Product Specification

Model: XH-ID-04-01

Version: 1.0

Date: 1st.1, 2025

Taiyuan Tengxing sensor technology Co., Ltd

Declaration

1. The copyright of instructions belong to Shanxi Tengxing sensor technology Co., Ltd(hereinafter referred to as the Company), nobody is allowed to copy, translate, spread or store without written approval.
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Shanxi Tengxing sensor technology Co., Ltd

1. Performance

The 4-series laser methane sensor probe uses tunable laser absorption spectroscopy (TDLAS) technology to accurately measure target gases. The sensor probe integrates advanced lasers and detectors to achieve high precision, high density, and high reliability in a miniaturized integrated package. The sensor probe utilizes an open gas exchange method. The sensor probe utilizes a superior optical system and advanced algorithms to achieve highly accurate measurements, ensuring the sensor's advantages of high detection accuracy, fast response, and low power consumption.

2. Characteristic:

(1) High precision, miniaturization, and low power consumption;

(2) Long effective absorption path, achieving a long effective absorption path in a compact optical system;

(3) High reliability and intrinsic anti-interference (no reaction to gases other than methane);

(4) Wide operating voltage range (3.3V to 5.0V) and TTL serial port for easy secondary integration;strong anti-interference ability

3. Main applications:

➢ Petroleum, chemical, and mining industries;

➢ Natural gas pipelines, transmission stations, and gas filling stations;

➢ Coal mine safety monitoring;

➢ Pipeline leak monitoring and household natural gas leak monitoring;

➢ Underground integrated pipeline corridors, gas leak monitoring, and biogas monitoring;

➢ Other related safety supervision and testing areas.

4. Technical parameters (for reference only):

Notes:

4.1 The specific data format and communication protocol are shown in Appendix 1.

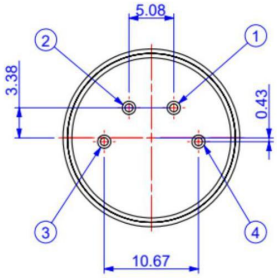
4.2 In power-saving mode, the recommended operating voltage for this sensor probe is 3.6V, with an operating current limit of 300mA to 400mA.

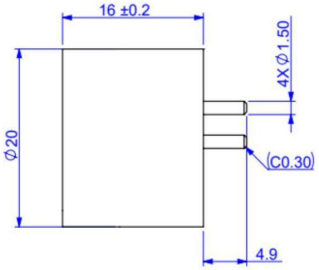
4.3 **It is recommended that this product be protected by a protective housing and adequate heat dissipation measures be taken**.

Parameter		Mix values	Typical values	Max values	Unit
General parameters					
Storage temperature		-40	——	85	℃
Operating temperature	82010521-04	-20	——	60	℃
	82010521-05		——		
	82010521-06	-40	——	70	
	82010521-07		——		
Operating humidity (non-condensing)		——	——	98	%RH
Working pressure		80	——	116	kPa
Detection range		0	——	100	%LEL
Basic error		normal temperature		±3	%LEL
		full temperature		±5	%LEL

Detection limit		1000			ppm
Minimum resolution		0.01			%vol
Communication interface					
TTL	Baud rate	——	9600	——	baud
	Stop bit	——	1	——	Bit
	Data bit		8	——	Bit
	Parity bit		——	——	Bit
	Flow control bit	——	——	——	Bit
Electrical properties (room temperature)					
Operating voltage		3.3	3.6	50	V
Operating current (average)		——	——	——	mA
Operating current (instantaneous)		——	250	320	mA
Size					
Size		Φ20 x 16 (Length 4.9mm excluding pins)			mm
Filter method	82010521-04	Filter with waterproof breathable membrane			——
	82010521-05	Filter			——
	82010521-06	Filter with waterproof breathable membrane			——
	82010521-07	Filter			——

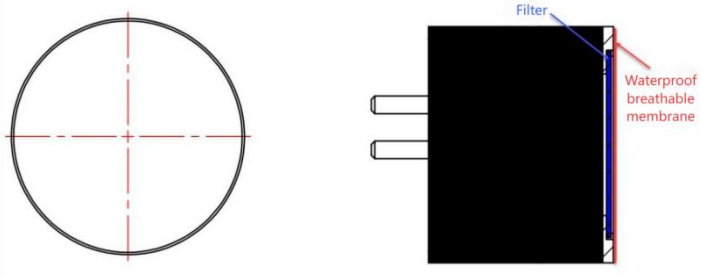
5. Product appearance and lead definition





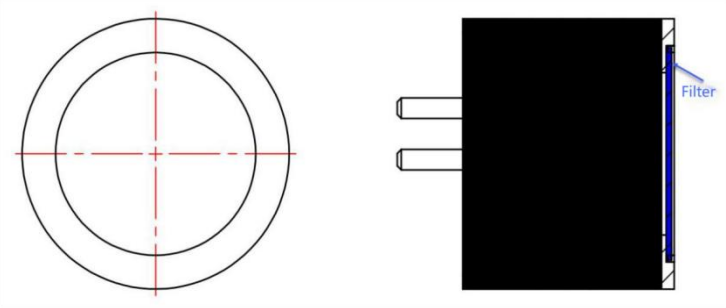
引脚	定义
1	V+
2	GND
3	Tx
4	Rx

Size(All model)



(Waterproof and breathable membrane can be removed independently)

Filter with waterproof breathable membrane(82010521-04、82010521-06)



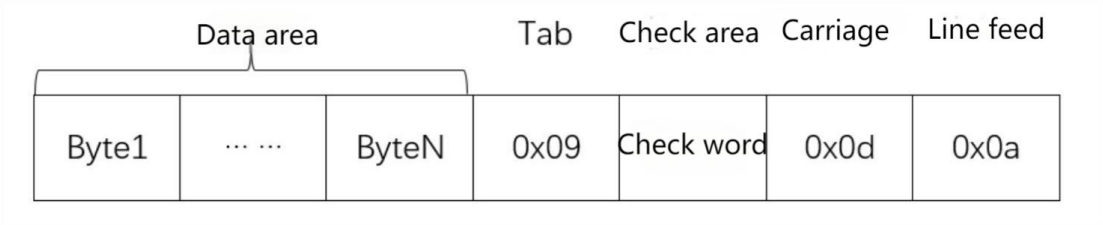
Filter diagram（82010521-05、82010521-07）

6. Protocol Overview

Baud rate: 9600;

Data bits: 8; Stop bits: 1; Parity bit: None

7. Packet format



7.1 A data packet is a string of ASCII codes.

7.2 Checksum algorithm: The sum of all bytes in the data area (Byte 1 to Byte N, excluding tabs) is calculated as

Sum. The checksum is then Checksum = (unsigned char)(-(signed char)Sum).

7.3 Checksum content: The two-digit ASCII code of the checksum (occupies two bytes). For example, if the checksum is 0x23, the checksum is 0x32, 0x33 (i.e., the characters '2' and '3'). For example, if the checksum is 0xab, the checksum is 0x41, 0x42 (i.e., the characters 'A' and 'B'; note that these characters should be uppercase).

Note: All tests in the figure were performed under standard test conditions, with the abscissa being the observation time and the ordinate being the VRL value.

8. Serial port protocol command table

Command	Function Name	Description
R0	Read firmware version number	/
R2	Read only temperature	/

R4	Read sensor range and unit	/
R6	Read-only concentration	/
R8	Read concentration, temperature, and pressure	/
RA	Read only light intensity	/
RC	Read only status code	/
FO	Switch to F0 mode	The sensor enters passive mode.
F1	Switch to F1 mode	The sensor enters active mode, sending only concentration values.
F4	Switch to F4 mode	The sensor enters active mode, sending concentration, temperature, and pressure values.
S1	Set packet interval to 1s	/
S2	Set packet interval to 2s	/
S5	Set baud rate to 115200	/
S6	Set baud rate to 9600	/
T0, zero value	Set zero value	Unit: %VOL
T1	Read zero value	Unit: %VOL
J5, concentration value	Set fine calibration concentration	Up to 13 precise calibration concentration points can be set. For detailed parameters, see Protocol 9.17.
J6, concentration value	Set F-factor calibration concentration	/
J7, 00X.00	Set the concentration output mode	X value range: 0, 1, 2, where: 0: Outputs the exact calibrated concentration value; 1: Outputs the F-factor calibrated concentration value; 2: Outputs the original concentration value
J8	Read parameters related to fine calibration	/
J9	Read concentration output mode	/
JE	Read F-factor value	/
JA	Clear fine calibration and F-factor calibration parameters	/
JB	Clear F-factor calibration parameters	/
JC	Clear fine calibration parameters	/
H0	Restore factory settings	/
		Check whether the "zero value status," "concentration precision

		calibration times," and "℉ coefficient calibration status" are consistent with the factory settings.
H1	Determine factory defaults	

Note:

1. The product will respond to each command. If there is no response, please check that communication is smooth and that the command sent meets the protocol requirements.

2. It is recommended that the "Calibration" function be performed at a temperature of 20-30°C.

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Protocol Example and Description

9.1 "R0" Command: Read Firmware Version Number

Send: 0x52 0x30 0x09 0x37 0x45 0xOD 0xOA

(Converted to ASCII: RO 7E)

Response: 0x52 0x30 0x2C 0x56 0x65 0x72 0x3A 0x47 0x4A 0x2D 0x50 0x4E 0x30 0x30 0x30 0x38 0x2D 0x30 0x30 0x37 0x2C 0x56 0x31 0x2E 0x30 0x2C 0x32 0x34 0x2D 0x30 0x31 0x2D 0x32 0x34 0x09 0x33 0x46 0xOD 0xOA

(Converted to ASCII code: RO, Ver: GJ-PN0008-007.V1.0.24-01-24 3F)

Description: Ver: GJ-PN0008-007.V1.0.24-01-24 -- Firmware version number

9.2 “R2” Recommend: Only read tempreature

Send: 0x52 0x32 0x09 0x37 0x43 0x0D 0x0A

(Converted ASCII : R2 7C)

Response: 0x2B 0x32 0x35 0x2E 0x30 0x09 0x31 0x30 0x0D 0x0A

(Converted ASCII : +25.0 10)

Note: Temperature25.0 (℃)。

9.3 “R4” Recommend: Read the range and unit of sensor

Send: 0x52 0x34 0x09 0x37 0x41 0x0D 0x0A

(Converted ASCII : R4 7A)

Response: 0x52 0x34 0x2C 0xC1 0xBF 0xB3 0xCC 0x3A 0x31 0x30 0x30 0x2C 0xB5 0xA5 0xCE 0xBB 0x3A 0x30 0x28 0x25 0x56 0x4F 0x4C 0x29 0x09 0x41 0x34 0x0D 0x0A

(Converted ASCII : R4,range:100,unit:0(%VOL) A4)

Note: range:100 —— r a n g e i s 100,

Unit:0(%VOL) —— U n i t i s %VOL。

9.4 “R6” Recommend: Read-only concentration

Send: 0x52 0x36 0x09 0x37 0x38 0x0D 0x0A

(Converted ASCII : R6 78)

Response: 0x2B 0x30 0x30 0x32 0x2E 0x30 0x30 0x09 0x42 0x35 0x0D 0x0A

(Converted ASCII : +002.00 B5)

Note: concentration is 2.00(unit)。

9.5 “R8” Recommend: Read concentration, temperature, pressure

Send: 0x52 0x38 0x09 0x37 0x36 0x0D 0x0A

(Converted ASCII : R8 76)

Response: 0x2B 0x30 0x30 0x32 0x2E 0x30 0x30 0x2C 0x2B 0x32 0x35 0x2E 0x30 0x2C 0x31 0x30 0x31 0x33 0x2E 0x32 0x35 0x2C 0x30 0x30 0x09 0x38 0x37 0x0D0x0A

(Convertes ASCII : +002.00,+25.0,1013.25,0087),

Note: concentration is 2.00(unit)

temperature 25.0( ),

pressure 1013.25(mbar),

The status code is 00。

Status code definition: The status code expressed in ASCII code represents the working status of the probe. Convert two ASCII code bytes into the corresponding BCD code, that is, convert eac h byte into a 4-bit hexadecimal data. Convert the first ASCII byte into BCD code to form the upper 4 bits, and convert the second ASCII byte into the lower 4 bits. A total of 8 data bits form a byte. E ach bit represents a different fault, specifically:

Byte 1				Byte 2			
D8	D7	D6	D5	D4	D3	D2	D1
reserve	Temperature control abnormal marking	Temperature and pressure sensor communication abnormality mark	Whether to calibrate the flag	Light intensity is too small	The light intensity is too large	Whether the absorption peak is out of the mark	reserve
Default is 0	1: Temperature control abnormality 0: Normal	1: Communication abnormality 0: Normal	1: Not calibrated 0:Calculated	1: Too small 0: Normal	1: Too big 0: Normal	1: Offset 0: Not biased	Default is 0

For example:

a. The product works normally: the output status code is 00 at this time, and the ASCII code corresponding to byte 1 is 0X30 and its corresponding

The BCD code is B0000, the ASCII code corresponding to the 2nd byte is 0X30 and its corresponding BCD code is B0000, and the corresponding flag bit is: B0000 0000.

b. If the absorption peak is biased: the output status code is 02 at this time, and the corresponding 1-byte ASCII code is 0X30 and its corresponding

The BCD code is B0000, the ASCII code corresponding to the 2nd byte is 0X32 and its corresponding BCD code is B0010, and the corresponding flag bit is: B0000 0010.

c. If the temperature control is abnormal and the light intensity is too high at the same time: the output status code is 44 at this time, the ASCII code corresponding to byte 1 is 0X34 and its corresponding BCD code is B0100, the ASCII code corresponding to byte 2 is 0X34 and its corresponding BCD code is

B0100, the corresponding flag is: B0100 0100

d. If the temperature control is abnormal, the temperature pressure sensor communication is abnormal, the product is not calibrated, the light intensity is too small, and the absorption peak is biased: the output status code is 7A at this time, the ASCII code corresponding to byte 1 is 0X37 and its corresponding BCD code is B0111, the ASCII code corresponding to byte 2 is 0X41 and its corresponding BCD code is B1010, and the corresponding flag bit is: B0111 1010.

9.6 “RA” Recommend: Read-only light intensity

Send: 0x52 0x41 0x09 0x36 0x44 0x0D 0x0A

(Converted ASCII : RA 6D)

Response: 0x2B 0x31 0x30 0x30 0x35 0x30 0x09 0x44 0x46 0x0D 0x0A

(Converted ASCII : +10050 DF)

Note: light intensity 10050

9.7 “RC” Recommend: Read-only status code

Send: 0x52 0x43 0x09 0x36 0x42 0x0D 0x0A

(Converted ASCII : RC 6B)

Response: 0x30 0x30 0x09 0x41 0x30 0x0D 0x0A

(Converted ASCII : 00 A0)

Note: status code is 00。

9.8 “F0” Recommend: Switch to passive mode

Send: 0x46 0x30 0x09 0x38 0x41 0x0D 0x0A

(Converted ASCII : F0 8A)

Response: 0x46 0x30 0x09 0x38 0x41 0x0D 0x0A

Converted ASCII : F0 8A)

Note: The sensor switches to passive mode. In this mode, it only responds to commands and does not actively output data. It is powered off for protection.

9.9 “F1” Recommend: Switch to active mode to send only concentration data

Send: 0x46 0x31 0x09 0x38 0x39 0x0D 0x0A

(Converted ASCII : F1 89)

Response: 0x46 0x31 0x09 0x38 0x39 0x0D 0x0A

(Converted ASCII : F1 89)

Note: The sensor switches to active mode. In this mode, it only actively sends concentration data and maintains the data when the power is off. For the data output format, refer to the response section 9.4.

9.10 F4 Recommend: Switch to active data sending mode

Send: 0x46 0x34 0x09 0x38 0x36 0x0D 0x0A

(Converted ASCII : F4 86)

Response: 0x46 0x34 0x09 0x38 0x36 0x0D 0x0A

(Converted ASCII : F4 86)

Note: The sensor switches to the mode of actively sending concentration, temperature, pressure, and status data. The data is retained when the power is off. For the data output format, refer to the response section 9.5.

9.11 "S1" Recommend: Set the packet interval is **1s**

Send: 0x53 0x31 0x09 0x37 0x43 0x0D 0x0A

(Coverted ASCII : S1 7C)

Response: 0x53 0x31 0x09 0x37 0x43 0x0D 0x0A

(Converted ASCII : S1 7C)

Note: In the "F1" or "F4" active output mode, set the sensor output data packet time interval to 1s, and keep it in the power off state.

9.12 "S2" Recommend: **S**et the packet interval to **2s**

Send: 0x53 0x32 0x09 0x37 0x42 0x0D 0x0A

(Converted ASCII : S2 7B)

Response: 0x53 0x32 0x09 0x37 0x42 0x0D 0x0A

(Converted ASCII : S2 7B)

Note: In the "F1" or "F4" active output mode, set the sensor output data packet time interval to 2s, and maintain it when the power is off.

9.13 "S5" Recommend: Set the baud rate to **115200**

Send: 0x53 0x35 0x09 0x37 0x38 0x0D 0x0A

(Converted ASCII : S5 78)

Response: 0x53 0x35 0x09 0x37 0x38 0x0D 0x0A

(Converted ASCII : S5 78)

Note: Switch the sensor serial communication baud rate to 115200, and keep it when power off.

9.14 “S6” Recommend: Set the baud rate to **9600**

Send：0x53 0x36 0x09 0x37 0x37 0x0D 0x0A

(Converted ASCII ： S6 77)

Response：0x53 0x36 0x09 0x37 0x37 0x0D 0x0A

(Converted ASCII ： S6 77)

Note: Switch the serial communication baud rate of the sensor to 9600, and keep it when power off.

9.15 “T0” Recommend: Setting the zero value

Data format：“T0,XXX.XX”。

“XXX.XX” is the input value，unit：%VOL，6 total，two are decimal places

Send：0x54 0x30 0x2C 0x30 0x30 0x30 0x2E 0x31 0x35 0x09 0x32 0x43 0x0D 0x0A

(Converted ASCII ： T0,000.15 2C)

Response：0x54 0x30 0x2C 0x30 0x30 0x30 0x2E 0x31 0x35 0x09 0x32 0x43 0x0D 0x0A

(Converted ASCII ： T0,000.15 2C)

Note: Set the zero value to 000.15(%VOL)

The factory default zero value is 000.10%VOL

9.16 “T1” Recommend: Read zero value

Send：0x54 0x31 0x09 0x37 0x42 0x0D 0x0A

(Convert ASCII ： T1 7B)

Response：0x54 0x31 0x2C 0x30 0x30 0x30 0x2E 0x35 0x35 0x09 0x32 0x37 0x0D 0x0A

(Converted ASCII ： T1,000.55 27)

Note：Read zero value is 000.55（%VOL）。

9.17 “J5” Recommend: Setting precise calibration concentrations

Data format：“J5,XXX.XX”。

“XXX.XX” is the input value，unit：%VOL，6 total，two are decimal places

Send：0x4A 0x35 0x2C 0x30 0x32 0x30 0x2E 0x30 0x30 0x09 0x33 0x35 0x0D 0x0A

(Convert ASCII ： J5,020.00 35)

Response（Two states）：

Setup successful：0x4A 0x35 0x2C 0x30 0x32 0x30 0x2E 0x30 0x30 0x09 0x33 0x35 0x0D 0x0A

(Convert ASCII ： J5,020.00 35)

Setup failed：0x4A 0x35 0x2C 0x2D 0x2D 0x2D 0x2D 0x2D 0x2D 0x09 0x34 0x37 0x0D 0x0A

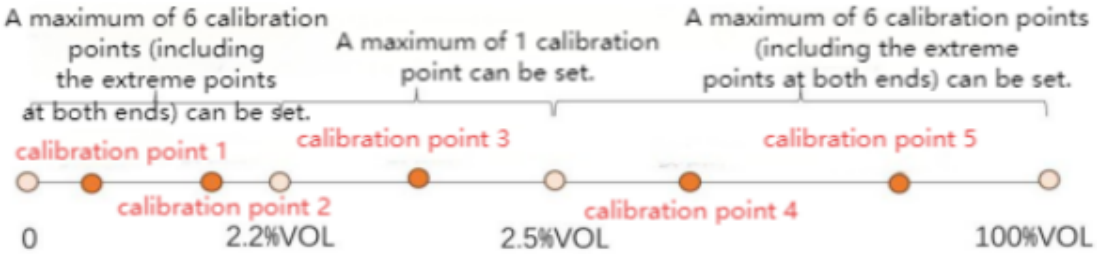
(Converted ASCII ： J5,------ 47)

Description: Set the precise calibration concentration to20%VOL。

Instruction Description：

a. Applicable concentration range：0~100%VOL。

b. Up to 13 precise calibration concentration points can be set with in the full concentration range, as follows:



c. After the command is issued, the sensor output mode will switch to "0" (see 9. 19 for details). Power is off and the sensor will remain in effect. If the setting fails, the product will not perform any action.
d. The accurately calibrated concentration point can be read back using the protocol command in 9.20.
e. It is recommended to wait for the sensor to stabilize for 10 minutes and for the calibration gas to be completely replaced before performing any operation.
f. After the response command is returned, the calibration is complete and any further operations are prohibited.

9.18 "J6" Recommend： Set the F-factor calibration concentration

Data foramt： "J6,XXX.XX"。

"XXX.XX" is the input value，unit：%VOL，6 total，two are decimal places

Send：0x4A 0x36 0x2C 0x30 0x32 0x35 0x2E 0x30 0x30 0x09 0x32 0x46 0x0D 0x0A

(Converted ASCII：J6,025.00 2F)

Response（Two states）：

Setup successful：0x4A 0x36 0x2C 0x30 0x32 0x35 0x2E 0x30 0x30 0x09 0x32 0x46 0x0D 0x0A(Converted ASCII ： J6,025.002F)

Setup failed：0x4A 0x36 0x2C 0x2D 0x2D 0x2D 0x2D 0x2D 0x2D 0x09 0x34 0x36 0x0D 0x0A

(Convert ASCII ： J6,------ 46)

Note：Under 25%VOL standard gas condition, set F coefficient

CalibrationInstruction Description：

a. Applicable concentration range：0~100%VOL。

b. After the command is issued, the sensor output mode will switch to "1", see 9.19 for details. It will be kept when the power is off. If the setting fails, the product will not do anything.。

c. For sensors that have already undergone F-factor calibration, the new calibration will replace the previous calibration factor.

d. It is recommended to wait for the sensor to stabilize for 10 minutes and for the calibration gas to be completely replaced before performing any operation.

e. After the response command is returned, the calibration is complete and any further operation is prohibited.

f. The sensor output concentration is:

$$C_{输出} = C_{原始} \times F_{系数}$$

g. F Coefficient calculation instructions (automatically calculated within the sensor)：

1. Assume that the calibration is performed on 20.00% VOL gas, which is recorded as S1；
2. Introduce standard gas and read the current original concentration value, recorded as S2 , example: 20.50%VOL；
3. Calculating the F coefficient：$F_{系数} = \frac{C_1}{C_2} = \frac{20}{20.5} \approx 0.976$；
4. Output concentration value $C_{输出} = C_{原始} \times F_{系数} = 20.5 \times 0.976 \approx 20$；
5. 在全波段范围内，此 $F_{系数}$ 全程有效，即 $S_{输出}$ 均等于 $S_{原始}$ 乘以此 $F_{系数}$。

9.19 **“J7,00X.00”** Recommend： Set the concentration output mode

Data format： “J7,00X.00”。

“00X.00” is input numerical value, X range is 0, 1, 2, and other values are invalid and will be retained after power off; if the setting fails, the product will not do anything. Corresponding data description:

“0”：Output accurate calibrated concentration value,

“1”：Output F-factor calibrated concentration value,

“2”：Output sensor raw concentration value

Send：0x4A 0x37 0x2C 0x30 0x30 0x31 0x2E 0x30 0x30 0x09 0x33 0x34 0x0D 0x0A

(Convert ASCII ： J7,001.00 34)

Response (two states)：

Setup Successful：0x4A 0x37 0x2C 0x30 0x30 0x31 0x2E 0x30 0x30 0x09 0x33 0x34 0x0D 0x0A

(Converted ASCII ： J7,001.00 34)

Setup failed：0x4A 0x37 0x2C 0x2D 0x2D 0x2D 0x2D 0x2D 0x2D 0x09 0x34 0x35 0x0D 0x0A

(Convert ASCII ： J7,------ 45)

Note: **S**et the output concentration to the concentration value calculated after **F** coefficient calibration**.**

9.20 “J8” Recommend： Read precise calibration related parameters

Response data format：“J8,AA，BB.BB，CC.CC”。

“AA”：The maximum number of calibration points is 13.

“BB.BB”：Current calibration point, expected concentration value during calibration, unit %VOL, 5 digits in total, including 2 decimal places

“CC.CC”：Current calibration point, the original concentration value of the sensor during calibration, in %VOL, 5 digits in total, including 2 decimal places

Output all relevant parameters of the calibrated points in sequence.

Send：0x4A 0x38 0x09 0x37 0x45 0x0D 0x0A

(Converted ASCII ： J8 7E)

Response1：0x4A 0x38 0x2C 0x30 0x31 0x2C 0x30 0x39 0x2E 0x35 0x30 0x2C 0x30 0x39 0x2E 0x37 0x39 0x09 0x39 0x36 0x0D 0x0A

0x4A 0x38 0x2C 0x30 0x32 0x2C 0x38 0x35 0x2E 0x30 0x30 0x2C 0x38 0x36 0x2E 0x39 0x38 0x09 0x39 0x30 0x0D 0x0A

(Converted ASCII 码： J8,01,09.50,09.79 96

J8,02,85.00,86.98 90)

Note: Read the precise calibration points, calibration concentration and original concentration, which are：

Calibration point 1, calibration concentration is 9.50%VOL, original concentration is 9.79%VOL；

Calibration point 2, calibration concentration is 85.00%VOL, original concentration is 86.98%VOL.

Response 2：0x4A 0x38 0x2C 0x2D 0x2D 0x2D 0x2D 0x2D 0x2D 0x09 0x34 0x34 0x0D 0x0A

(Convert ASCII ： J8,------ 44)

Note: This message is sent when the precise calibration function is not used.

9.21 “J9” Recommend： Read concentration output mode

Response data format： “J9,X”。

“X” Is the output value, where X ranges from 0, 1, 2, corresponding to the data description：

“0”： Output accurate calibrated concentration value,

“1”： Output F-factor calibrated concentration value,

“2”： Outputs the sensor's raw concentration value.

Send：0x4A 0x39 0x09 0x37 0x44 0x0D 0x0A

(Convert ASCII ： J9 7D)

Response：0x4A 0x39 0x2C 0x32 0x09 0x31 0x46 0x0D 0x0A

(Converted ASCII ： J9,2 1F)

Note: The current concentration value is the original concentration。

9.22 “JE” Recommend： Read the F-factor value

Send：0x4A 0x45 0x09 0x37 0x31 0x0D 0x0A

(Converted ASCII ： JE 71)

Response：0x4A 0x45 0x2C 0x30 0x30 0x30 0x2E 0x30 0x32 0x09 0x32 0x35 0x0D 0x0A

(Converted ASCII ： JE,000.02 25)

Note: Read the current F coefficient value as 0.02.

When the F-factor calibration function is not used, the default F-factor value is 1.

9.23 “JA” Recommend： Clear the parameters related to precise calibration and F-factor calibration

Send：0x4A 0x41 0x09 0x37 0x35 0x0D 0x0A

(Converted ASCII ： JA 75)

Response：0x4A 0x41 0x09 0x37 0x35 0x0D 0x0A

(Converted ASCII ： JA 75)

Note: Clears the parameters related to precise calibration and F-factor calibration at the same time.

The concentration output mode will automatically switch to "2", which means outputting the sensor's original concentration.

9.24 “JB” Recommend: Clear F-factor calibration related parameters

Send: 0x4A 0x42 0x09 0x37 0x34 0x0D 0x0A

(Converted ASCII : JB 74)

Response: 0x4A 0x42 0x09 0x37 0x34 0x0D 0x0A

(Converted ASCII : JB 74)

Description: Clear the parameters related to F coefficient calibration.

The concentration output mode remains the same as before the command was issued. **9.**

25 “JC” Recommend: Clear precise calibration related parameters

Send: 0x4A 0x43 0x09 0x37 0x33 0x0D 0x0A

(Converted ASCII : JC 73)

Response: 0x4A 0x43 0x09 0x37 0x33 0x0D 0x0A

(Converted ASCII : JC 73)

Note: Clear the parameters related to precise calibration.

The concentration output mode remains the same as before the command was issued.

9.26 “H0” Recommend: Restore factory settings

Send: 0x48 0x30 0x09 0x38 0x38 0x0D 0x0A

(Converted ASCII : H0 88)

Response: 0x48 0x30 0x09 0x38 0x38 0x0D 0x0A

(Converted ASCII : H0 88)

Note:

After restoring factory settings, the following parameters will be changed:

a. Restore the factory zero value;
b. Clear the parameters related to precise calibration;
c. Clear F-factor calibration related parameters;
d. The concentration output mode will automatically switch to "2", which means the sensor's original concentration is output.

Notes: 1. After restoring the factory settings, if the power is not turned off, the data will jump for about 30 seconds, which is normal.

2. After the command is issued, the next step can be performed only after the response command is received. Special attention: power off is prohibited, otherwise the sensor firmware may be lost.

9.27 "H1" Recommend: Determine the factory status

Response data format: "H1,A,BB,C"。

"A": Zero value status.

"BB": Precise calibration times.

"C": F-factor calibration status

Status Description:

Status	Factory default setting	User modified
Zero value status	0	1
F-factor calibration status		1

Determine the zero value status, concentration accurate calibration times, and F-factor calibration status.

Send: 0x48 0x31 0x09 0x38 0x37 0x0D 0x0A

(Converted ASCII : H1 87)

Response: 0x48 0x31 0x2C 0x30 0x2C 0x30 0x34 0x2C 0x31 0x09 0x33 0x45 0x0D 0x0A

(Converted ASCII : H1,0,04,1 3E)

Note: The zero adjustment value is the factory default setting, the number of precise calibrations is 4 times, and the F coefficient has been modified by the user.

10 Protocol related codes (for reference)

10.1 calibration

```
unsigned char hex_to_char(char a )
{

    char i = a;
    if((i >= 0)&&(i <= 9)) //0-9
    {
            i= (char)('0' + i );

}
else if((i>=10)&&(i<=15)) //A-F
{
            i = (char)('0'+ 7 + i);
```

```
            }
            else
                    i = 0;

        return i;
}
unsigned short CalCulateLRC(unsigned char *puchMsg, unsigned int usDataLen)
{
            int i,sum;
            unsigned char checksum;
            unsigned char charhigh = 0,charlow = 0;
            unsigned short check_data = 0;
            sum = 0;
            for(i=0;i<usDataLen;i++)
                    {
                            sum +=*puchMsg;
                            puchMsg++;
                    }
          checksum = (unsigned char)(-(signed char)sum);
          charhigh = (checksum&0xf0)>>4;
          charlow = checksum&0x0f;
           charhigh = hex_to_char(charhigh);
           charlow = hex_to_char(charlow);
           check_data = (short)(charhigh << 8 | charlow);
           return check_data ;
  }
```