

# Vortex / Swirl Flowmeter

## Communication Protocol (ModBus)

### 1 Protocol Overview

Vortex / Swirl flowmeter communication protocol is the standard MODBUS-RTU mode.

- **Communication interface:** RS-485.
- **Support standard Modbus-RTU : Support functions codes** 03, 04, 06, 16.
- **Register length limit:** Supports max 8 registers.

#### 1.1 Serial Communication Parameters

Parameter	Ranges	Default Value
Address	1--247	1
Baud rate	9600, 4800, 2400, 1200, 600	9600
Data Length	8	8
Parity	None	None
Stop Bits	1	1

#### 1.2 Communication Data Format

H880BR/TBR supports data format types:

1) **Float: Floating point data**

The float data is 4-byte floating-point number in standard IEEE-754 format.

For example, in the case of 100.0 (hexadecimal representation: 0x42, 0xC8, 0x00, 0x00), the order of transmission is: 0x42, 0xC8, 0x00, 0x00.

2) **Unsigned short: 2-byte unsigned integer**

For example, in the case of 4660 (hexadecimal representation: 0x12, 0x34), the order of transmission is: 0x12, 0x34.

3) **Unsigned char: Single-byte unsigned number**

#### 1.3 Communication Interface Functions Format

##### 1.3.1 Function 03 (Read Holding Registers)

Example: Read the upper range value (assuming the current value is 100.0), the corresponding register starting address: 524 (0x020C in hexadecimal).

**Request frame:**

Address	Function Code	Register Address	Register Numbers	CRC Check
0x01	0x03	0x02,0x0C	0x00,0x02	0x05,0xB0

**The correct response frame:**

Address	Function Code	Data Length	Data	CRC Check
0x01	0x03	0x04	0x42,0xC8,0x00,0x00	0x6F,0xB5

### 1.3.2 Function 04(Read the Input Register)

Example: To read accumulation (assuming its current value is 100.0), the corresponding register starting address: 1034 (0x040A in hexadecimal).

**Request frame:**

Address	Function Code	Register Address	Register Numbers	CRC Check
0x01	0x04	0x04,0x0A	0x00,0x02	0x50,0xF9

**The correct response frame:**

Address	Function Code	Data Length	Data	CRC Check
0x01	0x04	0x04	0x42,0xC8,0x00,0x00	0x6E,0x02

### 1.3.3 Function 16(Write Holding Registers)

Example: Set the upper range value to 100.0, the corresponding register starting address is: 524 (0x020C in hexadecimal)

**Request frame:**

Address	Function Code	Register Address	Register Numbers	Data Length	Data	CRC Check
0x01	0x10	0x02,0x0C	0x00,0x02	0x04	0x42,0xC8,0x00,0x00	0x7F,0x1C

**The correct response frame:**

Address	Function Code	Register Address	Register Numbers	CRC Check
0x01	0x10	0x02,0x0C	0x00,0x02	0x80,0x73

## 2 Registers Description

### 2.1 Input Registers Table (Variables)

Register Address (Hexadecimal)	Parameter Name	Access Type	Data Length (word)	Data Type	Description
0x0402	Percentage	R	2	float	
0x0404	Instantaneous Flow	R	2	float	Register 0x021C holds the unit of instantaneous flow
0x0408	Sensor Value	R	2	float	Sensor output frequency value
0x040A	Total Flow	R	2	float	Register 0x021D holds the unit of total flow
0x040C	Overflows Number of Total	R	2	float	
0x0414	Signal Gain	R	2	float	
0x041C	Signal Channel	R	1	unsigned short	
0x0421	Current	R	2	float	
0x0423	Pressure	R	2	float	
0x0425	Temperature	R	2	float	

0x0427	Density	R	2	float	
0x0429	Pressure Sensor Value	R	2	float	
0x042B	Temperature Sensor Value	R	2	float	

## 2.2 Holding Register List(Configuration Data)

Register Address (Hexadecimal)	Parameter Name	Access Type	Data Length (word)	Data Type	Description
0x0200	Modbus Addr.	R/W	1	unsigned short	Value range:1 ~ 247
0x0201	Flow Mode	R/W	1	unsigned short	{ 0, "Liquid_QV Liquid Volume "}, { 1, "Liquid_QM Liquid Mass"}, { 2, "Gas_QV Gas Volume"}, { 3, "Gas_QM Gas Mass"}, { 4, "Steam_QV Steam Volume"}, { 5, "Steam_PT Steam Pressure and Temperature Compensation "}, { 6, "Steam_SAT_T Saturated Vapor (Temperature Compensation)"}, { 7, "Steam_SAT_P Saturated Vapor (Pressure Compensation)"}
0x0202	Meter Size and Fluid Type.	R/W	1	unsigned short	{ 0x0000, "Liquid N15" }, { 0x0001, "Liquid DN20" }, { 0x0002, "Liquid DN25" }, { 0x0003, "Liquid DN32" }, { 0x0004, "Liquid DN40" }, { 0x0005, "Liquid DN50" }, { 0x0006, "Liquid DN65" }, { 0x0007, "Liquid DN80" }, { 0x0008, "Liquid DN100"}, { 0x0009, "Liquid DN125"}, { 0x000A, "Liquid DN150"}, { 0x000B, "Liquid DN200"}, { 0x000C, "Liquid DN250"}, { 0x000D, "Liquid DN300"}, { 0x000E, "Liquid DN350"}, { 0x000F, "Liquid DN400"}, { 0x0010, "Liquid DN450"}, { 0x0011, "Liquid DN500"}, { 0x0012, "Liquid DN600"}, { 0x0100, "Gas DN15" },

					{ 0x0101, "Gas DN20" }, { 0x0102, "Gas DN25" }, { 0x0103, "Gas DN32" }, { 0x0104, "Gas DN40" }, { 0x0105, "Gas DN50" }, { 0x0106, "Gas DN65" }, { 0x0107, "Gas DN80" }, { 0x0108, "Gas DN100"}, { 0x0109, "Gas DN125"}, { 0x010A, "Gas DN150"}, { 0x010B, "Gas DN200"}, { 0x010C, "Gas DN250"}, { 0x010D, "Gas DN300"}, { 0x010E, "Gas DN350"}, { 0x010F, "Gas DN400"}, { 0x0110, "Gas DN450"}, { 0x0111, "Gas DN500"}, { 0x0112, "Gas DN600"},
0x0204	Maximum Signal Magnification	R/W	2	float	0~1500
0x0206	Minimum Frequency	R	2	float	
0x0208	Maximum Frequency	R	2	float	
0x020A	K-Factor	R/W	2	float	>0
0x020C	Upper Range Value	R/W	2	float	>0
0x020E	Damping	R/W	2	float	0 ~ 32.0
0x0210	High Alarm Limit	R/W	2	float	
0x0212	Low Alarm Limit	R/W	2	float	
0x0214	Gas Density(kg/ m <sup>3</sup> )	R/W	2	float	
0x0216	Gas Pressure (Gauge)	R/W	2	float	
0x0218	Gas Temperature (°C)	R/W	2	float	
0x021A	Liquid Density (g/c m <sup>3</sup> )	R/W	2	float	
0x021C	Flow Unit	R/W	1	unsigned short	{ 188 , "Nm3/h" }, { 189 , "Nm3/min" }, { 190 , "Nm3/s" }, { 29 , "m3/d" }, { 19 , "m3/h" }, { 131 , "m3/min"}, { 28 , "m3/s" }, { 138, "l/h" }, { 17, "l/min" },

					{ 24, "l/s" }, { 185, "Scf/h" }, { 123, "Scf/m" }, { 186, "Scf/s" }, { 130, "cf/h" }, { 15, "cf/m" }, { 26, "cf/s" }, { 136, "USG/h" }, { 16, "USG/m" }, { 22, "USG/s" }, { 30, "UKG/h" }, { 18, "UKG/m" }, { 137, "UKG/s" }, { 135, "bbl/d" }, { 134, "bbl/h" }, { 253, "special_Qv" } { 79, "t/d" }, { 78, "t/h" }, { 77, "t/min" }, { 76, "kg/d" }, { 75, "kg/h" }, { 74, "kg/min" }, { 73, "kg/s" }, { 72, "g/h" }, { 71, "g/min" }, { 70, "g/s" }, { 83, "lb/d" }, { 82, "lb/h" }, { 254, "special_Qm" }
0x021D	Total Flow Unit	R	1	unsigned short	{ 43, "m3" }, { 41, "l" }, { 172, "Nm3" }, { 168, "Scf" }, { 112, "cf" }, { 40, "USGal" }, { 42, "UKgal" }, { 46, "bbl" }, { 61, "kg" }, { 60, "g" }, { 62, "ton" }, { 63, "lb" }, { 253, "special" }, { 254, "special" },

0x0250	Display Mode	R/W	1	unsigned short	{ 0, "Three-line Display" }, { 1, "Two-line Display" },
0x021E	The Third Line Shows Setting	R/W	1	unsigned short	{ 0, "Current" }, { 1, "Percentage" }, { 4, "Frequency" }, { 6, "Density" }, { 7, "Pressure" }, { 8, "Temperature" }, { 9, "Pressure and Temperature" },
0x021F	Flow Display Point	R/W	1	unsigned short	{ 0, "0" }, { 1, "1" }, { 2, "2" }, { 3, "3" },
0x0220	Write Protection	R/W	1	unsigned short	{ 0, " Write Enable " }, { 1, "Write Disable" }
0x0221	K-Factor User Trim Points	R/W	1	unsigned short	{ 0x00, "0" }:No User Trim { 0x02, "2" }, { 0x03, "3" }, { 0x04, "4" }, { 0x05, "5" }
0x0222	K-Factor User Trim: Frequency Value 1	R/W	2	float	
0x0224	K-Factor User Trim: Frequency Value 2	R/W	2	float	
0x0226	K-Factor User Trim: Frequency Value 3	R/W	2	float	
0x0228	K-Factor User Trim: Frequency Value 4	R/W	2	float	
0x022A	K-Factor User Trim: Frequency Value 5	R/W	2	float	
0x022C	K-Factor User Trim: Correction factor 1	R/W	2	float	
0x022E	K-Factor User Trim: Correction factor 2	R/W	2	float	
0x0230	K-Factor User Trim: Correction factor 3	R/W	2	float	
0x0232	K-Factor User Trim: Correction factor 4	R/W	2	float	
0x0234	K-Factor User Trim: Correction factor 5	R/W	2	float	
0x0236	PV Cutoff (%)	R/W	2	float	0 ~ 20.0
0x023B	Function Operation	R/W	1	unsigned	{ 0x0100, "Total Flow Reset" },

	Code			short	
0x0247	Output Pulse Unit	R/W	1	unsigned short	{ 43, "m3" }, { 172, "Nm3" } { 61, "kg" }, { 62, "ton" }, { 168, "Scf" }, { 112, "cf" }, { 40, "USGal" }, { 42, "UKgal" }, { 46, "bbl" }, { 63, "lb" },
0x023F	The number of output pulses per pulse unit.	R/W	2	float	>0
0x0244	Work Mode	R/W	1	unsigned short	{ 0x0000, "F1: Anti-vibration Mode " }, { 0x0001, "F2: Normal Mode " }, { 0x0002, "F3: Turbine Mode " }, { 0x0003, "F4: Test Mode " },
0x0245	Temperature and Pressure Acquisition Mode Setting.	R/W	1	unsigned short	{ 0x0000, " Pressure Manual Input, Temperature Manual Input " }, { 0x0001, " Pressure Manual Input, Temperature Auto Acquisition " }, { 0x0010, " Pressure Auto Acquisition, Temperature Manual Input " }, { 0x0011, " Pressure Auto Acquisition, Temperature Auto Acquisition " },
0x0246	Baud Rate	R/W	1	unsigned short	{ 0, "9600bps,8bits,1stop, No parity " }, { 1, "4800bps,8bits,1stop, No parity " }, { 2, "2400bps,8bits,1stop, No parity " }, { 3, "1200bps,8bits,1stop, No parity " }, { 4, "600bps,8bits,1stop, No parity " }
0x024A	Low Flow Limit	R/W	2	float	According to the meter size and measuring media, set the corresponding low limit of the flow. The unit of 'Low Flow Limit' is fixed as <b>m<sup>3</sup>/h</b> . The actual measurement of the lower limit of about 50% of 'Low Flow Limit'.
0x024C	High Flow Limit	R/W	2	float	The 'High Flow Limit' defaults to 10 times the 'Low Flow Limit', the actual measurement of the upper limit of 2.5

					times the set value. The unit of 'High Flow Limit' is fixed as <b>m<sup>3</sup>/h</b> . When the actual required range ratio exceeds 20: 1, you can manually modify the 'High Flow Limit'.
0x024E	Frequency Factor	R/W	2	float	0~20 The reference frequency value of the five-point correction is multiplied by the Frequency Factor, and then the new reference frequency value of the correction point is obtained. Normally, this value should be 1.
0x2400	Pressure Sensor Low Trim: Internal ADC Measurements	R/W	2	float	Unit: mV
0x2402	Pressure Sensor High Trim: Internal ADC Measurements	R/W	2	float	Unit: : mV
0x2404	Temperature Sensor Low Trim: Internal ADC Measurements	R/W	2	float	Unit: : Ohm
0x2406	Temperature Sensor High Trim: Internal ADC Measurements	R/W	2	float	Unit: : Ohm
0x2408	Pressure Sensor Low Trim: Input Calibration Value	R/W	2	float	Unit: : Kpa
0x240A	Pressure Sensor High Trim: Input Calibration Value	R/W	2	float	Unit: : Kpa
0x240C	Temperature Sensor Low Trim: Input Calibration Resistance Value	R/W	2	float	Unit: : Ohm
0x240E	Temperature Sensor High Trim: Input Calibration Resistance Value	R/W	2	float	Unit: : Ohm
0x2410	Pressure Cutoff	R/W	2	float	Unit: : Kpa
0x2412	Pressure Bias Value	R/W	2	float	Unit: : Kpa