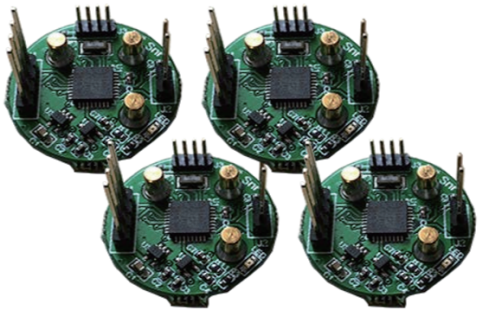
• Description

This 4LEL-Smart Module PCBA consists of a data collection and processing PCB assembly, and a SemeaTech 4-Series Catalytic combustion (LEL) sensor. The PCB assembly in the module collects the data from the gas sensor output, and then processes it with amplification, sampling and filtration through a built-in MCU to deliver stable and accurate digital output reflecting the actual target gas concentration. The 4LEL-Smart Sensor Module delivers the signal output through UART bus, which provides a good user experience for quickly integrating gas sensors into the existing systems for a variety of gas detection applications. Users can visit the website for detailed sensor parameters.

• Product Dimensions



• Specifications

Product Model:	4LEL-Smart
Detectable Gas Types:	Combustible gas
Detection Principle:	Catalytic combustion
Gas Concentration Range:	0 ~ 100% LEL
Resolution:	1% LEL
Measurement Error:	< ±5%FS
Operating Voltage:	(3.3 ~ 3.6) VDC
Operating Current:	≤ 110 mA @ 3.3 VDC
Output Mode:	UART (3.3V TTL)
Operating Temperature:	0°C ~ 40°C
Operating Humidity:	≤ 98%RH (25°C)
Operating Pressure:	86 ~ 116 KPa
Storage Temperature:	-20°C ~ 40°C
Dimensions:	Φ 24.2 x 26.8 mm

• Pin Definitions

Vin	Power input positive
GND	Power input negative
TXD	Serial port sending
RXD	Serial port receiving

• Communication Settings

Baud rate:	9,600 bps
Data bits:	8
Stop bit:	1
Check bit:	None

• Communication Command

This module uses serial port (TXD/RXD) and uses question-and-answer mode for data transmission. All data transmission is in hexadecimal format (HEX).

1. Command for terminal Read Module Information

Start byte of a command	Information reading command	Module address (default at 0x01)	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	0F	01	C5	80	EE

For example: AA 0F 01 C5 80 EE

Note: In this command Byte 2 and Byte 3 will be checked with CRC16 (Modbus).

Modular response (sending information data to terminal)

Start byte of a command	Information reading command	Module address (default at 0x01)	Sensor type (LEL)	Modular measure-ment range (hexadecimal)	Modular measure-ment range (hexadecimal)
AA	0F	01	05	00	64
Calibration of gas concentration (hexadecimal)	Calibration of gas concentration (hexadecimal)	High Alarm Point (Hexadecimal)	High Alarm Point (Hexadecimal)	Low Alarm Point (Hexadecimal)	Low Alarm Point (Hexadecimal)
00	19	00	19	00	0F
Sensor reading units (% LEL)	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte		
00	63	84	EE		

For example: AA 0F 01 05 00 64 00 19 00 19 00 0F 00 63 84 EE

Note: In this command Byte 2 ~ Byte 13 will be checked with CRC16 (Modbus).

2. Commands for gas concentration request

Start byte of a command	Command for concentration sending request	Module address (default at 0x01)	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	01	01	C1	E0	EE

For example: AA 01 01 C1 E0 EE

Note: In this command Byte2 and Byte3 will be checked with CRC16 (Modbus).

Modular response (sending concentration data to terminal)

Start byte of a command	Command for concentration sending request	Module address (default at 0x01)	Data symbol bit (0x80: negative; 0x00: positive)	Fixed to zero	Data (% LEL), Hex format
AA	01	01	80	00	00
Fixed to zero	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte		
00	15	CA	EE		

For example: AA 01 01 80 00 00 00 15 CA EE

Note: In this command Byte 2 ~ Byte 7 will be checked with CRC16 (Modbus).

3. Command for terminal sending Module Zero-setting

Start byte of a command	Command for Zero-setting	Module address (default at 0x01)	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	02	01	C1	10	EE

For example: AA 02 01 C1 10 EE

Note: 1) In this command Byte 2 and Byte 3 will be checked with CRC16 (Modbus);

2) During zero-setting, the LED flickers at a frequency of 1 second per time, lasting for 30 seconds.

Zero-setting success, module sending:

AA 02 01 10 D0 5C EE

Zero-setting failure, module sending:

AA 02 01 20 D0 48 EE

Start byte of a command	Command for Zero-setting	Module address (fixed at 0x01)	Signs of success/failure	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	02	01	10/20	D0/D0	5C/48	EE

Note: In this command Byte 2 ~ Byte 4 will be checked with CRC16 (Modbus).

4. Command for terminal sending Module Calibration

Start byte of a command	Command for Calibration	Module address (default at 0x01)	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	03	01	C0	80	EE

For example: AA 03 01 C0 80 EE

Note: 1) In this command Byte 2 and Byte 3 will be checked with CRC16 (Modbus);

2) During zero-setting, the LED flickers at a frequency of 1 second per time, lasting for 120 seconds.

Calibration success, module sending:

AA 03 01 10 81 9C EE

Calibration failure, module sending:

AA 03 01 20 81 88 EE

Start byte of a command	Command for Calibration	Module address (default at 0x01)	Signs of success/failure	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	03	01	10/20	81/81	9C/88	EE

Note: In this command Byte 2 ~ Byte 4 will be checked with CRC16 (Modbus).

5. Command for Module Address Modification

Start byte of a command	Command for Address Modification	Module new address	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	04	02	82	B1	EE

For example: AA 04 02 82 B1 EE

Note: In this command Byte 2 and Byte 3 will be checked with CRC16 (Modbus).

Address Modification success, module sending:

AA 04 02 10 30 AD EE

Start byte of a command	Command for Address Modification	Module new address	Signs of success/failure	CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte
AA	04	02	10	30	AD	EE

Note: In this command Byte 2 ~ Byte 4 will be checked with CRC16 (Modbus).

6. Command for Adjustment of Calibration Gas Concentration

Start byte of a command	Command for concentration adjustment	Module address (default at 0x01)	Fixed to zero	Concentration to be modified (%LEL, Hex format)	CRC16 (Modbus) Check high byte
AA	05	01	00	32	D0
CRC16 (Modbus) Check low byte	Command end byte				
FD	EE				

For example: AA 05 01 00 32 D0 FD EE

Note: In this command Byte 2 ~ Byte 5 will be checked with CRC16 (Modbus).

Adjustment success, module sending:

AA 05 01 10 00 32 69 EC EE

Adjustment failure, module sending:

AA 05 01 20 00 32 69 E3 EE

Start byte of a command	Command for Adjustment	Module address (default at 0x01)	Signs of success/failure	Fixed to zero	Concentration to be modified (%LEL, Hex format)
AA	05	01	10/20	00	32
CRC16 (Modbus) Check high byte	CRC16 (Modbus) Check low byte	Command end byte			
69/69	E3/E3	EE			

Note: In this command Byte 2 ~ Byte 6 will be checked with CRC16 (Modbus).

• Warning

1) This product does not have any intrinsic safety certification or explosion proof certification. Please do NOT use this product in any hazardous locations.
2) This product does not have reverse power protection and Electrostatic Discharge (ESD) protection. Please carefully verify the electrical polarity and make the ESD protection before each use or installation.
3) Please use a stable DC power supply for this gas sensor module. It is highly recommended to use a power supply with the output voltage fluctuation less than 1%.

Appendix 1: MODBUS CRC16 algorithm

```
unsigned short modbus_CRC16(unsigned  char *ptr, unsigned char len)
{
unsigned short wcrc=0XFFFF; / /
int  i=0, j=0;
for (i=0; i<len; i++)
        {
                wcrc^=*prt++;
                for ( j=0; j<8; j++)
                    {
                        if (wcrc&0X0001)
                          {
                              wcrc=wcrc>>1^0XA001;
                           }
                        else
                          {
                              wcrc>>=1;
                           }
                    }
          }
return wcrc<<8| wcrc>>8;   //little endian (LSB fist)

}
```