General

Version 1.1

C4H10-LD-3V is world's lowest concentration detectable small size butane sensor module. Its persistent accuracy and stability through the life cycle, and Temperature Effect Compensation are incomparably favored by industrial field experts carrying various flammable, explosive, and hazard gases.

Datasheet for C4H10-LD-3V

Features

- NDIR Technology to measure butane gas level.
- Excellent compensation of Temperature Effect.
- Diffusion Type
- Output : TTL-UART, I2C

  (Analog Voltage is option)
- Easy Calibration with Non-Periodic Manual Calibration (MCDL : CAL1) and Periodic Automatic Calibration (ACDL : CAL2).
- Size : 40mmx38mmx18.5mm
- Weight : 17 grams

※ Specification of C4H10-LD-3V could be changed without notice.

C4H10-LD-3V Specifications

Applications

C4H10-LD-3V expands the application category to even Homes and Offices as well as industrial gas dealing factories as Gas leakage alarming detector for Butane, LNG or combustible gases in Mine, metallurgy, liquefied gas station, petroleum, fuel gas ,etc.

General Performance

Operating Temperature : -20 ~ 50℃, **Storage Temperature :** -30℃ ~70℃

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

CO_2 Measurement

Sensing Method : NDIR (Non-dispersive Infrared)

Output unit : 'ppm' as default ('LEL %' is optional)

Measurement Range : 0~5,000ppm(0~10% LEL) is default , 0~18,000ppm(0~100% LEL) is optional.

Accuracy : ±3% of F.S. (1),(2),(3)

Detection Resolution : 50ppm(=0.3% LEL)

Lowest Detection limit : 100ppm(=0.6% LEL)

Step Response Time (90%, 1/e) : 120 seconds (90%), 70 seconds (1/e) for Diffusion type

Sampling Interval : 3 seconds

Warming-up Time : 6 seconds (for Detection), 5 minutes (for Accuracy)

Electrical Data

Power Input : 3.2V ~3.6V**DC**

Current Consumption : Normal mode : 14mA, Peak/Typical : 270mA, (4)

Product Derivatives and Relative Functions

Products	Feature
C4H10-LD-3VG	Resistant up to 99% humidity
C4H10-LF-3V	Flow through type
C4H10-LFG-3V	Resistant up to 99% humidity for Flow through type

(1)DC Supply should be regulated without ripple < 100mV, low noise power source is needed for best accuracy

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

(3) Air pressure is assumed as 101.3 kPa..

(4) Current Capacity should 2~3 times of Peak Current.

C4H10-LD-3VG and C4H10-LFG have 'G' suffix which could resistant to 99% humidity. C4H10-LF and C4H10-LFG has 'F' option which has two tube inlets for 'Flow Through' instead of white colored filter for 'Diffusion'.

Pin Map with J1&J2 Connectors

J-1	C4H10-LD-3V
1/3	VDD (+3.3VDC)
2/4	GND

J-2	C4H10-LD-3V	C4H10-LD-3V (Analog Voltage Option)
1	TTL RXD (← CPU of Master Board)	
2	TTL TXD (→ CPU of Master Board)	
3	I2C SCL	
4	I2C SDA	
5	GND	
6	Reserved	Analog Voltage Output (0.5~3V)
7	CAL2-pin : ACDL (for every 7 days ACDL with periodic C4H10-'0'ppm circumstance)	
8	Reserved	
9	CAL1-pin : MCDL (for 1 minute MCDL with CH4-'0'ppm- C4H10-'0'ppm circumstance)	
10	Reset (Low Active)	

Pin Map with JP-1 Connectors

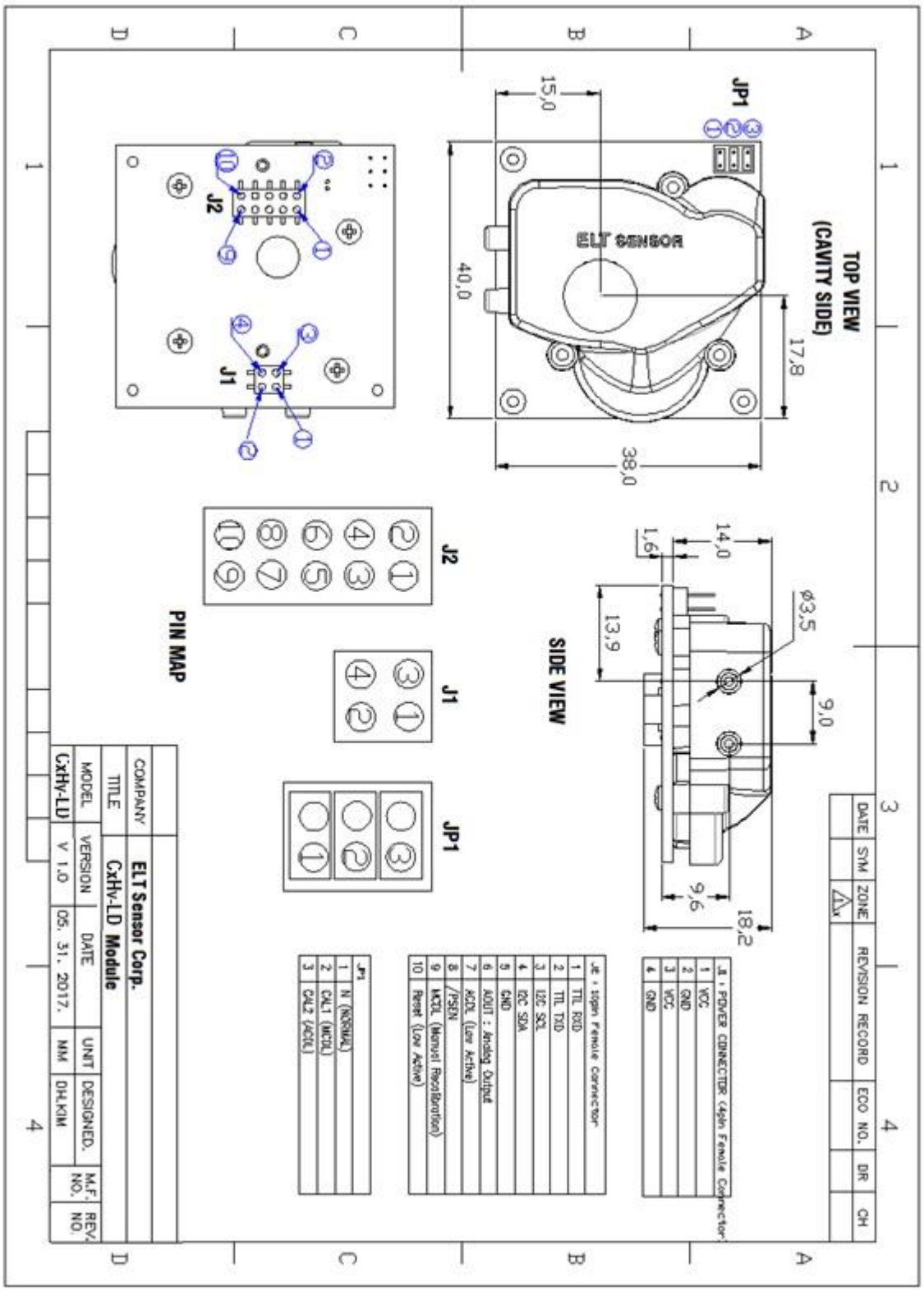
JP-1	C4H10-LD-3V
1	N (Normal)
2	CAL1 (MCDL)
3	CAL2 (ACDL)

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 (option) : 0.5~3V

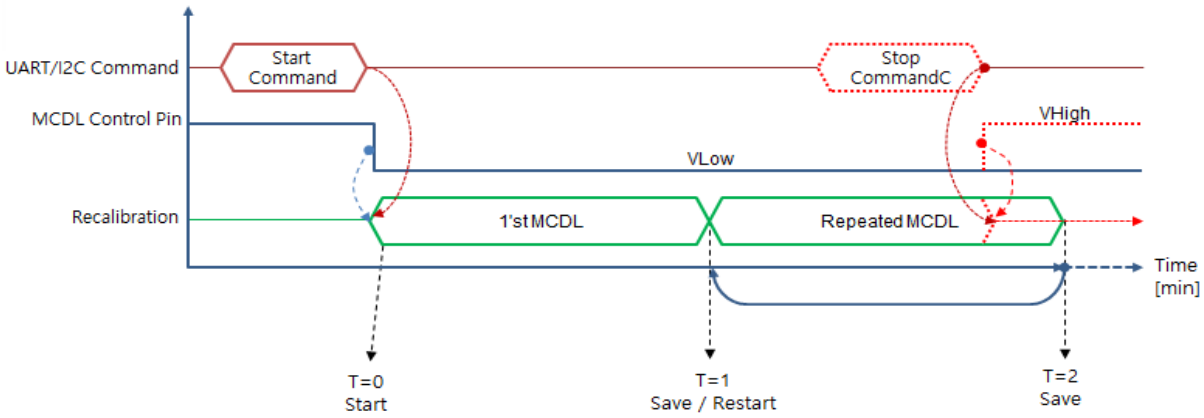
Cavity Dimensions (unit : mm)



MCDL and ACDL Calibration.

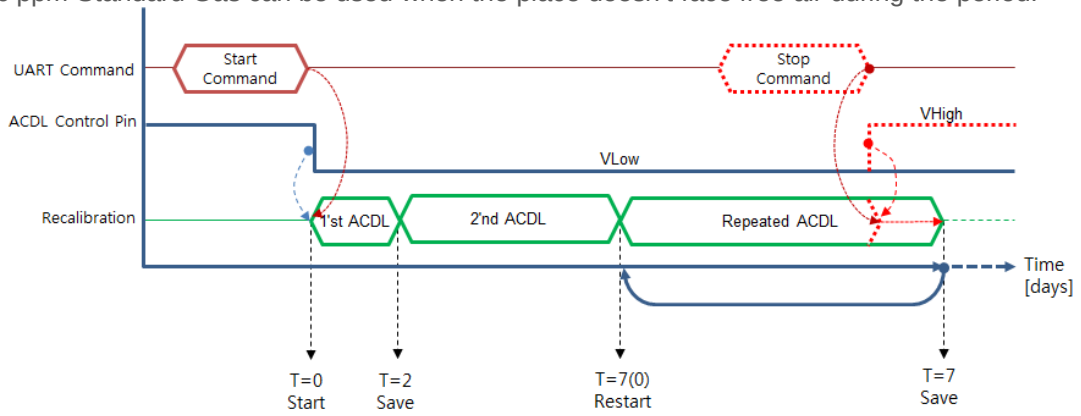
MCDL (1 minutes Manual Calibration)

'0' ppm Manual Calibration can be done by giving start command or low signal to CAL1-pin at least more than 1 minute since the fresh air is fully balanced near sensor.



ACDL (Periodic Automatic Calibration)

Periodic Automatic Calibration can be used by giving start command or low signal to CAL2-pin. The sensor calibrate automatically first in 2 days, seconds 5 days and every week.
'0'ppm Standard Gas can be used when the place doesn't face free air during the period.



Method 1. Commands set for MCDL or ACDL Calibrations for is available.**EK-100SL (Evaluation kit, with Emulation program 'ELTWSD')** is purchasable for user's convenience.
UART/I2C Command Sets are available at J12 pin-1,2 (RX, TX) / J12 pin-3/4 (SCL,SDA).

Method 2. MCDL/ACDL Control pins are available. **TRB-100ST (Test and Recalibration Board)** JIG-Board at ambient air-flow condition or with 0'ppm Standard Gas and execute by moving jumper following Manual on the website.
CAL1 / CAL2 control pins are available at J12 pin-9/ pin-7 or JP1 pin-2/pin-3

CAL1 MCDL	CAL 2 ACDL	Function	Process
Low	High	H/W MCDL	Let C4H10-LD-3V-3V sensor be located at ambient place where no butane gas exist and wait 1 minute. '0'ppm Standard gas can be used when '0'ppm is not guaranteed.
High	**Low**	H/W ACDL	Automatic Calibration can be used where CH4 meet the clear air more than 3 minutes per week.
High	High	Normal	Operate with Factory Calibrated or previously set status

※ CAL-1pin and CAL-2pin shouldn't have 'Low' at the same time.

Output Descriptions

UART Descriptions

Data Format

SP	SP	SP	D2	D1	'%'	SP	'L'	'E'	'L'	CR	LF

SP x 3	Space: 0x20
D2 ~ D1	2 byte CH4 density string
%	%: 0x25
SP	Space: 0x20
'LEL'	' LEL' string
CR	Carriage return : 0x0D
LF	Line feed : 0x0A

Above 12byte consist by 6 byte hexadecimal digits, <SP>,<SP>,<SP>,0x70 0x70 0x6D, <CR><LF> , where decimal '0' (corresponds to hexadecimal digit '0x30') is replaced by space (corresponds to hexadecimal digit '0x20'),

EX) 7% LEL (= 3,500 ppm) string is '0x20 0x20 0x20 0x20 0x37 0x25 0x20 0x4C 0x45 0x4C, 0x0D 0x0A',, of which display on the screen is '____7%_LEL<CR><LF>'.

'ppm' display is Option on sale, which D6~D1 string display the C4H10 concentration of

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

EX) 3,500 ppm string is '0x20 0x20 0x33 0x35 0x30 0x30 0x20 0x70 0x70 0x6D 0x0D 0x0A', of which display on the screen is '__3500_ppm<CR><LF>'.

I2C Communication (Only Slave Mode Operation)

Internal pull up resister 10kΩ

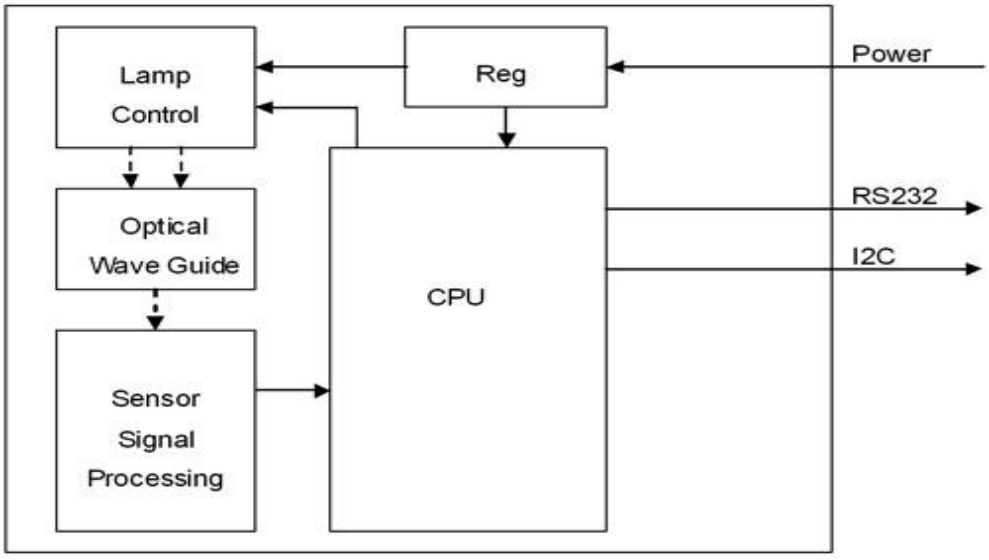
Slave Address: 0x31, Slave Address Byte: Slave Address(0x31) 7 Bit + R/W 1 Bit

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 0x63, When writing the data, Slave Address Byte is 0x62.

Block Diagram



Transmission Sequence in Master

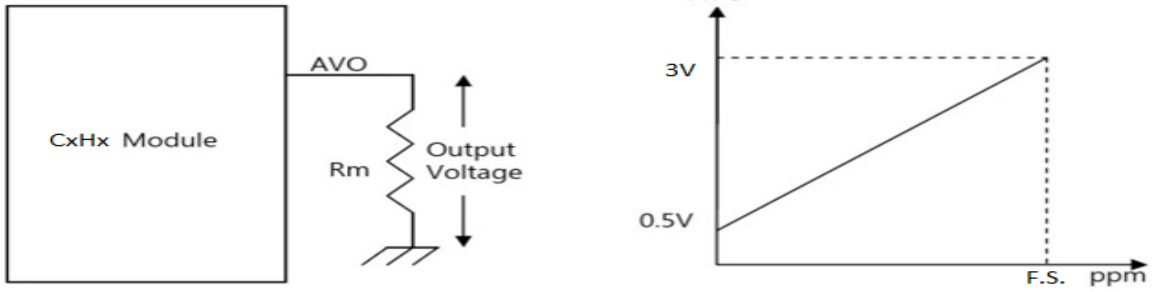
1) I2C Start Condition
2) Write Command(Slave Address + R/W Bit(0) = 0x62) Transmission and Check Acknowledge
3) Write Command(ASCII 'R' : 0x52) Transmission and Check Acknowledge
4) I2C Stop Command
5) I2C Start Command
6) Read Command(Slave Address + R/W Bit(1) = 0x63) Transmission and Check Acknowledge
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.

Analog Voltage Output Descriptions : Optional



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

* C4H10 Measurement $_{(ppm)}$ = Output $_{Voltage}$– 0.5/ (3 – 0.5) $_{Voltage}$ x 5,000ppm.
  cf. F.S. $_{(ppm)}$: 5,000 ppm (18,000 is optional.)

EX) if the Output $_{Voltage}$ is 1.0V in LEL 0~5,000 range,
C4H10 ppm= (1.0 – 0.5) V÷ (3 – 0.5)V x 5,000ppm
=0.5 x 5,000ppm LEL = 1,000ppm

※ Caution

1. Please use only ‘PCB’ of sensor to avoid the physical shock on sensor without holding Cavity directly. Rough handling or Transportation could result in inaccurate reading..
   But, 0_MCDL with CAL1 or 0_ACDL with CAL2 are available to correct the sensor to normal status.

2. Proper ESD protection during handling is important to avoid electrostatic defect occurrence. The storage of sensor should be insulated as well

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