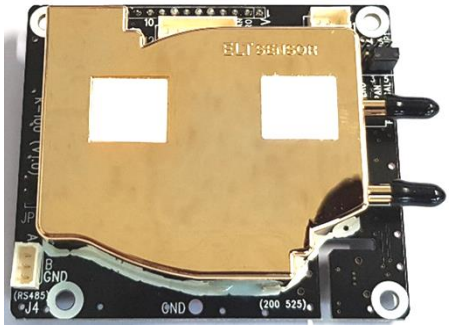
General

Ver. 1.01

CH4-K100 ranges as the lowest concentration methane gas detectable NDIR sensor module. Its humidity as well as temperature compensation contribute the sensor' long-term consistent stability with accuracy. Diffusion type for ambient detection and flow-thru type for faster response with in/out tubes are selectable.

ELT Sensor
Data Sheet for CH4-K100



Features

- Non-Dispersive Infrared (NDIR) Dual Channel Technology to measure down to 50ppm CH4 levels.
- Excellent compensation of Humidity as well as Temperature change effect.
- Output : TTL-UART, I2C, ALARM, PWM, Analog Voltage,RS485Modbus is optional.
- Zero calibration (0_MCDL) is executable at site or with standard gas of Dry air or Nitrogen gas.

- Size : 40mmx38mmx18.5mm
- Weight : 20 grams

Specifications

Applications

CH4-K100's low concentration detectability expands to Bio-Energy as well as gas leakage alarming detector for Methane, Butane, LNG or combustible gases in Mine, metallurgy, liquefied gas station, petroleum, fuel gas ,etc.

General Performance

Operating Temperature : -20 ~ 50℃, **Storage Temperature :** -20℃ ~50℃

Operating Humidity : 0 ~ 95% RH (Non-condensing), **'G' option :** 0 ~ 99% RH (Non-condensing) (1)

Measurement

Sensing Method : NDIR (**N**on-**D**ispersive **I**nfra-**R**ed) type.

Measurement Range : 0~5,000ppm is default (0~50,000 ppm is optional)

Accuracy : ±3% of F.S. (1),(2),(3),

Output unit: ppm, **Resolution:** 20 ppm

Lowest Detection Limit: 50ppm @25℃

Step Response Time: $T_{90\%}$ 240 secs(D-type), **25 secs(**F-type) $\tau_{(1/e)}$ **:** 120 secs(D-type), 15 secs**(**F-type)

Sampling Interval: 3 seconds

Warming-up Time : < 10 seconds (for output), 3 minutes (for Accuracy)

Electrical Data

Power Input : 12V (8~15V tolerance) (4)(5)

Current Consumption : Normal mode : 20mA, Peak : 330mA

Product Derivatives and Relative Functions

Products	Feature
CH4-K100D(G)	Enable sensor to operate in very humid environment up to 99 %RH humidity, protecting PCB from rustiness.
CH4-K100F(G)	Flow-thru type of CH4-K100F, open two holes on side and block to disable the white colored filter on the top of Gold Cavity.
G option	Enable sensor to operate in very humid environment up to 99 %RH humidity, protecting PCB from rustiness.

(1) 'G' type : 0 ~ 99% RH (Non-condensing) for Industrial Application of Methane gas.

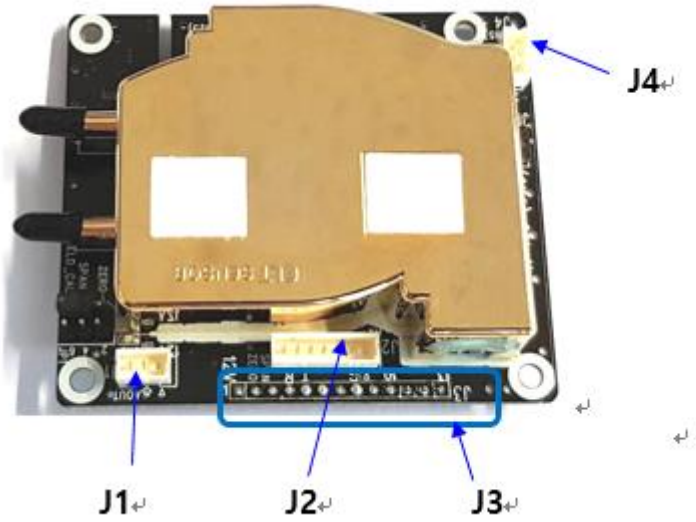
(2) If sensor is affected by the shock, may need field calibration before installation.

(3) Air pressure is assumed as 101.3 kPa.

(4) If sensor is affected by the shock, may need field calibration before installation.

(5) 5V power, normal current is 35mA with peak current 600mA, must be careful not to wire to wrong location of PCB to avoid being burn out.

CH4-K100 has various output TTL-UART, I2C, Alarm and Analog voltage, PWM, RS-485Modbus is selectable as option.



76mmx64mmx22mm
(W,D,H)

Connectors	Power and Output wiring
J1'power + outputs	J1's 12V Power, J1's Analog output (with 3pin connectors)
J1'power+J2'outputs	12V Power, UART communication (with 3pins + 7pins connectors)
J2'power+output	5V Power, UART communication (with 7pins-connector)
J3'power+output	12V Power, I2C, PWM, Alarm outputs (with 13 holes connection)
J1'power+J4'output	12V Power, RS485 Output (3 pins + 3 pins connector)

Pin Map with J11&J12 Connectors

J1	Description
1	+12V VCC In
2	AOUT (0.5V ~ 4.5V)
3	GND

J2	Description
1	+5V VCC
2	TTL TXD (→ CPU of Master Board)
3	TTL RXD (← CPU of Master Board)
4	GND
5	PSEN
6	RESET
7	N.C (No Connection)

Pin-map with 2.54mm pitch J3 Side-holes

J-3	CH4-K100	CH4-K100 (Analog Voltage or PWM option)
1	+12V VCC	
2	Zero Calibration (with Dry air or CH4-Zero-gas=$N2_{100\%}$gas)	
3	Reserved as is not in need (Span Calibration)	
4	TTL RXD (← CPU of Master Board)	
5	TTL TXD (→ CPU of Master Board)	
6	RESET	
7	PSEN	
8	GND	
9	Reserved	Analog Voltage Output (0.5~4.5V)
10	Reserved	PWM Output
11	I2C SDA	
12	I2C SCL	
13	Alarm (Open Collector Type)	

UART 38,400BPS, 8bit, No parity, 1 stop bit
9,600 or 19,200 BPS can selectable through command sets or EK-100SL.

I2C Slave mode only, Internal pull up resister 10kΩ
TTL Level Voltage : $0 \le V_{IL} \le 0.4$, $2 \le V_{IH} \le V_{DD}$, $0 \le V_{OL} \le 0.4$, $2.4 \le V_{OH} \le V_{DD}$ (Volt)

Analog Voltage: 0.5~4.5V (option) Open Collector type, endurable up to 50A**.**

PWM (option)

t_H = 2 msec(Start) + 1,000 msec x ($Measurement_{(ppm)}$/ $Range_{(ppm)}$), T_L= 2,000 ms - t_H ,

Pin-map with 2.54mm pitch J4 connector

J4	Marked	RS485Modbus
1	A	485A
2	B	485B
3	GND	Ground

In need of detail protocol specification of **'RS485Modbus specification'** could be provided by contacting Sales Rep.

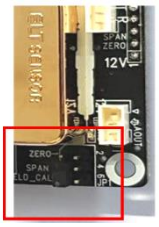
Pin-map with JP1 Jumper

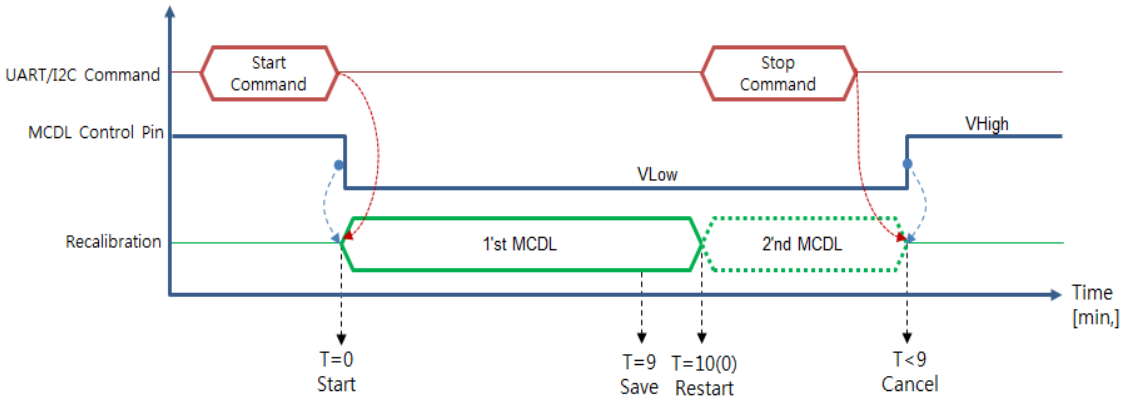
JP-1	Marked	CH4-K100
1-2	Zero Cal.	Zero Calibration
3-4	Span Cal.	Reserved as is not in need (Span Calibration).
5-6	Field Cal.	Reserved as is not in need (Field Calibration at customer site)

Zero / Span / Field Calibration is executable by plugging jumper-cap between 1-2/3-4/5-6 each.

Zero Calibrations (10 minutes Manual Calibration)

Zero Calibration can be done by locating jumper-cap on JP-1:pin1/pin2 each, alternative ways are giving start command or low signal to J13-pin2/pin3 each at least more than 2 minutes with dry air/ span gas.





Time Diagram of MCDL

Method 1. UART Command Set; J12: pin-2 (UART-TX) and pin-3 (UART-RX) to Main-Board (J13: pin-5 and pin-4 can be used instead.).

Method 2. I2C Command Set; J13: pin-12 (SCL) and pin-11 (SDA) to Main-Board.

Output Descriptions

UART Descriptions

Data Format

Above 12byte consist by 6 byte hexadecimal digits, where decimal '0' (corresponds to hexadecimal digit '0x30') is replaced by space (corresponds to hexadecimal digit '0x20'),

EX) D6~D1 string display the CH4-K100 concentration of

D6	D5	D4	D3	D2	D1	SP	'p'	'p'	'm'	CR	LF

D6 ~ D1	6 byte CH4 density string
SP	Space: 0x20
'ppm'	' ppm' string
CR	Carriage return : 0x0D
LF	Line feed : 0x0A

EX) 1,500 ppm string is '0x20 0x20 0x31 0x35 0x30 0x30 0x20 0x70 0x70 0x6D 0x0D 0x0A', of which display on the screen is '__1500_ppm<CR><LF>'.

I2C Communication (Only Slave Mode Operation)

Internal pull up resister 10kΩ

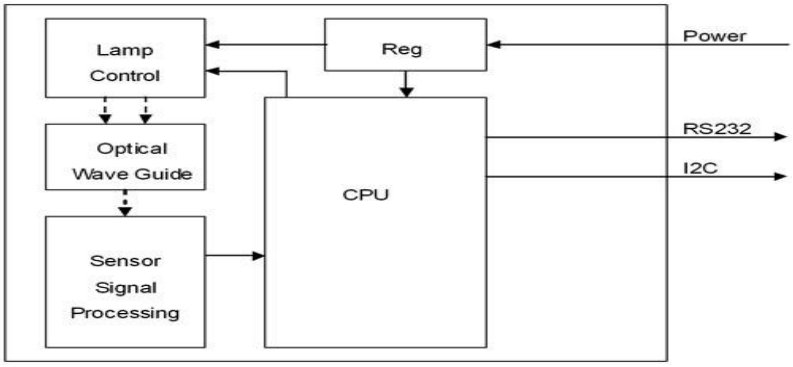
Slave Address: 0x51[6], Slave Address Byte: Slave Address(0x51) 7 Bit + R/W 1 Bit

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	1	1	0	0	0	1	R/W Bit

R/W Bit : Read = 1/Write = 0

When reading the data, Slave Address Byte is 0x52, When writing the data, Slave Address Byte is 0x52.

Block Diagram



Transmission Sequence in Master

1) I2C Start Condition

[6] Slave address of all kinds of Methane sensors is changed to 0x51 since Sep. of 2020. Should the sensor with other address, please make sure to mark on purchase order sheet.

2) Write Command(Slave Address + R/W Bit(0) = 0xA4) Transmission and Check Acknowledge

3) Write Command(ASCII 'R' : 0x52) Transmission and Check Acknowledge

4) I2C Stop Command

5) I2C Start Command

6) Read Command(Slave Address + R/W Bit(1) = 0xA5) Transmission and Check Acknowledge

7) Read 7 Byte Receiving Data from Module and Send Acknowledge

(Delay at least 1ms for reading each byte)

Configuration	CO_2	reserved	reserved	Reserved	reserved
1 Byte	2 Byte	0x00	0x00	0x00	0x00

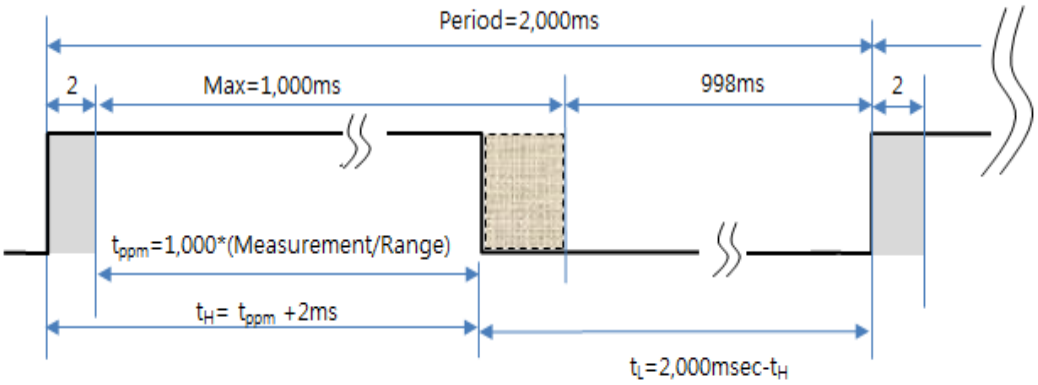
0	0	0	0	1	0	0	0

In need of detail protocol specification and time sequence, **'I2C programming guide'** could be provided by contacting Sales Rep.

PWM Descriptions

* Measurement$_{(ppm)}$ = (t_H-2msec)/1000msec x Range$_{(ppm)}$ (t_H : High Pulse Width)

* Range$_{(ppm)}$: 0~2,000ppm



EX) t_H (High Pulse Width) calculation for 500ppm in 0~5000ppm Range.

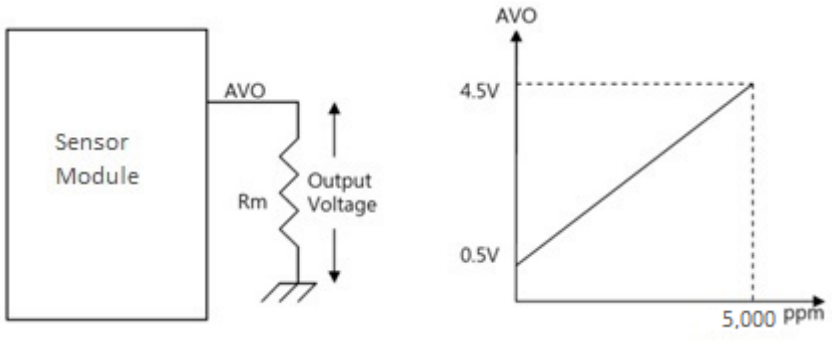
*Measurement(ppm) = 500ppm = (t_H -2ms)/2,000msec x Range(5,000ppm) ,

* t_H = 1,000 msec * (500ppm / 5,000ppm) + 2msec = 102msec

(cf: t_L = Period - t_H = 2,000 msec – 102 msec = 1,898 msec.)

Analog Voltage Output Descriptions : Option

Measured Voltage 0.5V~4.5V match proportionally to 0 ~ 5,000ppm.



* CH4 Measurement $_{(ppm)}$ = Output $_{Voltage}$– 0.5/ (4.5 – 0.5) $_{Voltage}$ x 5,000ppm.

EX) if the Output $_{Voltage}$ is 2.5V in 0~5,000ppm range,

CH4 (ppm) = (2.5 – 0.5) V÷ (4.5 – 0.5)V x 5,000ppm

=0.5 x 5,000ppm = 2,500ppm

※Caution

1. Please use only 'PCB' of sensor to avoid the physical shock on sensor without holding Gold-Colored-Cavity directly. Rough handling or Transportation could result in inaccurate reading.. But, Zero-Calibration (0_MCDL) is available to correct the sensor to normal status.
2. Proper ESD protection during handling is important to avoid electrostatic defect occurrence like motors and the storage of sensor should be insulated as well.
3. Sensor location should be protected from Vibration as far as possible, which could effect the sensor location.
4. Sensor should not be drop and wet by water, which lead to unfixable damage.
5. Sensor location should be a bit higher 1.5~2m because Methane gas has low specific gravity than air.
6. Zero Calibration (0_MCDL) is recommended when restart Sensor after long period storage or effected by physical shock or drop. Please make sure to calibrate on operating environment when use higher or lower temperature or humidity than normal.
7. When Zero Calibration (0_MCDL) is finished, please make sure to let the jumper-cap of JP-1 return to original location.

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