

ECtox Gas Sensor Device

Communication Protocol



ECtox Gas Sensor Device Communication Protocol

Easy Gas Sensor Device Innovations

Communication Interface: RS485

Baud Rate: 9600

Communication Protocol: Modbus-RTU

This document only deals with agreements related to this product.

Default Address: 0x01.

Users can set their own address if needed.

1. Special instructions are used to modify the user's Modbus protocol address:

Send Command:

Index	0	1	2	3	4	5	6	7	8	9	10
Explanation	Command Head										addr
	0x80	0x72	0x65	0x70	0x6F	0x6C	0x65	0x76	0x65	0x44	x

Back-Up Data:

Index	0	1	2	3	4	5	6	7	8	9	10
Explanation	Command Head										addr
	0xFF	0x72	0x65	0x70	0x6F	0x6C	0x65	0x76	0x65	0x44	x

2. Write Modbus address example -Write 0x01.

Send:

0x80, 0x72, 0x65, 0x70, 0x6F, 0x6C, 0x65, 0x76, 0x65, 0x44, 0x01

Received:

0xFF, 0x72, 0x65, 0x70, 0x6F, 0x6C, 0x65, 0x76, 0x65, 0x44, 0x01

3. Special instructions are used to read the user's Modbus protocol address:

Send Command:

Index	0	1	2	3	4	5	6	7	8	9	10
Explanation	Command Head										
	0x80	0x67	0x65	0x74	0x6D	0x74	0x61	0x64	0x64	0x72	0x00

Back-Up Data:

Index	0	1	2	3	4	5	6	7	8	9	10
Explanation	Command Head										addr
	0xFF	0x67	0x65	0x74	0x6D	0x74	0x61	0x64	0x64	0x72	x

4. Read Modbus address example.

Send:

0x80, 0x67, 0x65, 0x74, 0x6D, 0x74, 0x61, 0x64, 0x64, 0x72, 0x01

Received:

0xFF, 0x67, 0x65, 0x74, 0x6D, 0x74, 0x61, 0x64, 0x64, 0x72, 0x01

5. Sensor data - Holding register (Non-standard Modbus-RTU protocol, There will be examples later)

Address	Data	R/W	Explanation
0x2000	Byte[0]	RO	Gas concentration, float type (byte[0]<<24) (byte[1]<<16) (byte[2]<<8) byte[3] Convert according to the 32-bit float data type. (IEEE754 Single precision 32-bit)
	Byte[1]	RO	
0x2002	Byte[2]	RO	
	Byte[3]	RO	
0x2004	Byte[4]	RO	Temperature, unit 16 type, with 2 decimal places (byte[4]<<8) byte[5]
	Byte[5]	RO	
0x2006	Byte[6]	RO	Relative humidity, unit 16 type, with 2 decimal places (byte[6]<<8) byte[7]
	Byte[7]	RO	
0x2008	Byte[8]	RO	Maximum range, unit 16 type (byte[8]<<8) byte[9]
	Byte[9]	RO	
0x200A	Byte[10]	RO	Fixed 0
	Byte[11]	RO	Sensor type (Refer to table 1)
0x200C	Byte[12]	RO	Fixed 0
	Byte[13]	RO	Pump warning: 0-Working, sampling gas error 2: Emptying gas error 3: Pump stops working If an error occurs with the pump, then the following points (1 – 4) may be the cause: 1) Power supply is incorrect. 2) Gas tube is blocked. 3) Positive or negative pressure. 4) Mechanical pump or sensor error.
0x200E	Byte[14]	RO	Fixed 0
	Byte[15]	RO	Over range warning 0: In range 1: Over range When over range: 1) The measurement value is incorrect. 2) If detection is continued, it is possible to damage the gas sensor.
0x2010	Byte[16]	RO	Fixed 0
	Byte[17]	RO	Reserved
0x2012	Byte[18]	RO	Fixed 0
	Byte[19]	RO	Zero value warning 0: Zero value correct 1: Zero value over range If zero value over range, the reason could be: The last measurement concentration value is too high or the sensor recovery time takes longer. Please perform two more measurements to check if the error warning still exists.
0x2014	Byte[20]	RO	Fixed 0
	Byte[21]	RO	Concentration is invalid 0: Valid 1: Invalid
0x2016	Byte[22]	RO	Fixed 0
	Byte[23]	RO	Sensor State 0: Sensor OK 1: Sensor must be replaced 2: Reserved 3: Recommended to replace the sensor

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6. Read 0x2000~0x2016 register data example.

Send:

```
0x01, 0x03, 0x20, 0x00, 0x00, 0x0C, 0x4E, 0x0F
```

Received:

```
byte[0], byte[1], byte[2], byte[3], byte[4], byte[5], byte[6], byte[7], byte[8], byte[9], byte[10], byte[11], byte[12], byte[13], byte[14],  
byte[15], byte[16], byte[17], byte[18], byte[19], byte[20], byte[21], byte[22], byte[23], byte[24], byte[25], byte[26], byte[27], byte[28]
```

Receive data analysis:

byte[0]

--RS485 addr

byte[1]

--Read holding register cmd

byte[2]

--Read data number.

byte[3], byte[4], byte[5], byte[6]

-- Concentration (ppm) value is 32-bit float data. $HEX_DATA = (byte[3] \ll 24) | (byte[4] \ll 16) | (byte[5] \ll 8) | byte[6]$.

if $HEX_DATA == 0x41D2F8C0$, the float data is :2.63714599609375E1

You can convert data in web:http://www.binaryconvert.com/convert_float.html?

You can also convert via the union structure in the program (Note the big- and little-endian mode). Like this:

```
typedef union {  
    float data;  
    uint32_t uint32_data;  
    uint8_t uint8_data[4];  
}FLOAT_DATA_U;
```

byte[7],byte[8]

--Temperature (Celsius), 16-bit signed integer. $(byte[4] \ll 8) | byte[5]$, With 2 decimal places

byte[9], byte[10]

--Humidity (%rh), 16-bit unsigned integer $byte[6] \ll 8 | byte[7]$, With 2 decimal places

byte[11], byte[12]

--Maximum range, 16-bit unsigned integer, $byte[8] \ll 8 | byte[9]$

byte[13]

--Fixed 0

byte[14]

--Sensor type

byte[15]

--Fixed 0

byte[16]

--Pump warning 0: Working 1: Sampling gas error 2: Emptying gas error 3: Pump stops working

If an error occurs with the pump, then the following points (1 – 4) may be the cause:

1) Power supply is incorrect. 2) Gas tube is blocked. 3) Positive or negative pressure. 4) Mechanical pump or sensor error.

byte[17]

--Fixed 0

byte[18]

--Over range warning 0: In range 1: Over range

When over range:

1) The measurement value is incorrect. 2) If detection is continued, it is possible to damage the gas sensor.

byte[19], byte[20]

--Reserved

byte[21]

--Fixed 0

byte[22]

--Zero value warning 0: Zero value correct 1: Zero value over range

If zero value over range, the reason could be:

The last measurement concentration value is too high or the sensor recovery time takes longer.

Please perform two more measurements to check if the error warning still exists.

byte[23]

--Fixed 0

byte[24]

--Whether the concentration value is invalid 0: Valid 1: Invalid

byte[25]

--Fixed 0

byte[26]

--Sensor status 0: Sensor OK 1: Sensor must be replaced 2: Reserved 3: Recommended to replace the sensor

byte[27]

--Modbus-RTU CRC_L

byte[28]

--Modbus-RTU CRC_H

The following are the newly added holding registers (Use the standard Modbus-RTU protocol)

1. Software version - Holding register (Standard Modbus-RTU protocol)

Address	Data	R/W	Explanation
0x3000	Byte[0]	RO	Please parse it into ascii code.
	Byte[1]	RO	
0x3001	Byte[2]	RO	
	Byte[3]	RO	
0x3002	Byte[4]	RO	
	Byte[5]	RO	
0x3003	Byte[6]	RO	
	Byte[7]	RO	
0x3004	Byte[8]	RO	
	Byte[9]	RO	
0x3005	Byte[10]	RO	
	Byte[11]	RO	
0x3006	Byte[12]	RO	
	Byte[13]	RO	
0x3007	Byte[14]	RO	
	Byte[15]	RO	

2. Read 0x3000~0x3007 register (SW version) data example.

Send:

0x01, 0x03, 0x30, 0x00, 0x00, 0x08, 0x4B, 0x0C

Received:

0x01, 0x03, 0x10, 0x31, 0x2E, 0x31, 0x2E, 0x31, 0x2E, 0x33, 0x2E, 0x32, 0x30, 0x32, 0x33, 0x30, 0x36, 0x31, 0x36, 0x09, 0x74

Receive data analysis:

1.1.1.3.20230616d

3. Sensor data - Holding register

Address	Data	R/W	Explanation
0x3100	Byte[0]	RO	Gas concentration, float type (byte[0]<<24) (byte[1]<<16) (byte[2]<<8) byte[3] Convert according to the 32-bit float data type. (IEEE754 Single precision 32-bit)
	Byte[1]	RO	
0x3101	Byte[2]	RO	
	Byte[3]	RO	
0x3102	Byte[4]	RO	Temperature, unit 16 type, with 2 decimal places (byte[4]<<8) byte[5]
	Byte[5]	RO	
0x3103	Byte[6]	RO	Relative humidity, unit 16 type, with 2 decimal places (byte[6]<<8) byte[7]
	Byte[7]	RO	

Address	Data	R/W	Explanation
0x3104	Byte[8]	RO	Maximum range, unit 16 type (byte[8]<<8) byte[9]
	Byte[9]	RO	
0x3105	Byte[10]	RO	Fixed 0
	Byte[11]	RO	Sensor type (Refer to Table 1)
0x3106	Byte[12]	RO	Fixed 0
	Byte[13]	RO	Pump warning: 0-Working, sampling gas error 2: Emptying gas error 3: Pump stops working If an error occurs with the pump, then the following points (1 – 4) may be the cause: 1) Power supply is incorrect. 2) Gas tube is blocked. 3) Positive or negative pressure. 4) Mechanical pump or sensor error.
0x3107	Byte[14]	RO	Fixed 0
	Byte[15]	RO	Over range warning 0: In range 1: Over range When over range: 1) The measurement value is incorrect. 2) If detection is continued, it is possible to damage the gas sensor.
0x3108	Byte[16]	RO	Fixed 0
	Byte[17]	RO	Reserved
0x3109	Byte[18]	RO	Fixed 0
	Byte[19]	RO	Zero value warning 0: Zero value correct 1: Zero value over range If zero value over range, the reason could be: The last measurement concentration value is too high or the sensor recovery time takes longer. Please perform two more measurements to check if the error warning still exists.
0x310A	Byte[20]	RO	Fixed 0
	Byte[21]	RO	Concentration is invalid 0: Valid 1: Invalid
0x310B	Byte[22]	RO	Fixed 0
	Byte[23]	RO	Sensor State 0: Sensor OK 1: Sensor must be replaced 2: Reserved 3: Recommended to replace the sensor

4. Read 0x3100~0x310B register data example.

Send:

0x01, 0x03, 0x20, 0x00, 0x00, 0x0C, 0x4E, 0x0F

Received:

byte[0], byte[1], byte[2], byte[3], byte[4], byte[5], byte[6], byte[7], byte[8], byte[9], byte[10], byte[11], byte[12], byte[13], byte[14],
byte[15], byte[16], byte[17], byte[18], byte[19], byte[20], byte[21], byte[22], byte[23], byte[24], byte[25], byte[26], byte[27], byte[28]

Receive data analysis:

byte[0]

--RS485 addr

byte[1]

--Read holding register cmd

byte[2]

--Read data number.

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byte[3], byte[4], byte[5], byte[6]

-- Concentration (ppm) value is 32-bit float data. $\text{HEX_DATA} = (\text{byte}[3] \ll 24) | (\text{byte}[4] \ll 16) | (\text{byte}[5] \ll 8) | \text{byte}[6]$.

if $\text{HEX_DATA} == 0x41D2F8C0$, the float data is :2.63714599609375E1

You can convert data in web:http://www.binaryconvert.com/convert_float.html?

You can also convert via the union structure in the program (Note the big- and little-endian mode). Like this:

```
typedef union {
    float data;
    uint32_t uint32_data;
    uint8_t uint8_data[4];
}FLOAT_DATA_U;
```

byte[7],byte[8]

--Temperature (Celsius), 16-bit signed integer. $(\text{byte}[4] \ll 8) | \text{byte}[5]$, With 2 decimal places

byte[9], byte[10]

--Humidity (%rh), 16-bit unsigned integer $\text{byte}[6] \ll 8 | \text{byte}[7]$, With 2 decimal places

byte[11], byte[12]

--Maximum range, 16-bit unsigned integer, $\text{byte}[8] \ll 8 | \text{byte}[9]$

byte[13]

--Fixed 0

byte[14]

--Sensor type

byte[15]

--Fixed 0

byte[16]

--Pump warning 0: Working 1: Sampling gas error 2: Emptying gas error 3: Pump stops working

If an error occurs with the pump, then the following points (1 – 4) may be the cause:

1) Power supply is incorrect. 2) Gas tube is blocked. 3) Positive or negative pressure. 4) Mechanical pump or sensor error.

byte[17]

--Fixed 0

byte[18]

--Over range warning 0: In range 1: Over range

When over range:

1) The measurement value is incorrect. 2) If detection is continued, it is possible to damage the gas sensor.

byte[19], byte[20]

--Reserved

byte[21]

--Fixed 0

byte[22]

--Zero value warning 0: Zero value correct 1: Zero value over range

If zero value over range, the reason could be:

The last measurement concentration value is too high or the sensor recovery time takes longer.

Please perform two more measurements to check if the error warning still exists.

byte[23]

--Fixed 0

byte[24]

--Whether the concentration value is invalid 0: Valid 1: Invalid

byte[25]

--Fixed 0

byte[26]

--Sensor status 0: Sensor OK 1: Sensor must be replaced 2: Reserved 3: Recommended to replace the sensor

byte[27]

--Modbus-RTU CRC_L

byte[28]

--Modbus-RTU CRC_H

5. Manufacturer ID (Read only) - Holding register

Address	Data	R/W	Explanation
0x3300	Byte[0]	RO	Parse according to the data type written by the client. Write register: 0x4300~0x4304
	Byte[1]	RO	
0x3301	Byte[2]	RO	
	Byte[3]	RO	
0x3302	Byte[4]	RO	
	Byte[5]	RO	
0x3303	Byte[6]	RO	
	Byte[7]	RO	

6. Read 0x3300~0x3304 register (Manufacturer ID) data example.

Send:

0x01, 0x03, 0x33, 0x00, 0x00, 0x04, 0x4B, 0x4D

Received:

0x01, 0x03, 0x08, 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07, 0x08, 0x65, 0x13

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7. Manufacturer ID (Write only) - Holding register

Address	Data	R/W	Explanation
0x4300	Byte[0]	WO	Calculate the CRC value of Byte[2]~Byte[9] (CRC-16/Modbus x16+x15+x2+1) Byte[0] = CRC&0xFF Byte[1] = CRC>>8
	Byte[1]	WO	
0x4301	Byte[2]	WO	Write the ID code according to your own needs. Read register: 0x3300~0x3303
	Byte[3]	WO	
0x4302	Byte[4]	WO	
	Byte[5]	WO	
0x4303	Byte[6]	WO	
	Byte[7]	WO	
0x4304	Byte[8]	WO	
	Byte[9]	WO	

8. Write 0x4300~0x4304 register (Manufacturer ID) data example.

Send:

0x01, 0x10, 0x43, 0x00, 0x00, 0x05, 0x0A, 0xB0, 0xCF, 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07, 0x08, 0xE4, 0xEF

Received:

0x01, 0x10, 0x43, 0x00, 0x00, 0x05, 0x8E, 0x15

• Table 1.

Gas	HCHO	VOC	CO	Cl ₂	H ₂	H ₂ S	HCl	HCN	HF	NH ₃	NO ₂	O ₂	O ₃	SO ₂	HBr
Value	0x17	0x18	0x19	0x1A	0x1B	0x1C	0x1D	0x1E	0x1F	0x20	0x21	0x22	0x23	0x24	0x25
Gas	Br ₂	F ₂	PH ₃	AsH ₃	SiH ₄	GeH ₄	B ₂ H ₆	BF ₃	WF ₆	SiF ₄	XeF ₂	TiF ₄	SMELL	IAQ	AQI
Value	0x26	0x27	0x28	0x29	0x2A	0x2B	0x2C	0x2D	0x2E	0x2F	0x30	0x31	0x32	0x33	0x34
Gas	NMHC	SO _x	NO _x	NO	C ₄ H ₈	C ₃ H ₈ O ₂	CH ₄ S	C ₈ H ₈	C ₄ H ₁₀	C ₂ H ₆	C ₆ H ₁₄	C ₂ H ₄ O	C ₃ H ₉ N	C ₂ H ₇ N	C ₂ H ₆ O
Value	0x35	0x36	0x37	0x38	0x39	0x3A	0x3B	0x3C	0x3D	0x3E	0x3F	0x40	0x41	0x42	0x43
Gas	CS ₂	C ₂ H ₆ S	C ₂ H ₆ S ₂	C ₂ H ₄	CH ₃ OH	C ₆ H ₆	C ₈ H ₁₀	C ₇ H ₈	CH ₃ COOH	ClO ₂	H ₂ O ₂	N ₂ H ₄	C ₂ H ₈ N ₂	C ₂ HCl ₃	
Value	0x44	0x45	0x46	0x47	0x48	0x49	0x4A	0x4B	0x4C	0x4D	0x4E	0x4F	0x50	0x51	
Gas	CHCl ₃	C ₂ H ₃ Cl ₃													
Value	0x52	0x53													



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