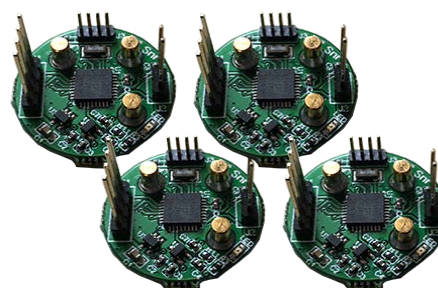


4ECM-SMART MODULE PCB

Description

This 4ECM-Smart Module PCB consists of a data collection and processing PCB assembly, and a SemeaTech 4-Series electrochemical (EC) sensor. The PCB assembly in the module collects the data from the gas sensor output, and then processes it with amplification, sampling, filtration, and temperature compensation through a built-in MCU to deliver stable and accurate digital output reflecting the actual target gas concentration. Any of SemeaTech 4-series EC sensors can be used to form a 4ECM-Smart Sensor Module that 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.



Pin Definition

Vin	GND	TXD	RXD
Power input positive	Power input Negative	Serial Port Sending	Serial port receiving

Specifications

Product model	4ECM-Smart
Detectable gas types	Toxic and harmful gases such as CO, H2S and NO2
Detection Principle	Electrochemical
Gas concentration range	Refer to EC sensor datasheet
Resolution	Refer to EC sensor datasheet
Measurement error	< $\pm 5\%$ FS
Operating voltage	4 ~ 6 VDC
Operating current	$\leq 2\text{mA} @ +5.0\text{VDC}$;

Output mode	UART(+3.3v TTL)
Operating temperature	-20°C ~ +50°C
Operating humidity	0%~90% RH (No condensation)
Operating pressure	1 standard atmospheric pressure (+10%)
Storage temperature	-20°C ~ +60°C
Dimensions	Φ22 x 25 mm
Weight	10 g

Communication Settings

Baud rate	9600bps
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

Example : AA 0F 01 C5 80 EE

Byte1--AA: Start byte of a command;
 Byte2--0F: Information reading command;
 Byte3--01: Module address (default at 0x01);
 Byte4--C5: CRC16 (Modbus) Check high byte;
 Byte5--80: CRC16 (Modbus) Check low byte;
 Byte6--EE: Command end byte;

Note: In this command Byte 2 and Byte 3 will be checked with CRC 16 (Modbus).

Modular response (Sending Information Data to Terminal)

Example : AA 0F 01 0F 00 14 00 05 00 02 00 01 02 C5 99 EE

Byte1--AA: Start byte of a command;
 Byte2--0F: Information reading command;
 Byte3--01: Module address (default at 0x01);
 Byte4--0F: Sensor type;
 Byte5/6--00/14: Modular measurement range (hexadecimal);
 Byte7/8--00/05: Calibration of gas concentration (hexadecimal);
 Byte9/10--00/02: High Alarm Point (Hexadecimal);

Byte11/12--00/01: Low Alarm Point (Hexadecimal);
 Byte13--02: Sensor reading units
 (% LEL: 0x00; % VOL: 0x01; PPM: 0x02; PPB: 0x03; N/A: 0x04);
 Byte14--C5: CRC16 (Modbus) Check high byte;
 Byte15--99: CRC16 (Modbus) Check low byte;
 Byte16--EE: Command end byte;

Note: In this command Byte 2 ~ Byte 13 will be checked with CRC 16 (Modbus).

Addendum: Sensor type code

00 None	01 EX	02 CO	03 O2	04 H2	05 CH4	06 C3H8	07 CO2	08 O3	09 H2S	0A SO2	0B NH3	0C C12	0D ETO
0E HCL	0F Ph3	10 Hbr	11 HCN	12 ASH3	13 HF	14 Br2	15 NO	16 NO2	17 NOX	18 CLO2	19 SIH4	1A Cs2	1B F2
1C b2H6	1D gEH4	1E N2	1F THT	20 C2H2	21 C2H4	22 CH2O	23 Lpg	24 HC	25 C6H6	26 H2O2			

2. Commands for gas concentration request

Example: AA 01 01 C1 E0 EE

Byte1--AA: Start byte of a command;
 Byte2--01: Command for concentration sending request;
 Byte3--01: Module address (default at 0x01);
 Byte4--C1: CRC16 (Modbus) Check high byte;
 Byte5--E0: CRC16 (Modbus) Check low byte;
 Byte6--EE: Command end byte;

Note: In this command Byte2 and Byte3 will be checked with CRC 16 (Modbus).

Modular response (sending concentration data to the terminal)

Example: AA 01 01 80 00 0000 15 CA EE

Byte1--AA: Start byte of a command;
 Byte2--01: Command for concentration sending request;
 Byte3--01: Module address (default at 0x01);
 Byte4--80: Data symbol bit (0x80: negative; 0x00: positive);
 Byte5/6--00/00: Data (ppm) integer part (0-65535);
 Byte7--00: Data (ppm) fractional part (0.00-0.99);
 Byte8--15: CRC16 (Modbus) Check high byte;
 Byte9--CA: CRC16 (Modbus) Check low byte;
 Byte10--EE: Command end byte;

Note: In this command Byte 2 ~ Byte 7 will be checked with CRC 16 (Modbus).

3. Command for terminal sending Module Zero-setting

Example : AA 02 01 C1 10 EE

Byte1--AA: Start byte of a command;
Byte2--02: Command for Zero-setting;
Byte3--01: Module address (default at 0x01);
Byte4--C1: CRC16 (Modbus) Check high byte;
Byte5--10: CRC16 (Modbus) Check low byte;
Byte6--EE: Command end byte;

Note: 1) In this command Byte 2 and Byte 3 will be checked with CRC 16 (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

Byte1--AA: Start byte of a command;
Byte2--02: Command for Zero-setting;
Byte3--01: Module address (fixed at 0x01);
Byte4--10/20: Signs of success/failure;
Byte5--D0: CRC16 (Modbus) Check high byte;
Byte6--5C/48: CRC16 (Modbus) Check low byte;
Byte7--EE: Command end byte;

Note: In this command Byte 2 ~ Byte 4 will be checked with CRC 16 (Modbus).

4. Command for terminal sending Module Calibration

Example : AA 03 01 C0 80 EE

Byte1--AA: Start byte of a command;
Byte2--03: Command for Calibration;
Byte3--01: Module address (default at 0x01);
Byte4--C0: CRC16 (Modbus) Check high byte;
Byte5--80: CRC16 (Modbus) Check low byte;
Byte6--EE: Command end byte;

Note: 1) In this command Byte 2 and Byte 3 will be checked with CRC 16 (Modbus);
2) During calibration, 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

Byte1--AA: Start byte of a command;
Byte2--03: Command for Calibration;
Byte3--01: Module address (default at 0x01);
Byte4--10/20: Signs of success/failure;
Byte5--81/81: CRC16 (Modbus) Check high byte;
Byte6--9C/88: CRC16 (Modbus) Check low byte;
Byte7--EE: Command end byte;

Note: In this command Byte 2 ~ Byte 4 will be checked with CRC 16 (Modbus).

5. Command for Module Address Modification

Example : AA 04 02 82 B1 EE

Byte1--AA: Start byte of a command;
Byte2--04: Command for Address Modification;
Byte3--02: Module new address;
Byte4--82: CRC16 (Modbus) Check high byte;
Byte5--B1: CRC16 (Modbus) Check low byte;
Byte6--EE: Command end byte;

Note: In this command Byte 2 and Byte 3 will be checked with CRC 16 (Modbus).

Address Modification success, module sending:

AA 04 02 10 30 AD EE

Byte1--AA: Start byte of a command;
Byte2--04: Command for Calibration;
Byte3--03: Command for Address Modification;
Byte4--10: Signs of success/failure;
Byte5--30: CRC16 (Modbus) Check high byte;
Byte6--AD: CRC16 (Modbus) Check low byte;
Byte7--EE: Command end byte;

Note: In this command Byte 2 ~ Byte 4 will be checked with CRC 16 (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%.