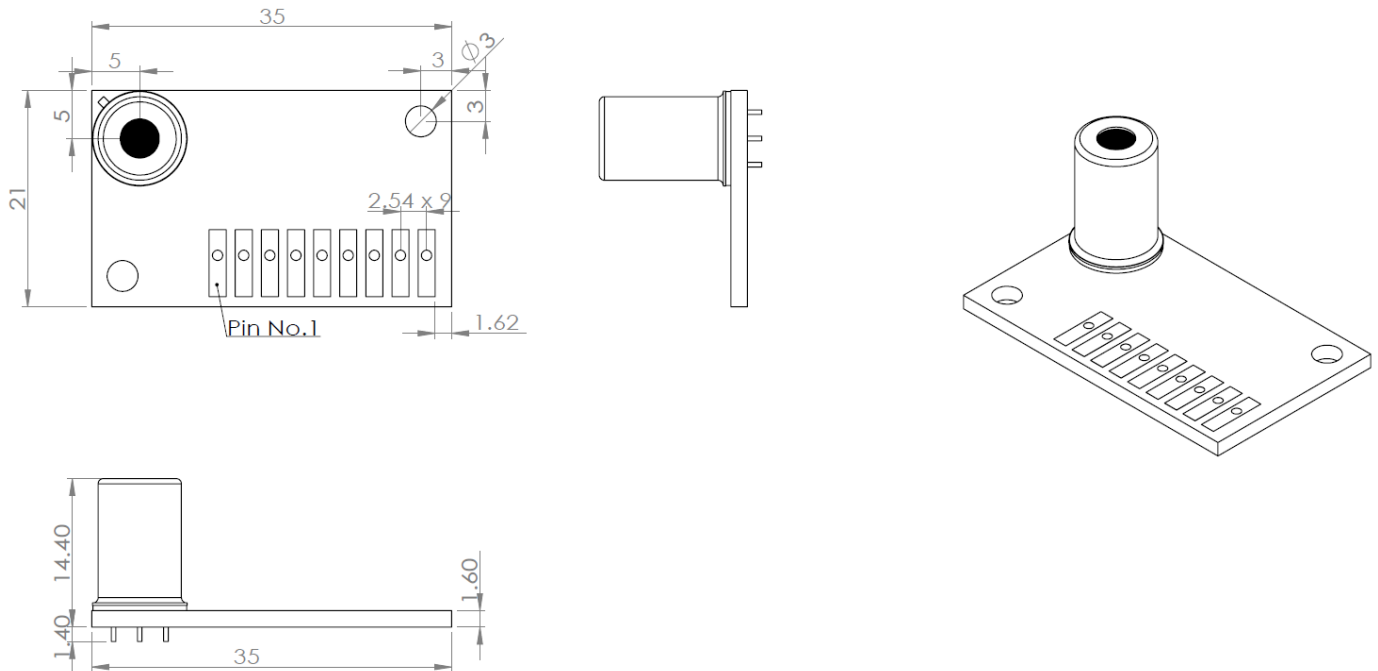
Sensor & electrical performance specification (T_a = 25°C)

Parameters		Condition	Symbol	Min	Typ	Max	Unit
Gas	Target gas	-	T _{Gas}	CO ₂			-
Data	Sensor type	-	EC	Electrochemical			
	Detection range	-	DD _R	350-6,200			ppm
	Resolution	-	D _R	1			ppm
	Accuracy	-	D _A	-10	After Starting 15 min	10	%
-		D _{A3}	-15	10 min	15		
-		D _{A10}	-25	3 min	25		
Time	Response	-	T _{Res}	2min for 90% for diffusion sampling method			
	Warm-up	-	T _{WU}	1	3	-	min
	Life-time	-	T _{LT}	10			Years
Power	Input	-	V _{IN}	4.5	5	5.1	V
	Current Consumption	-	P _A	-	0.12	0.15	A
	Warm-up consumption	-	P _W	-	0.6	1	W
Output	Interface connections	-	O _C	UART, I2C, Vout			
	DACout - Warm up	-	V _{wrm}	4.7			V
	DACout - Normal Operation	-	V _{nor}	0.4~4.4 CO ₂ ppm = V _{nor} x 1000			V
	DACout - Alarm	-	V _{alm}	0			V
	DACout - ppm	-	V _{ppm}	400~4,000			ppm
	I2C-ppm	-	I2C_ppm	350~6,200			ppm
	UART-ppm	-	UART_ppm	350~6,200			ppm
	State	-	Stat	0: Normal, 1:Warm-up			
	Error	-	Error	0:Normal, 1:Error			
	Sampling interval	-	T _{SPL}		1		Hz
	Connector	-	CNT	2.54 pitch hole, not specified connector It depends on customer's requirements			
Ambient	Operating Temp	-	O _T	-20	25	70	°C
	Operating Humidity	No condensing	O _H	0	-	95	%
	Storage Temp	-	S _T	-40	25	105	°C
	Storage Humidity	Pack in moisture proof bag	S _H	5	-	90	%
Calibration		-	CAL	Not required. and Self mode is ready			-

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Module Overview



Theory of operation

Introduction

The CO₂ Sensor module is a gas sensor system that has been optimized for carbon dioxide. It is highly sensitive system including gas sensor and self calibration. CO₂ sensor is operated by following 3 steps.

1. Warm-up
2. Normal operating
3. Calibration

Warm-up

Electrochemical CO₂ sensor is consisted with micro heater and sensing material. The sensing material should be heated for 1~15 minutes to measure specific CO₂ level. About 15 minutes later, the module shows stable and correct value of CO₂ concentration.

The module consume about 0.5 W while warm-up. And after warming-up, it reduced to about 0.1W.

Normal operating

In continuous operation, CO₂ sensor module shows stable and linear signal by CO₂ concentration. If the module is turned off, warm-up is required again to measure CO₂ concentration after turn on.

Calibration

After applying power to the module, the measurement value may be deviated in 2 days. The deviation is related with installation environment. However, if the module is operated continuously over 2 days, the module learn about the installation environment and shows higher accuracy than specification sheet value by self calibration logic.

CO₂ Sensor Module

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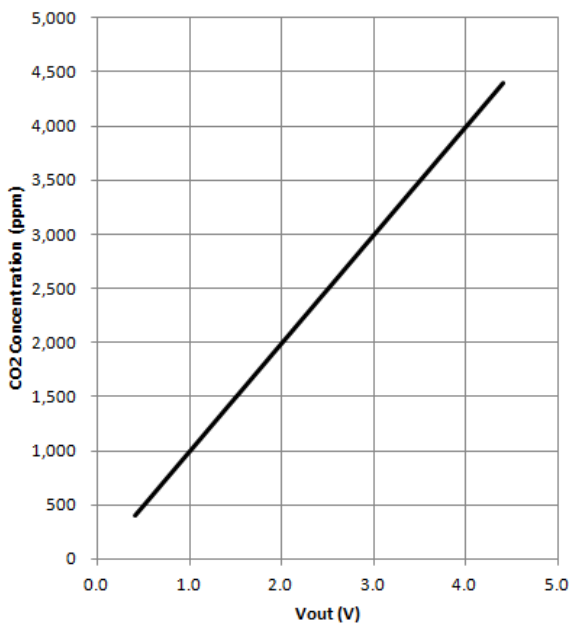
Terminal descriptions

Connector is not specified. It will be discussed between customer and EXSEN. Basically, connector is not attached.

Pin No.	Symbol	Description
1	SCL	Digital input, Serial clock for I2C communication
2	SDA	Digital bidirectional, Serial Address and Data
3	VCC	Supply, 5V
4	GND	Ground
5	DAC-out	Analogue output (0.4~4.4V), Failure=0V, Warm-up=4.7V
6	Rx	UART Rx
7	Tx	UART Tx
8	Manufacturer	SWCLK
9	Manufacturer	SWDIO

Communication

DAC-out



CO₂ Concentration / DAC out

Vout	ppm	Vout	ppm
0	Failure	2.5	2,500
0.4	400	2.6	2,600
0.5	500	2.7	2,700
0.6	600	2.8	2,800
0.7	700	2.9	2,900
0.8	800	3.0	3,000
0.9	900	3.1	3,100
1.0	1,000	3.2	3,200
1.1	1,100	3.3	3,300
1.2	1,200	3.4	3,400
1.3	1,300	3.5	3,500
1.4	1,400	3.6	3,600
1.5	1,500	3.7	3,700
1.6	1,600	3.8	3,800
1.7	1,700	3.9	3,900
1.8	1,800	4.0	4,000
1.9	1,900	4.1	4,100
2.0	2,000	4.2	4,200
2.1	2,100	4.3	4,300
2.2	2,200	4.4	4,400
2.3	2,300	4.7	Warm-up
2.4	2,400		

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I2C

output range: 350 ppm ~ 6200 ppm (Device Address: 0x23)

SCL Frequency: 200kHz

* **Master, Slave**

S	Address(W)	A	Command	A	S	Address(R)	A	DATA1	A	Data n	NA	P
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General-purpose registers

Address	Data Bit	Default Value	Access	Name	Description
0xA1	[2:0]	-	RO	ACON	CO2 data (ppm)
	[3]	-	RO	STAT	0:Normal 1:Warm up
	[4]	-	RO	ERROR	0:Normal 1:Warm up
0xA2	[2:0]	-	RO	ACON	CO2 data (ppm)
0xA5	[0]	-	RO	STAT	0:Normal 1:Warm up
	[1]	-	RO	ERROR	0:Normal 1:Warm up
0x90	[0]	0	R/W	CALI	0:Auto CAL mode 1:Manual CAL mode 10: Manual CAL Action Manual CAL Sequence (1)Manual CAL mode --> (2)Manual CAL Action --> (3) Auto CAL mode

UART

Baud rate: 9600

date expression: # 5000 Nr Nr

	#	Space	CO2 Concentration (ppm)	Space	Warm up Status	Space	Sensor Status
Data type	#		####		Wu/Nr		Er/Nr
Description	Start		Four digit		Wu: Warm up Nr: Stable		Er: sensor is not working properly. Nr: normal status

Revision history

Rev No.	Date	Page	Details
R01	Mar 2016	ALL	Initiate HX-105N, CO ₂ sensor module specification

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