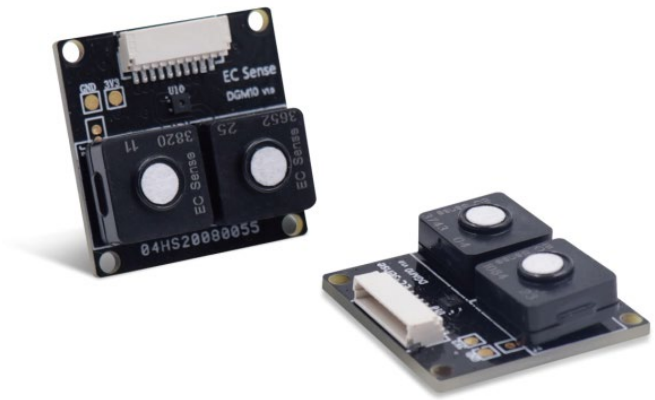
EC Sense
Easy Gas Sensors



DGM10 Double Gas Sensor Module

UART Modbus-RTU & I²C Interface Communication Protocol

This document describes the communication protocol of the UART and I²C Interface of the DGM10 Double Gas Sensor Module and the main commands during usage by the user in detail.

For detailed electrical parameters of DGM10 and usage methods of the product, please refer to the technical specifications and product manual.

UART Modbus-RTU Interface Communication Protocol

1. Communication Mode

DGM10 module uses UART (TTL) interface communication, please follow the parameters bellow:

Signal Voltage	Baud Rate	Data Bit	Stop Bit	Parity
3.3V	115200	8-bit	1	None

Adaptive baud rate operation: After powering on the device for 5 seconds, send two bytes of data 0x7F, 0x7F, and then send specific commands according to the communication protocol.

Note: If the two bytes 0x7F and 0x7F are not sent after power-on, or other data is sent, the adaptive baud rate may fail and the communication cannot be normal.

Currently, the supported adaptive baud rates are 115200, 57600, 19200, 9600, 2400

Transmission mode: Modbus-RTU **Slave device address:** 01 **Read out and write data interval:** ≥ 1s

The communication protocol uses all holding registers by three commands.

1) 03 (0x03) command: Read multiple holding registers

2) 06 (0x06) command: Write single holding register

3) 16 (0x10) command: Write multiple holding registers

The sensor module communication is the master to the slave mode. The master sends instructions for each data transmission and the slave transmits corresponding data according to the instructions.

2. Change Address

When modifying the product address of a sensor module, the address of a single product must be modified one by one, should not be modified at the same time.

Use a group of two commands to modify the modbus address. They must be sent in sequence, with an interval ≥ 1s.

The [addr] in the instruction is the modbus address that needs to be modified. Range: 01(0x01) ≤ addr ≤ 247(0xF7), the value out of range, the default is 01(0x01).

- **Command 1**

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x55	0x4E	0x4C	0x4F	0x43	0x4B	0x32	0x50

- **Command 2**

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]	Byte[8]	Byte[9]
0x4D	0x4F	0x44	0x49	0x46	0x59	0x00	addr	CRC_L	CRC_H

Sensor Type

The sensor gas type can be identified by read out from the holding register. Follow the Sensor Type code table below:

Gas Sensor	Formaldehyde	Organic Volatiles	Carbon Monoxide	Chlorine	Hydrogen	Hydrogen Sulfide	Hydrogen Chloride	Hydrogen Cyanide
Gas Formula	HCHO	VOC	CO	Cl_2	H_2	H_2S	HCl	HCN
Code	0x17	0x18	0x19	0x1A	0x1B	0x1C	0x1D	0x1E

Gas Sensor	Hydrogen Fluoride	Ammonia	Nitrogen Dioxide	Oxygen	Ozone	Sulfur Dioxide	Hydrogen Bromide	Bromine
Gas Formula	HF	NH_3	NO_2	O_2	O_3	SO_2	HBr	Br_2
Code	0x1F	0x20	0x21	0x22	0x23	0x24	0x25	0x26

Gas Sensor	Fluorine	Phosphine	Arsenide	Silane	Germane	Diborane	Boron Trifluoride	Hydrogen Selenide
Gas Formula	F_2	PH_3	AsH_3	SiH_4	GeH_4	B_2H_6	BF_3	H_2Se
Code	0x27	0x28	0x29	0x2A	0x2B	0x2C	0x2D	0x31

Gas Sensor	Malodorous	Indoor Air Quality	Outdoor Air Quality	Non-Methane Total Hydrocarbons	Sulfide	Nitrogen Oxides	Nitric Oxide	Isobutylene
Gas Formula	SMELL	IAQ	AQI	NMHC	SO_X	NO_X	NO	C_4H_8
Code	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39

Gas Sensor	Propylene Glycol	Methyl Mercaptan	Styrene	Tetrahydro-thiophene	Phosphorus Oxychloride	Phosgene	Ethylene Oxide	Trimethylamine
Gas Formula	$C_3H_8O_2$	CH_4S	C_8H_8	THT	$POCl_3$	$COCl_2$	C_2H_4O	C_3H_9N
Code	0x3A	0x3B	0x3C	0x3D	0x3E	0x3F	0x40	0x41

Gas Sensor	Dimethyla-mine	Ethanol	Carbon Disulfide	Ethyl Mercaptan	Dimethyl Disulfide	Ethylene	Methanol	Benzene
Gas Formula	C_2H_7N	C_2H_6O	CS_2	C_2H_6S	$C_2H_6S_2$	C_2H_4	CH_3OH	C_6H_6
Code	0x42	0x43	0x44	0x45	0x46	0x47	0x48	0x49

Gas Sensor	P-xylene	Toluene	Acetic Acid	Carbon Dioxide	Hydrogen Peroxide	Hydrazine	Unsymmetrical Dimethyl Hydrazine
Gas Formula	C_8H_{10}	C_7H_8	CH_3COOH	ClO_2	H_2O_2	N_2H_4	$C_2H_8N_2$
Code	0x4A	0x4B	0x4C	0x4D	0x4E	0x4F	0x50

Gas Sensor	Trichloroe-thylene	Trichlorome-thane	Trichloroe-thane
Gas Formula	C_2HCl_3	$CHCl_3$	$C_2H_3Cl_3$
Code	0x51	0x52	0x53

1. Read-Out Measured Values

The group of addresses is used to read out measurement values (gas concentrations), temperature, humidity, sensor module range, sensor module gas type, operating light switch control, sensor lifetime and performance.

DGM10 Double Gas Module includes two gas sensors, which have their own position on the circuit board S0 and S1. Please see the table below:

Address	Data	Readout/Writing	Function	Description
0xF000	data[0]	Read & Write	Running light status	1: Open 0: Off
0xF001	data[1]	Only Read	Temperature	Type: 32-bit float type (data[1]<<16)|data[2]
0xF002	data[2]	Only Read		Then convert according to the 32-bit float data type Unit: °C
0xF003	data[3]	Only Read	Humidity	Type: 32-bit float type (data[3]<<16)|data[4]
0xF004	data[4]	Only Read		Then convert according to the 32bit float data type Unit: %RH
0xF005	data[5]	Only Read	S0 sensor detection result Gas concentration	Type: 32-bit float type (data[5]<<16)|data[6]
0xF006	data[6]	Only Read		Then convert according to the 32bit float data type Unit: PPM (Oxygen:%vol.)
0xF007	data[7]	Only Read	S0 sensor maximum range	Type: unit 32 (data[7]<<16)|data[8]
0xF008	data[8]	Only Read		Unit: PPM (Oxygen:%vol.)

Address	Data	Readout/Writing	Function	Description
0xF009	data[9]	Only Read	S0 sensors gas type	Type: unit 16 Please refer to <Table1> for specific corresponding values
0xF00A 0xF00B	data[10] data[11]	Only Read Only Read	S1 sensor detection result Gas concentration	Type: 32-bit float type (data[10]<<16)|data[11] Then convert according to the 32-bit float data type Unit: ppm except Oxygen gas Oxygen Unit: %vol.
0xF00C 0xF00D	data[12] data[13]	Only Read Only Read	S1 sensor maximum range	Type: uint 32 (data[12]<<16)|data[13] Unit: ppm except Oxygen gas Oxygen Unit: %vol.
0xF00E	data[14]	Only Read	S1 sensors gas type	Type: uint 16 Please refer to <Table1> for specific corresponding values
0xF00F	data[15]	Only Read	S0 Sensor Lifetime and Performance	Type: uint 16 2: Sensor failure, replace new sensor 1: Sensor is close to failure, prepare replacement 0 : Working
0xF010	data[16]	Only Read	S1 Sensor Lifetime and Performance	Type: uint 16 2: Sensor failure, replace new sensor 1: Sensor is close to failure, prepare replacement 0 : Working

- **Example:**
  Read 0xF000 ~ 0xF010 instruction address
  Downstream: Read out 17 registers data

Command Format:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x03	0xF0	0x00	0x00	0x11	0xB6(CRC_L)	0xC6(CRC_H)

Answer Format:

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]
0x01	0x03	0x22	0x00	0x01	0x41	0x9C	0x12	0x10	0x42	0x65	0xFB	0x00

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]
0x41	0xAC	0xF2	0x2A	0x00	0x00	0x00	0x32	0x00	0x22	0x41	0x10	0x87

Byte[26]	Byte[27]	Byte[28]	Byte[29]	Byte[30]	Byte[31]	Byte[32]	Byte[33]	Byte[34]	Byte[35]	Byte[36]	Byte[37]	Byte[38]
0x74	0x00	0x00	0x00	0x32	0x00	0x22	0x00	0x00	0x00	0x00	0xC9	0xD5

2. Control LED

One of the LEDs on the circuit board shows the working condition of the gas module. If you want to have less power consumption, the LED can be switched off.

- **Example:** Switch LED off or on
  Downstream: Switch LED off, Write down 0 to 0xF000

Command Format:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x06	0xF0	0x00	0x00	0x11	0xB6(CRC_L)	0xC6(CRC_H)

Answer Format:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x06	0xF0	0x00	0x00	0x11	0xB6(CRC_L)	0xC6(CRC_H)

3. Read-Out Firmware Version

The firmware of the sensor module can be updated. If you want to get information, please follow the number in the Read-Out Firmware Version table below:

Address	Value	Readout/Writing	Function	Description
0xB000	'D' 'G'			
0xB001	'M' '1'			
0xB002	'0' ' ' –			
0xB003	'1' ' ' .			
0xB004	'1' ' ' .			
0xB005	'1' ' ' .	Only Read	Firmware Version Number	The Firmware version number, please refer to the read-out data
0xB006	'0' ' ' –			
0xB007	'2' '0'			
0xB008	'2' '0'			
0xB009	' ' . '0'			
0xB00A	'8' ' ' '			
0xB00B	'2' '4'			

- **Example:**

  Read 0xB000~0xB00B instruction address

  Downstream: Get Gas Module Firmware Version number

  Command Format:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x03	0xB0	0x00	0x00	0x0C	0xB6(CRC_L)	0xC6(CRC_H)

  Answer Format:

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]
0x01	0x03	0x18	0x44	0x47	0x4D	0x31	0x30	0x5F	0x31	0x2E	0x31	0x2E

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]
0x31	0x2E	0x30	0x5F	0x32	0x30	0x32	0x30	0x2E	0x30	0x38	0x2E	0x32

Byte[26]	Byte[27]	Byte[28]
0x34	0xC8	0x57

4. Sleeping Mode

For less power consumption, please follow the table below to control the sensor module's sleep or awake mode. After entering the sleep mode, other commands will not be executed. For sending other commands you must exit the sleeping mode.

Address	Data	Readout/Writing	Register	Description
0xC000	data[0]	Only Read	Sleep status	Type: unit 16 1: Entry sleep mode 0: Exit sleep mode

- **Command Format:**

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x06	0xC0	0x00	0x00	0x01	0xB6(CRC_L)	0xC6(CRC_H)

Answer Format (Going Sleeping Mode):

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x06	0xC0	0x00	0x00	0x01	0xB6(CRC_L)	0xC6(CRC_H)

Note: After entering the dormant state, sending other commands will not be executed and will be regarded as an invalid command until exiting the dormant state.

5. Sensor Serial Number

Each sensor has an independent number. DGM10 is a dual sensor module with two independent sensor serial numbers. Obtain the serial number of the sensor in the current module by reading the data in the following address:

Address	Data	Readout/Writing	Register	Description
0xB100	'1' '2'	Only Read	S0 Sensor serial number	ascii code string Length: 16 bytes The specific sensor serial number, please refer to the read-out data
0xB101	'3' '4'			
0xB102	'5' '6'			
0xB103	'7' '8'			
0xB104	'9' 'A'			
0xB105	'B' 'C'			
0xB106	'D' 'E'			
0xB107	'F' '0'			

Address	Data	Readout/Writing	Register	Description
0xB108	'0' '1'	Only Read	S1 Sensor serial number	ascii code string Length: 16 bytes The specific sensor serial number, please refer to the read-out data
0xB109	'2' '3'			
0xB10A	'4' '5'			
0xB10B	'6' '7'			
0xB10C	'8' '9'			
0xB10D	'A' 'B'			
0xB10E	'C' 'D'			
0xB10F	'E' 'F'			

- Read 0xB100~0xB10F instruction address
  Downstream: Get the serial number of the sensor

Command Format:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x01	0x03	0xB1	0x00	0x00	0x10	0xB6(CRC_L)	0xC6(CRC_H)

Answer Format:

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]
0x01	0x03	0x20	0x31	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39	0x41

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]
0x42	0x43	0x44	0x45	0x46	0x30	0x30	0x31	0x32	0x33	0x34	0x35	0x36

Byte[26]	Byte[27]	Byte[28]	Byte[29]	Byte[30]	Byte[31]	Byte[32]	Byte[33]	Byte[34]	Byte[35]	Byte[36]
0x37	0x38	0x39	0x41	0x42	0x43	0x44	0x45	0x46	0xDD	0xCA

Re-calibration Sensor Module

If you want to calibrate the sensor module, please use the commands to modify. Separate operations are required when calibrating the zero point and span. First step is calibrate the zero point, second step is calibrate the span. When calibrating the zero point, it needs to be in clean air without the target gas and interfering gas, or use cylinder air or Nitrogen. When calibrating the span, it is necessary to use standard gas bottle with certification. The detailed operation, please refer to the DGM10 product manual.

Address	Data	Readout/Writing	Register	Description
0xC100	data[0]	Read & Write	Start S0 sensor Zero re-calibration	Start Zero re-calibration of S0 sensor by writing 1 Restore the factory Zero value of S0 by writing 0
0xC101	data[1]	Only Writing	Re-calibration zero value of S0 sensor	The current measurement value of the S0 sensor to be zero by writing 1, writing 0 is invalid value. When read out the zero value should be show 0 after successful zero calibration.
0xC102	data[2]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC103	data[3]	Only Read	Check S0 has zero re-calibration	Read out value is 1: S0 sensor had Zero re-calibration Read out value is 0: S0 sensor no Zero re-calibration
0xC104	data[4]	Read & Write	Start S0 sensor Span calibration	Start Span calibration of S0 sensor by writing 1 Restore the factory Span value of S0 by writing 0
0xC105	data[5]	Only Read	Check S0 has Span re-calibration	Read out value is 1: S0 sensor had Span re-calibration Read out value is 0: S0 sensor no Span re-calibration
0xC106 0xC107	data[6] data[7]	Only Writing	Re-calibration Span value of S0 sensor	The current measurement value of the S0 sensor to be correct Span by writing 1, writing 0 is invalid value. The read-out value is 0 after successful Span re-calibration. The data type is float and the value must more than 0
0xC108 0xC109	data[8] data[9]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC10A 0xC10B	data[10] data[11]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC10C 0xC10D	data[12] data[13]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC10E 0xC10F	data[14] data[15]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC110	data[16]	Read & Write	Start S1 sensor Zero re-calibration	Start Zero re-calibration of S1 sensor by writing 1 Restore the factory Zero value of S1 by writing 0
0xC111	data[17]	Only Writing	Re-calibration zero value of S1 sensor	The current measurement value of the S1 sensor to be zero by writing 1, writing 0 is invalid value. When read out the zero value should be show 0 after successful zero calibration.
0xC112	data[18]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC113	data[19]	Only Read	Check S1 has zero re-calibration	Read out value is 1: S1 sensor had Zero re-calibration Read out value is 0: S1 sensor no Zero re-calibration
0xC114	data[20]	Read & Write	Start S1 sensor Span calibration	Start Span calibration of S1 sensor by writing 1 Restore the factory Span value of S1 by writing 0
0xC115	data[21]	Only Read	Check S1 has Span re-calibration	Read out value is 1: S1 sensor had Span re-calibration Read out value is 0: S1 sensor no Span re-calibration
0xC116 0xC117	data[22] data[23]	Only Writing	Re-calibration Span value of S1 sensor	The current measurement value of the S1 sensor to be correct Span by writing 1, writing 0 is invalid value. The read-out value is 0 after successful Span re-calibration. The data type is float and the value must more than 0
0xC118 0xC119	data[24] data[25]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC11A 0xC11B	data[26] data[27]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC11C 0xC11D	data[28] data[29]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable
0xC11E 0xC11F	data[30] data[31]	Unreadable & writable	Retain	When read out the Retain value is 0, Unwritable

I²C Interface Communication Protocol

The description of DGM10 Double Gas Sensor Module I²C interface. Please make sure you have the right connection according to the Datasheet, since there are two connections, UART and I²C interface, available.

1. Communication Mode

DGM10 module uses UART (TTL) interface communication, please follow the parameters below:

Signal Voltage	I²C 7bit Address	Protocol Speed	Readout between Writing and Waiting Time
3.3V	0x50	I²C Standard mode, maximum clock frequency of 400 kHz	≥ 1s

Note: Between the write-command and the I²C readout value from the gas module, a minimum waiting time of 1s is required. However, it is recommended to wait longer than 1s.

2. Address Change

When modifying the product address of a sensor module, the address of a single product must be modified one by one, should not be modified at the same time.

Use two commands to change the Modbus address, which must be sent in sequence with an interval of ≥ 1s.

The I²C of the 7-bit address range: 0x 08 ~ 0x7F, the default is 0x50.

- **First Command**

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x55	0x4E	0x4C	0x4F	0x43	0x4B	0x32	0x50

- **Second Command**

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]	Byte[8]	Byte[9]
0x49	0x32	0x43	0x41	0x44	0x44	0x52	addr	CRC_L	CRC_H

Sensor Type

The Sensor Gas Type can be identified by the read-out from the holding register. Follow the sensor type code table bellow:

Gas Sensor	Formalde-hyde	Organic Volatiles	Carbon Monoxide	Chlorine	Hydrogen	Hydrogen Sulfide	Hydrogen Chloride	Hydrogen Cyanide
Gas Formula	HCHO	VOC	CO	Cl_2	H_2	H_2S	HCl	HCN
Code	0x17	0x18	0x19	0x1A	0x1B	0x1C	0x1D	0x1E

Gas Sensor	Hydrogen Fluoride	Ammonia	Nitrogen Dioxide	Oxygen	Ozone	Sulfur Dioxide	Hydrogen Bromide	Bromine
Gas Formula	HF	NH_3	NO_2	O_2	O_3	SO_2	HBr	Br_2
Code	0x1F	0x20	0x21	0x22	0x23	0x24	0x25	0x26

Gas Sensor	Fluorine	Phosphine	Arsenide	Silane	Germane	Diborane	Boron Trifluoride	Hydrogen Selenide
Gas Formula	F_2	PH_3	AsH_3	SiH_4	GeH_4	B_2H_6	BF_3	H_2Se
Code	0x27	0x28	0x29	0x2A	0x2B	0x2C	0x2D	0x31

Gas Sensor	Malodorous	Indoor Air Quality	Outdoor Air Quality	Non-Methane Total Hydrocarbons	Sulfide	Nitrogen Oxides	Nitric Oxide	Isobutylene
Gas Formula	SMELL	IAQ	AQI	NMHC	SO_X	NO_X	NO	C_4H_8
Code	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39

Gas Sensor	Propylene Glycol	Methyl Mercaptan	Styrene	Tetrahydro-thiophene	Phosphorus Oxychloride	Phosgene	Ethylene Oxide	Trimethyla-mine
Gas Formula	$C_3H_8O_2$	CH_4S	C_8H_8	THT	$POCl_3$	$COCl_2$	C_2H_4O	C_3H_9N
Code	0x3A	0x3B	0x3C	0x3D	0x3E	0x3F	0x40	0x41

Gas Sensor	Dimethyla-mine	Ethanol	Carbon Disulfide	Ethyl Mercaptan	Dimethyl Disulfide	Ethylene	Methanol	Benzene
Gas Formula	C_2H_7N	C_2H_6O	CS_2	C_2H_6S	$C_2H_6S_2$	C_2H_4	CH_3OH	C_6H_6
Code	0x42	0x43	0x44	0x45	0x46	0x47	0x48	0x49

Gas Sensor	P-xylene	Toluene	Acetic Acid	Carbon Dioxide	Hydrogen Peroxide	Hydrazine	Unsymmetrical Dimethyl Hydrazine
Gas Formula	C_8H_{10}	C_7H_8	CH_3COOH	ClO_2	H_2O_2	N_2H_4	$C_2H_8N_2$
Code	0x4A	0x4B	0x4C	0x4D	0x4E	0x4F	0x50

Gas Sensor	Trichloroe-thylene	Trichlorome-thane	Trichloroe-thane
Gas Formula	C_2HCl_3	$CHCl_3$	$C_2H_3Cl_3$
Code	0x51	0x52	0x53

1. Read-Out Measured Values

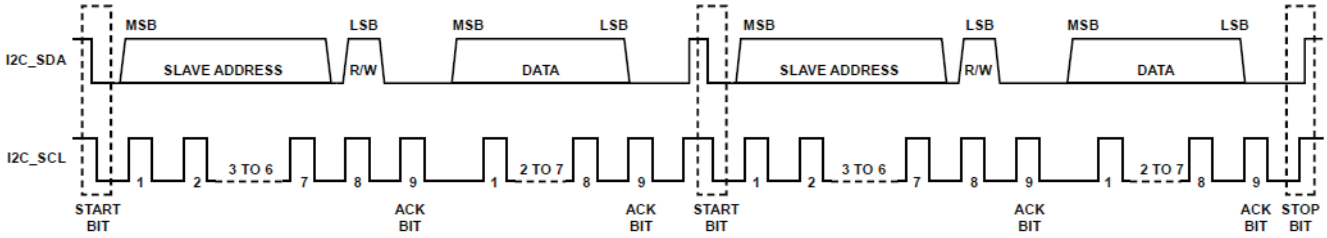
This group of addresses is used to read out measurement values (gas concentrations), temperature, humidity, sensor module range, sensor module gas type, operating light switch control, sensor lifetime and performance.

DGM10 Double Gas Module includes two gas sensors, which have their own position on the circuit board S0 and S1. Please see the table below:

Register Address	Data	Readout/Writing	Function	Description
0x00	Byte[0]	Only Read	Sensors Lifetime and Performance	Byte[0]bit[7:4]:S0 Performance Byte[0]bit[3:0]:S1 Performance 2: Sensor failure, replace new sensor 1: Sensor is close to failure, prepare replacement 0 : Working
0x01	Byte[1]	Read & Write	Switch LED	1: On 0: Off
0x02 0x03 0x04 0x05	Byte[2] Byte[3] Byte[4] Byte[5]	Only Read	Temperature	Type: 32 bit float data (data[2]<<24)|(data[3]<<16)|(data[4]<<8)|data[5] Convert according to the 32-bit float data type Unit:℃
0x06 0x07 0x08 0x09	Byte[6] Byte[7] Byte[8] Byte[9]	Only Read	Humidity	Type: 32 bit float data (data[6]<<24)|(data[7]<<16)|(data[8]<<8)|data[9] Convert according to the 32-bit float data type Unit: %RH
0x0A 0x0B 0x0C 0x0D	Byte[10] Byte[11] Byte[12] Byte[13]	Only Read	S0 Gas Sensor measured concentration	Type: 32 bit float data (data[10]<<24)|(data[11]<<16)|(data[12]<<8)|data[13] Convert according to the 32-bit float data type Unit: ppm Oxygen Unit: %vol.
0x0E 0x0F 0x10 0x11	Byte[14] Byte[15] Byte[16 Byte[17]	Only Read	S0 Gas sensor range	Unit: uint 32 (data[14]<<24)|(data[15]<<16)|(data[16]<<8)|data[17] Unit: ppm Oxygen Unit: %vol.
0x12 0x13	Byte[18] Byte[19]	Only Read	S0 Gas Sensor type	Type: uint 16 (byte[18]<<8)|byte[19]
0x14 0x15 0x16 0x17	Byte[20] Byte[21] Byte[22] Byte[23]	Only Read	S1 Gas Sensor measured concentration	Type: 32 bit float data (data[20]<<24)|(data[21]<<16)|(data[22]<<8)|data[23] Convert according to the 32-bit float data type Unit: ppm Oxygen Unit: %vol.
0x18 0x19 0x1A 0x1B	Byte[24] Byte[25] Byte[26] Byte[27]	Only Read	S1 Gas Sensor range	Type: uint 32 (data[24]<<24)|(data[25]<<16)|(data[26]<<8)|data[27] Unit: ppm Oxygen Unit: %vol.

Register Address	Data	Readout/Writing	Function	Description
0x1C 0x1D	Byte[28] Byte[29]	Only Read	S1 Gas Sensor type	Type: uint 16 (byte[28]<<8)|byte[29]
0x1E 0x1F 0x20 0x21 0x22 0x23 0x24 0x25 0x26 0x27 0x28 0x29 0x2A 0x2B 0x2C 0x2D 0x2E 0x2F 0x30 0x31 0x32 0x33 0x34 0x35	'D' 'G' 'M' '1' '0' ' ' '1' '.' '1' '.' '1' '.' '0' ' ' '2' '0' '2' '0' '.' '0' '8' '.' '2' '4'	Only Read	Firmware version number	For the Firmware Version Number, please refer to the read-out data.
0x36 0x37 0x38 0x39 0x3A 0x3B 0x3C 0x3D 0x3E 0x3F 0x40 0x41 0x42 0x43 0x44 0x45	'D' 'G' 'M' '1' '0' ' ' '1' '.' '1' '.' '1' '.' '0' ' ' '2' '0'	Only Read	S0 Sensor serial number	ascii code string Length: 16 bytes The serial number of each sensor is unique
0x46 0x47 0x48 0x49 0x4A 0x4B 0x4C 0x4D 0x4E 0x4F 0x50 0x51 0x52 0x53 0x54 0x55	'0' '1' '2' '3' '4' '5' '6' '7' '8' '9' 'A' 'B' 'C' 'D' 'E' 'F'	Only Read	S1 Sensor serial number	ascii code string Length: 16 bytes The serial number of each sensor is unique

2. I²C Transmitted Byte



Read and write interface routines:

```
/**********************************
Function: Write a byte of data to a register
dev_add: I2C 7bit address is shifted one bit to the left
register_addr: write register address
data: write data
**********************************/
void send_data(uint8_t dev_add, uint8_t register_addr, uint8_t data)
{
I2C_Start();
I2C_SendByte(dev_addr);
if(I2C_CheckAck())
{
I2C_Stop();
        return;
}
I2C_SendByte(register_addr);
if(I2C_CheckAck())
{
I2C_Stop();
return;
}
I2C_SendByte(data);
if(I2C_CheckAck())
{
        I2C_Stop();
        return;
}
I2C_Stop();
}
```

```
/**********************************
Function: register_addr start reading register read_len a byte
dev_add: I2C 7 -bit address is shifted one bit to the left
register_addr : write register address
data: read data storage address
read_len : read length
**********************************/
void read_data(uint8_t dev_add, uint8_t register_addr, uint8_t* data, uint8_t read_len)
{
        uint8 i = 0;
        I2C_Start();
        I2C_SendByte(dev_addr);
        if(I2C_CheckAck())
        {
                I2C_Stop();
                return;
        }
        I2C_SendByte(register_addr);
        if(I2C_CheckAck())
        {
                I2C_Stop();
                return;
        }

I2C_ReStart();

        I2C_SendByte(dev_addr|0x01);
        if(I2C_CheckAck())
        {
                I2C_Stop();
                return;
        }

        datax[i] = I2C_ReceiveByte();
        i++;
        for(i<data_len;i++)
        {
                I2C_SendAck();
                datax[i] = I2C_ReceiveByte();
}
I2C_SendNAck();
I2C_Stop();
}
```

Disclaimer

The EC Sense performance data stated above is based on data obtained under test conditions using the EC Sense gas distribution system and AQS test software. In the interest of continuous product improvement, EC Sense reserves the right to change design features and specifications without notice. We are not responsible for any loss, injury or damage caused by this. EC Sense assumes no responsibility for any indirect loss, injury or damage resulting from the use of this document, the information contained therein or any omissions or errors herein. This document does not constitute an offer to sell. The data it contains are for informational purposes only and cannot be considered a guarantee. Any use of the given data must be evaluated and determined by the user to comply with federal, state and local laws and regulations. All specifications outlined are subject to change without notice.

EC Sense
Easy Gas Sensors

Business Centre
Europe and the Rest of the World

EC Sense GmbH
Wangener Weg 3
82069 Hohenschäftlarn, Germany
Tel: +49(0)8178-99992-10 Fax: +49(0)8178-9999-211
Email: office@ecsense.com
www.ecsense.com, www.ecnose.de

Business Centre
Asia

Ningbo AQSystems Technology Co., Ltd.
F4-17 Building, Zhong Wu Technology Park No.228,
Jin Gu Bei Road, Yinzhou District NingBo,
Zhejiang Provence, P.R. China Post Code: 315100
Tel: +86(0)574 88097236, 88096372
Email: info@aqsystems.cn
www.ecsense.cn, www.ecnose.de