smartIAQ MODBUS Specification

Version 1.0.1 - 2025/05/15

1. Overview

This specification defines the MODBUS protocol for smartIAQ. The protocol allows for monitoring and control of the smartIAQ system, additional parameters, maintenance status, and system diagnostics.

2. Communication Parameters

2.1 Modbus Configuration

- **Protocol:** MODBUS RTU
- **Baud Rate:** 19200 bps (configurable)
- **Data Format:** 8-N-1 (8 data bits, No parity, 1 stop bit)
- **Device Address:** 1-247 (configurable, default: 1)
- **Response Timeout:** 1 Second

2.2 Modbus Parameter Changes

To change the device address or baud rate, use the Modbus registers.

1. Set desired values in unit ID and baud rate registers.

2. Write 1 to the apply configuration register to apply the changes.

3. Register Maps

3.1 Coil Registers (0xxxx) - Read/Write Digital Outputs

ADDRESS	DESCRIPTION	ACCESS	NOTES
00000	Inhibit Device	R/W	0=Off, 1=On
00001	System Reset	R/W	0=Normal, 1=Reset
00002	Filter Reset	R/W	0=Normal, 1=Reset
00003	Manual Mode	R/W	0=Auto, 1=Manual
00004	Apply Configuration	R/W	0=Normal, 1=Apply
00005	Ionizer Enable	R/W	0=Off, 1=On
00006	Eco Mode Enable	R/W	0=Off, 1=On

3.2 Discrete Input Registers (1xxxx) - Read-Only Status

ADDRESS	DESCRIPTION	ACCESS	NOTES
10000	System Active Status	R	0=Inactive, 1=Active
10001	Fault Present	R	0=No Fault, 1=Fault Present
10002	Air Quality Alert	R	0=Normal, 1=Air Quality Alert
10003	HCHO Alert	R	0=Normal, 1=HCHO Alert
10004	Refresh Response Active	R	0=Inactive, 1=Active
10005	Filter Warning	R	0=OK, 1=Replace Filter

ADDRESS	DESCRIPTION	ACCESS	NOTES
10006	Occupied (CO2)	R	0=Unoccupied, 1=Occupied

3.3 Input Registers (3xxxx) - Read-Only Values

ADDRESS	DESCRIPTION	UNITS	RANGE	NOTES
30000	CO2 Level	ppm	0-5000	Direct reading
30001	TVOC Level	µg/m³	0-3500	Direct reading
30002	NOx Level	Index	0-500	Direct reading
30003	HCHO Level	µg/m³	0-1000	Direct reading
30004	PM (WA)	µg/m³	0-1000	Direct reading
30005	PM1.0 Concentration	µg/m³	0-1000	Direct reading
30006	PM2.5 Concentration	µg/m³	0-1000	Direct reading
30007	PM4.0 Concentration	µg/m³	0-1000	Direct reading
30008	PM10 Concentration	µg/m³	0-1000	Direct reading
30009	Air Temperature	°F	0-200	Direct reading
30010	Relative Humidity	%RH	0-100	Direct reading
30011	CO2 Threshold	ppm	400-5000	Direct reading
30012	Fan Speed Percentage	%	0-100	Direct reading

ADDRESS	DESCRIPTION	UNITS	RANGE	NOTES
30013	Filter Life Remaining	%	0-100	Direct reading
30014	Runtime Seconds (Low Byte)	Seconds	0-65535	Direct reading
30015	Runtime Seconds (High Byte)	Seconds	0-65535	Direct reading
30016	Error Code (Low Byte)	-	0-255	Direct reading
30017	Error Code (High Byte)	-	0-255	Direct reading

3.4 Holding Registers (4xxxx) - Read/Write Parameters

ADDRESS	DESCRIPTION	UNITS	RANGE	NOTES
40000	Fan Speed	%	0-100	Setpoint for fan speed
40001	CO2 Threshold	ppm	400-5000	CO2 occupancy threshold
40002	Unit ID	1-247	1-247	Device address
40003	Baud Rate	0-4	0=9600, 1=19200, 2=38400, 3=57600, 4=115200	

Note: All multi-register values are transmitted in big-endian format. For floating-point values, use IEEE 754 single-precision format. All other values are unsigned 16-bit integers.

4. Error Bits (Input Registers 30015 - 30016)

BIT #	DESCRIPTION	POSSIBLE CAUSE
0	No Error	-
1	Fan Fault	Check fan obstruction/connection
2	Sensor Communication Error	Check sensor connections
3	Sensor Array 1 Error	Maintenance/replace sensor
4	CO2 Sensor Error	Maintenance/replace sensor
5	HCHO Sensor Error	Maintenance/replace sensor
6	Communication Error	Check connections/restart
7	EEPROM Error	Factory reset may be required
8	Unknown Error	Factory reset may be required

Note: The error bits are transmitted in big-endian format. Bit 0 is the least significant bit.

5. Implementation Notes

5.1 Reading Sensor Values

- All sensor values should be read from Input Registers

- Minimum polling interval: 5 seconds

5.2 Writing Controls

- **System Status:** Must be powered on (Input Register 10000) before accepting other commands
- **Configuration:** Changes take effect immediately
- **Write Limits:** Maximum 5 write operations per second
- **Fan Control:** 'Manual Mode' must be ON (1) to set fan speed percentage

5.3 Auto Mode Operation

- **Fan Control:** Speed is automatically adjusted based on air quality
- **Manual Settings:** Fan speed settings are ignored

Eco Mode Operation

- **Fan Operation:** Automatically reduces fan speed
- **Energy Management:** System optimizes for energy efficiency when CO2/Occupancy is 'low'

6. Recommended Polling Intervals

- **Status registers:** 5 second
- **Sensor readings:** 5 seconds
- **Configuration values:** 30 seconds
- **Error status:** 5 seconds