



GREYSTONE
ENERGY SYSTEMS INC

IAQRM Series

Multi Sensor

SETUP GUIDE MODBUS COMMUNICATION



Modbus Address	Typical Offset	Units	Data Type	Access	Description	Notes (All 16 bit Integers)	Register Value	Default Value
40001	+0	VOC Sensor Value	Word	Read	VOC Sensor Value	0-500 VOC Index, resolution 1 5-1382 PPB, resolution 1, or 23-6220 ug/m3, resolution 1, Sensor Error = -1000	0x0000 to 0x01F4 (0 to 500 VOC Index) 0x0033 to 0x3600 (51- 13824 PPB), or 0x17 to 0x184C corresponding to 230 to 62200 (multiplier = 1/10)	N/A
40002	1	RH Sensor Value	Word	Read	RH Sensor Value	0-100%RH, Resolution = 0.1%RH Sensor Error = -1000	0x0000 to 0x3E8 (0.0 to 100.0%RH multiplier = 10)	N/A
40003	2	Temperature Sensor Value	Word	Read	Temperature Sensor Value	0 to 50 °C, Resolution = 0.1 °C 32 to 122 °F, Resolution = 0.1 °F Sensor Error = -1000	0x0000 to 0x01F4, corresponding to 0.0 to 50.0 °C (multiplier = 10) 0x0140 to 0x04C4, corresponding to 32.0 to 122.0 °F (multiplier = 10)	N/A
40004	3	PM 1.0 Particulate Mass	Word	Read	PM1.0 Particulate Mass	0 to 1000ug/m ³ , resolution 1ug/m ³ Sensor Error = -1000	0x0000 to 0x03E8, corresponding to 0 to 1000 ug/m3	N/A
40005	4	PM 2.5 Particulate Mass	Word	Read	PM2.5 Particulate Mass	0 to 1000ug/m ³ , resolution 1ug/m ³ Sensor Error = -1000	0x0000 to 0x03E8, corresponding to 0 to 1000 ug/m3	N/A
40006	5	PM 4.0 Particulate Mass	Word	Read	PM4.0 Particulate Mass	0 to 1000ug/m ³ , resolution 1ug/m ³ Sensor Error = -1000	0x0000 to 0x03E8, corresponding to 0 to 1000 ug/m3	N/A
40007	6	PM 10 Particulate Mass	Word	Read	PM10.0 Particulate Mass	0 to 1000ug/m ³ , resolution 1ug/m ³ Sensor Error = -1000	0x0000 to 0x03E8, corresponding to 0 to 1000 ug/m3	N/A
40008	7	PM 0.5 Number concentration range	Word	Read	PM0.5 Particulate Count	0 to 3000 #/cm ³ , resolution 1 Sensor Error = -1000	0x0000 to 0x0BB8, corresponding to 0 to 3000 #/cm3	N/A
40009	8	PM 1.0 Number concentration range	Word	Read	PM1.0 Particulate Count	0 to 3000 #/cm ³ , resolution 1 Sensor Error = -1000	0x0000 to 0x0BB8, corresponding to 0 to 3000 #/cm3	N/A
40010	9	PM 2.5 Number concentration range	Word	Read	PM2.5 Particulate Count	0 to 3000 #/cm ³ , resolution 1 Sensor Error = -1000	0x0000 to 0x0BB8, corresponding to 0 to 3000 #/cm3	N/A
40011	10	PM 4.0 Number concentration range	Word	Read	PM4.0 Particulate Count	0 to 3000 #/cm ³ , resolution 1 Sensor Error = -1000	0x0000 to 0x0BB8, corresponding to 0 to 3000 #/cm3	N/A
40012	11	PM10 Number concentration range	Word	Read	PM10 Particulate Count	0 to 3000 #/cm ³ , resolution 1 Sensor Error = -1000	0x0000 to 0x0BB8, corresponding to 0 to 3000 #/cm3	N/A
40013	12	CO2 Sensor Value	Word	Read	CO2 Level	0 to 10,000PPM, resolution 1PPM Sensor Error = -1000	0x0000 to 0x2710, corresponding to 0 to 10,000 PPM	N/A
40014	13	Formaldehyde Sensor Value	Word	Read	Formaldehyde Level	0-1230 ug/m3, or 0 to 1000PPB, resolution 1 Sensor Error = -1000	0x0000 to 0x04CE, corresponding to 0 to 1230 ug/m3, or 0x0000 to 0x03E8, corresponding to 0 to 1000 PPB	N/A
40015	14	Relay Status	Word	Read		0 = Inactive, 1 = Active	0x0000 (Inactive) or 0x0001 (Active)	N/A

Modbus Address	Typical Offset	Units	Data Type	Access	Description	Notes (All 16 bit Integers)	Register Value	Default Value
40016	15	Temperature Units	Word	Read/Write	Celsius (0) or Fahrenheit (1)	0 = °C, 1 = °F	0x0000 (C) or 0x0001 (F)	0
40017	16	Temperature Offset	Word	Read/Write	Temperature Offset	-5 to 5 Δ°C, Resolution = 0.1 Δ°C -10 to 10 Δ°F, Resolution = 0.1 Δ°F	0xFFCE to 0x0032, corresponding to -5.0 to 5.0 °C (multiplier = 10) 0xFF9C to 0x0064, corresponding to -10.0 to 10.0 °F (multiplier = 10)	0
40018	17	Humidity Offset	Word	Read/Write	RH Offset	+/-10 %RH, Resolution = 1 %RH	0xFFF6 to 0X000A (-10 to 10 %RH)	0
40019	18	CO2 Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = CO2 Enabled, 1 = CO2 Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40020	19	VOC Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = VOC Enabled, 1 =VOC Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40021	20	PM Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = PM Enabled, 1 =PM Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40022	21	CH2O Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = CH2O Enabled, 1 = CH2O Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40023	22	LED Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = LED Enabled, 1 = LED Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40024	23	Status Bars Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = Status Bars Enabled, 1 = Status Bars LED Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40025	24	Touch Screen Availability	Word	Read/Write	Enable (0) or Disable (1)	0 = Touch Screen Enabled, 1 = Touch Screen LED Disabled	0x0000 (Enable) or 0x0001 (Disable)	0
40026	25	VOC Units	Word	Read/Write	0 = VOCl, 1 = PPB, 2=ug/m3	0 = VOCl, 1 = PPB, 2=ug/m3	0x0000 (VOCl), 0x0001 (PPB) or 0x0002(ug/m3)	0
40027	26	CH2O Units	Word	Read/Write	0 = ug/m3, 1 = PPB	0 = ug/m3, 1 = PPB	0x0000 (ug/m3) or 0x0001 (PPB)	0
40028	27	CO2 Offset	Word	Read/Write	CO2 Offset	+/-200PPM, Resolution = 10PPM	0xFF38 to 0X00C8(-200 to 200)	0
40029	28	CO2 Altitude Adjustment	Word	Read/Write	CO2 Altitude	0 to 3000meters, Resolution 100m	0x0000 to 0x0BB8, corresponding to 0 to 3000 Meters in 100m steps	0
40030	29	CO2 ASC	Word	Read/Write	Enable (0) or Disable (1)	0 = Enable ASC (Auto Cal), 0 = Disable ASC	0x0000 (Enable) or 0x0001 (Disable)	0
40031	30	Relay Assignment	Word	Read/Write	Relay Assignment	1 = VOC, 2 = RH, 3 = Temperature, 4 = CO2, 5 = PM_MASS, 6 = PM_NUMBER, 7 = CH2O, 0 = No Relay	0x0000 to 0x0007	3
40032	31	Relay Setpoint	Word	Read/Write	VOC: 100-500 VOC Index, RH: 20 to 90%RH TEMP: 5-40 °C, 40-100 °F CO2: 500 to 1500PPM PM: 50 to 900ug/m3 CH2O: 50 to 900 ug/m3, or PPB	Setpoint to activate Relay, VOC Index, range 100-500, resolution 10 or 500-10000 PPB, resolution 50, or 250-6000, resolution 25 RH range 20 to 90%RH 1%RH Temperature 5 to 40 °C, Resolution = 1 °C 40 to 100 °F, Resolution = 1 °F, CO2 range 500 to 9000ppm, Resolution=100ppm PM_MASS 50 to 900ug/m3, resolution 10ug/m3 PM_NUMBER 50 to 2900#/cm3, resolution 25#/cm3	0x0064 to 0x01F4 (100 to 500 VOC Index), or 0x1F4 to 0x2710 (500 to 10000 PPB), or 250-6000 for 250-60000ug/m3 (multiplier = 1/10) 0x0014 to 0X005A (20 to 90 %RH) 0x0005 to 0x0028 (5 to 40 °C) ,or 0x0028 to 0x0064 (40 to 100 °F). 0x01F4 to 0x2328 (500 to 9000PPM) 0x0032 to 0x0384 (50 to 900ug/m3), 0x0032 to	26

						CH2O 50 to 900 ug/m3 or PPB, resolution 10 No Relay = 0	0x0B54 (50 to 2900#/cm3) 0x0032 to 0x0384 (50 to 900 ug/m3 or PPB)	
Modbus Address	Typical Offset	Units	Data Type	Access	Description	Notes (All 16 bit Integers)	Register Value	Default Value
40033	32	Relay Hysteresis	Word	Read/Write	VOC: 10-50 VOC Index RH: 5 to 20%RH TEMP: 1 to 5 °C or 2-10/°F CO2: 25 to 200PPM PM: 10 to 40ug/m3 CH2O: 10 to 40 ug/m3 or PPB	Hysteresis for relay activation, VOC Index, range 10-50 resolution 1, or 10-100 PPB resolution 10, or 500-2000ug/m3, resolution =50 1%RH, range 5 to 20%RH, 1 °C/F, range 1 to 5 °C, or 2-10°F CO2 25 to 500PPM, Resolution=25ppm PM_MASS 10 to 40ug/m3, resolution 5ug/m3 PM_NUMBER 10 to 120 #/cm3, resolution 10#/cm3 CH2O 10 to 40 ug/m3 or PPB, resolution 5 No Relay = 0	0x000A to 0x0032 (10 to 50 VOC Index), or 0x000A to 0x0064(10-100PPB), or 500-2000ug/m3 0x0005 to 0x0014 (5 to 20 %RH) 0x0001 to 0x0005 (1 to 5°C),or 0x0002 to 0x000A (2 to 10 °F). 0x0019 to 0x01F4 (25 to 500PPM) 0x000A to 0x0028 (10 to 40ug/m3), 0x000A to 0x0078 (10 to 120#/cm3) 0x000A to 0x0028 (10 to 40 ug/m3 or PPB)	2
40034	33	Relay On Time	Word	Read/Write	0 to 255 Seconds	Delay time before relay activated, resolution 1second, range 255 seconds	0x0000 to 0x00FF (0 to 255 Seconds)	15
40035	34	Relay Test	Word	Read/Write	Normal (0) or Test (1)	0 = Inactive, 1 = Test. Customers must reset to 0 for relay normal operation after test	0x0000 (Inactive) or 0x0001 (Test)	0
40036	35	LCD Backlight	Word	Read/Write	LCD Backlight	1 = On, 2 = Off		1

RTU Message Format

Modbus Framing	8 bit binary
Data Bits	start bits --- 1 data bits --- 8 parity bits --- none, odd or even stop bits --- 1or 2
Baud Rate	9600, 19200, 38400, 57600, 76800 or 115200
Duplex	Half duplex
Error Checking	Cyclical Redundancy Check (CRC) CRC-16 --- polynomial $x^{16}+x^{15}+x^2+x^0$ 0x8005 or reversed version 0xA001 or CRC-CITT --- polynomial $x^{16}+x^{12}+x^5+x^0$ 0x1021 or reversed version 0x8408
Latency	More than 3.5 characters --- minimum, 50, 100, 150, 200, 250, 300 or 350 mS

RTU Framing Support and Bit Sequences

Start	1	2	3	4	5	6	7	8	Stop	
Start	1	2	3	4	5	6	7	8	Stop	Stop
Start	1	2	3	4	5	6	7	8	Odd	Stop
Start	1	2	3	4	5	6	7	8	Even	Stop

RTU Function Codes

0x03 --- Read holding registers

Query

Slave address (0x01 to 0xFF)	Function code (0x03)	Starting address MSB	Starting address LSB	Quantity of registers MSB	Quantity of registers LSB	CRC LSB	CRC MSB	CRC MSB
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* Starting address = 0x0000 to 0x0023, Quantity of registers = 0x0001 to 0x0024

Response

Slave address (0x01 to 0xFF)	Function code (0x03)	Byte count 2N	Register value MSB	Register value LSB	...	CRC LSB	CRC MSB	CRC MSB
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* N= Quantity of registers

0x06 --- Write single register

Query

Slave address (0x01 to 0xFF)	Function code 0x06	Register address MSB	Register address LSB	Register value MSB	Register value LSB	CRC LSB	CRC MSB	CRC MSB
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Response

Slave address (0x01 to 0xFF)	Function code 0x06	Register address MSB	Register address LSB	Register value MSB	Register value LSB	CRC LSB	CRC MSB	CRC MSB
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* Register address = 0x000F to 0x0023, Registers value = 0x0000 to 0xFFFF

Exception response

Slave address (0x01 to 0xFF)	Function code + 0x80	Exception code 0x01, 0x02 or 0x03	CRC LSB	CRC MSB
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* An exception response is only returned if the CRC is correct

Exception code 01 --- illegal function, 02 --- illegal address, 03 --- illegal data value

Note that the registers may be read individually, or multiple registers may be read at the same time by changing the query as shown below.

To read several registers with one query...

0x03 --- Read ALL REGISTERS

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x00 (Note 1)	0x00	0x05 (Note2)	CRC LSB	CRC MSB	CRC MSB
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Response

Slave address (0x01 to 0xFF)	0x03	0x0A (Note 3)	Register value MSB	Register value LSB	...	CRC LSB	CRC MSB	CRC MSB
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Note 1: The starting address (A) may be 0x0000 to 0x0022. The read multiple feature will read all registers from the starting address forward. If the starting address is 0x0000 then registers 40001 to 40036 can be read. If the starting address is 0x0008 then registers 40009 to 40036 can be read.

Note 2: The quantity of registers (N) may be 0x0001 to 0x0024, but must be limited to 36 – A. If the starting address (A) is set to 0x0000 then N may be 0x0001 to 0x0024. If the starting address is set to 0x0008 then N may be 0x0001 to 0x0001C.

Note 3: The byte count (B) will always be 2N. If the quantity of registers (N) is 0x0001 then B will be 0x02. If N is 0x0005 then B will be 0x0A.