

ZDG4-4 Four-in-One Gas Detection Module

Characteristic:

High integration
Small volume
Stable performance
High-accuracy
Supports multiple digital output protocols, including standard Modbus and compatible simple protocols

Application Area:

Factory gas leakage
Downhole operation
Tunnel inspection
Coal mine testing

I. Product Description:

The ZDG4-4 gas sensor module is a versatile four-in-one device supporting 1-4 gas detection types, including combustible gases, oxygen, carbon monoxide, and hydrogen sulfide. It offers customizable optional sensor types and provides outputs via UART, Modbus, and RS-485 interfaces. Featuring mature gas sensors and high-performance processors, this module transmits sensor concentration data to host computers through Modbus protocol via UART. The compatible protocol supports multi-vendor protocols.



II. Performance Parameters:

Working voltage	9-30V DC (5V customizable)
Working current	<150mA (current value varies by sensor type) Electrochemical <5mA Semiconductor <100mA Catalytic combustion <160mA Infrared <100mA PID<50mA
Measuring range	It has been set at the factory. Please refer to the actual situation.
Output signal	Optional: 0.4~2V DC, PWM Standard:UART / Modbus / RS485
Resolution ratio	1%FSD
Preheating time	0s
Response time	T90<30s
Accuracy	± (20ppm+5%F.S)
Temperature range	-20 °C ~60 °C
Humidity range	0~95%RH (no condensation)
Life span	>5 years
Size	46mm*46mm*22mm

III. Measurable Gas Order Parameters Table

3.1. Order Parameters Table for Toxic and Hazardous Gas Sensor Modules:

Gas type	Range	Understatement	Overstatement	Unit	Remarks
CO	0-1000ppm	35	200	ppm	Electrochemical principle
H ₂ S	0-100ppm	10	15	ppm	Electrochemical principle
O ₂	0-30%	19.5	23.5	%VOL	Electrochemical principle
NH ₃	0-100 ppm	25	50	ppm	Electrochemical principle
SO ₂	0-20PPM	2	5	ppm	Electrochemical principle
NO ₂	0-20PPM	3	5	ppm	Electrochemical principle
Cl ₂	0-20 ppm	0.5	1.0	ppm	Electrochemical principle
ClO ₂	0-1 ppm	0.1	0.2	ppm	Electrochemical principle
PH ₃	0-5 ppm	0.3	1.0	ppm	Electrochemical principle
HCL	0-10 ppm	2.0	5.0	ppm	Electrochemical principle
HCN	0-100ppm	4.7	10.0	ppm	Electrochemical principle
ETO	0-20 ppm	1.0	5.0	ppm	Electrochemical principle
CH ₂ O	0-5 ppm	0.1	.3	ppm	Electrochemical principle
CH ₃ SH	0-10 ppm	1.0	5.0	ppm	Electrochemical principle
CH ₆ S	0-10 ppm	1.0	5.0	ppm	Electrochemical principle
O ₃	0-5 ppm	0.1	0.3	ppm	Electrochemical principle
H ₂	0-1000ppm	200	500	ppm	Electrochemical principle

3.2. Order Parameters Table for Flammable Gas Sensor Module:

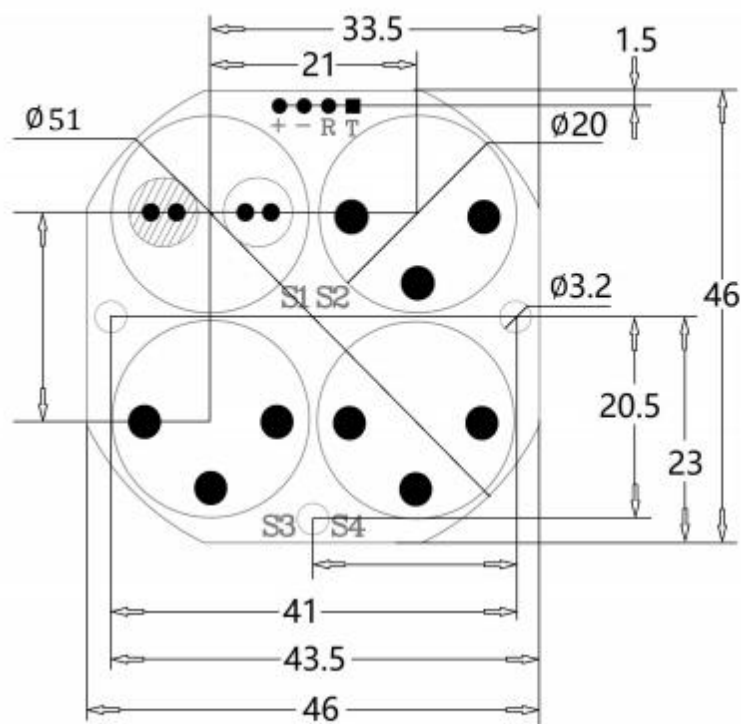
Gas type	Range	Understatement	Overstatement	Unit	Remarks
LEL	0-100%LEL	20	50	%LEL	Catalytic combustion, infrared source
CH ₄	0-100%LEL	20	50	%LEL	Catalytic combustion, infrared source
LNG	0-100%LEL	20	50	%LEL	Catalytic combustion, infrared source
C ₂ H ₅ OH	0-100%LEL	20	50	%LEL	Catalytic combustion
ppm	0-1000ppm	1000	5000	ppm	Semiconductor Principles
H ₂	0-100%LEL	25	50	%LEL	Catalytic combustion, electrochemistry
C ₂ H ₂	0-100%LEL	20	50	%LEL	Catalytic combustion
OIL	0-200 ppm	20	100	ppm	PID photoion

3.3. VOC Gas Sensor Module Order Parameters Table:

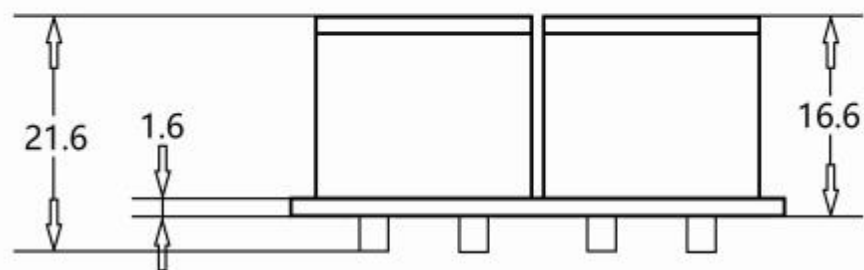
Gas type	Range	Understatement	Overstatement	Unit	Remarks
ppm	0-1000ppm	100	300	ppm	Semiconductor, electrochemical optional
ppm	0-2000ppm	100	300	ppm	PID photoion

Note: Labels conventional gas types, supporting gas sensors based on semiconductor, catalytic combustion, electrochemical, PID photoionization, and other principles.

IV. Structural Dimensions:



注：单位mm



注：单位mm

V. Output Method:

Simulated voltage output

Default simulation point voltage output as the sensor's original signal, **optional** Vout output voltage range (0.4-2V) corresponding to gas concentration (0-full range), **optional** PWM output (duty cycle 0-100%) corresponding to gas concentration (0-full range)

Serial Port Output (UART)

Hardware connection

Connect the sensor's +, -, R, and T terminals to the user's 5V-GND-TXD-RXD. (The user must use TTL level; conversion is required if RS232 level is used). The sensor can directly read gas concentration values through its UART interface without requiring calculation.

Query reporting mode (standard Modbus protocol)

Set the serial port baud rate to 9600, data bits to 8, stop bits to 1, and parity to off.

The Modbus-RTU communication protocol is adopted, with the following format:

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

Address code: The sensor's address (1-255), unique in the communication network (factory default: 0x01).

Function code: Indicates the host's command function. This sensor uses function code 0x03 (read register data).

Data area: This section contains specific communication data. Note that the high byte of 16-bit data must come first!

CRC code: A 2-byte checksum with lower bits first and higher bits last.

Host request frame structure:

Address code	FC	Register starting address	Register length	Check digit bit	Check code high bit
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Sensor response frame structure:

Address code	FC	Valid byte count	Data Area 1	Second Data Area	Data Area N	Check code
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

For example: The sensor responds to the data sent by the host as follows:

Host query: 01 03 00 00 00 0A C5 CD

Sensor response: 01 03 14 00000000 0064012C 07D00005 00000000 45000000 B687

- (1).01: Sensor address; (1st bit)
- (2).03: Read data; (2nd bit)
- (3).14: The number of data represents the 20-byte data that follows (excluding the CRC check sum); (3rd bit)
- (4).0000: indicates the numerical unit is PPM without decimal points, representing the current concentration, low reading, high reading, and the 17th and 18th bits of the range (see the parameter bit definition table); (register 00)
- (5).0000: The current detected gas concentration is 0; (Register 01)
- (6).0064: The low alarm threshold is 100; (Register 02)
- (7).012C: The high alarm threshold is 300; (Register 03)
- (8).07D0: The gas volume range is 2000; (Register 04)
- (9).0005: The sensor working state 0x05 is a low reporting state (see the state word definition table) (register 05)
- (10).0000: Real-time AD value of the sensor; (Register 06)
- (11).0000: Ambient temperature value; (Register 07) 25.5°C (data without decimal point, temperature equals register value minus 500 and divided by 10) **Note: For temperature and humidity modules, the value is the same as Register 01.**
- (12).45: Convert 10 to 69, represented as PH3 gas (see Gas Type Table); (Register 08 High 8 bits)
- (13).00: Reserved bit; (the lower 8 bits of register 08)
- (14).0000: Environmental humidity value; (Register 09) 60.8% (data without decimal point, humidity value equals register value divided by 10) **Note: If it is a temperature and humidity module, the value is the same as Register 06.**
- (15).B687: CRC checkcode;

10 register mapping relationships

Register number	Register add (hexadecimal)	PLC Configuration add	Register value description	Read instruction: Read the value of a single register
0	0x0000	40001	Binary parsing of register values: Numerical unit: bit15--12 Decimal point: bit11-8 Retention bits: bit7-0	01 03 00 00 00 01 84 0A
1	0x0001	40002	Current gas concentration	01 03 00 01 00 01 D5 CA
2	0x0002	40003	Set the low value	01 03 00 02 00 01 25 CA
3	0x0003	40004	Set the high report value	01 03 00 03 00 01 74 0A

4	0x0004	40005	Full range values	01 03 00 04 00 01 C5 CB
5	0x0005	40006	Sensor status (low 8 bits)	01 03 00 05 00 01 94 0B
6	0x0006	40007	Real-time AD value of the sensor	01 03 00 06 00 01 64 0B
7	0X0007	40008	Ambient temperature value	01 03 00 07 00 01 35 CB
8	0X0008	40009	Gas type	01 03 00 08 00 01 05 C8
9	0X0009	400010	Ambient humidity	01 03 00 09 00 01 54 08

1.1. Register 0 Value Definition

Number Value Table (Binary)

Bit12-15	Bit8-11
0000: ppm	Radix point
0010: %LEL	000: No decimal places
0100: %VOL	0100: A decimal
0110: mg/m3	1000: Two decimal places
1000: ppb	1100: Three decimal places
1010: °C	

1.2. State Definition

Register 05 Status Word Definition Table (16-ary)

Status word	Operative mode	Status word	Operative mode
00	Preheat	08	Outrange
01	Normal	09	Calibration required
02	Data error	0A	Overtime
03	Sensor failure	0B	stel report to the police
04	Early warning	0C	twa report to the police
05	Understatement	0D	Continue to have
06	Overreporting	0E	Continue to have
07	Access failure	0F	Communication failure

1.3. Gas Type

Register 08 Gas Type Table (10-Base Order)

Order number	Gas type	Order number	Gas type	Order number	Gas type	Order number	Gas type
0	NULL	30	C4H8O2	60	NO2	90	Continue to have
1	AR	31	C4H8S	61	NOX	91	Continue to have
2	ASH3	32	C4H10	62	NF3	92	Continue to have
3	B2H6	33	C4H10O	63	NH3	93	Continue to have
4	BR2	34	C5H12	64	N2	94	Continue to have
5	CO	35	C6H6	65	N2O	95	Continue to have
6	CO2	36	C6H6S	66	N2H4	96	Continue to have
7	COCL2	37	C6H12	67	O2	97	Continue to have
8	CH2O	38	C6H14	68	O3	98	Continue to have
9	CH2O2	39	C7H8	69	PH3	99	Continue to have
10	CH3BR	40	C7H16	70	PID	100	Continue to have
11	CH4	41	C8H8	71	P2O5	101	Continue to have

12	CH4O	42	C8H10	72	SO2	102	Continue to have
13	CH4S	43	C8H18	73	SO2F2	103	Continue to have
14	CH5N	44	CS2	74	SIH4	104	Continue to have
15	CH6O	45	EX	75	SIF4	105	Continue to have
16	CIC	46	ETO	76	SF6	106	Continue to have
17	CL2	47	F2	77	THT	107	Continue to have
18	CLO2	48	FX	78	TVOC	108	Continue to have
19	C2CL4	49	GEH4	79	VOC	109	Continue to have
20	C2HCL3	50	H2	80	VOCS	110	Continue to have
21	C2H2	51	H2O2	81	SO3	111	Continue to have
22	C2H3CL	52	H2S	82	NMHC	112	Continue to have
23	C2H	53	HCL	83	Temperature	113	Continue to have
24	C2H4O	54	HCN	84	Humidity	114	Continue to have
25	C2H6O	55	HBR	85	Wind speed	115	Continue to have
26	C3H3N	56	HE	86	Wind direction	116	Continue to have
27	C3H6O	57	HF	87	Rainfall	117	Continue to have
28	C3H8	58	I2	88	Noise	118	Continue to have
29	C3H8O	59	NO	89	Continue to have	119	Continue to have

2: Module Calibration Settings

2.1. Combustible Gas CH4 Parameter Settings (CH4 Module ID:0x01)

2.1.1. 0x84 Set the Module Low Report Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x01	Host 0x01	Co- mmand 0x84	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x01	Co- mmand 0x84	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.1.2. 0x85 Set the Module High Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x01	Host 0x01	Co- mmand 0x84	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x01	Co- mmand 0x85	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.1.3. 0x90 Calibration Module 0 Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x01	Host 0x01	Co- mmand 0x90	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x01	Co- mmand 0x85	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.1.4. 0x91 Calibration Module Concentration 1-Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x01	Host 0x01	Co- mmand 0x91	1 concentration 8-bit high	1 concentration Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x01	Co- mmand 0x85	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.2 Oxygen O2 Parameter Settings (O2 Module ID:0x02)

2.2.1. 0x84 Set the Module Low Report Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x02	Host 0x01	Co- mmand 0x84	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x02	Co- mmand 0x84	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.2.2. 0x85 Set the Module High Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x02	Host 0x01	Co- mmand 0x85	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x02	Co- mmand 0x85	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.2.3. 0x90 Calibration Module 0 Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x02	Host 0x01	Co- mmand 0x90	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x02	Co- mmand 0x90	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

2.2.4. 0x91 Calibration Module Concentration 1-Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x02	Host 0x01	Co- mmand 0x91	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x02	Co- mmand 0x91	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

3. CO Parameter Settings (C0 Module ID:0x03)

3.1. 0x84 Set the module low report value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x03	Host 0x01	Co- mmand 0x84	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x03	Co- mmand 0x84	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

3.2. 0x85 Set the Module High Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x03	Host 0x01	Co- mmand 0x85	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x03	Co- mmand 0x85	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

3.3. 0x90 Calibration Module 0 Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x03	Host 0x01	Co- mmand 0x90	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x03	Co- mmand 0x90	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

3.4. 0x91 Calibration Module Concentration 1-Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x03	Host 0x01	Co- mmand 0x91	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x03	Co- mmand 0x91	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

4. Hydrogen Sulfide (H2S) Parameter Settings (H2S Module ID:0x04)

4.1. 0x84 Set the Module Low Report Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x04	Host 0x01	Co- mmand 0x84	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x04	Co- mmand 0x84	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

4.2. 0x85 Set the Module High Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x04	Host 0x01	Co- mmand 0x85	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x04	Co- mmand 0x85	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

4.3. 0x90 Calibration Module 0 Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x04	Host 0x01	Co- mmand 0x90	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x04	Co- mmand 0x90	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

3.8. 0x91 Calibration Module Concentration 1-Point Offset Value

A host configuration command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Module 0x04	Host 0x01	Co- mmand 0x91	Low Alarm 8-bit high	Low Alarm Low 8 bits	0x00	0x00	0x00	0x00	Check bit

B module return command format

0	1	2	3	4	5	6	7	8	9	10
Start 0xFF	Host 0x01	Module 0x04	Co- mmand 0x91	0x50	Setup State	0x00	0x00	0x00	0x00	Check bit

VI. Precautions

1. This product is an electronic device. It is recommended to wear anti-static equipment during operation.
2. If stored for a long time, it is recommended to recalibrate before reuse.
3. Do not remove or replace the sensors or components on the module.
4. Avoid exposure to organic solvents, coatings, and high-concentration gases.
5. The module should be kept away from heat sources and direct sunlight and other thermal radiation.