

WS90 Modbus RTU v1.0.6

History

Versions	Date	Revise
V1.0.0	2022/11/21	Initial version
V1.0.1	2022/12/27	Add an atmospheric pressure register
V1.0.2	2023/03/22	Add measurement command (Light, UVI, Temperature, Humidity, Wind, Gust, Wind direction, Rain, Barometric pressure). Modify the invalid temperature value
V1.0.3	2023/07/17	Add register(RainCounter)
V1.0.4	2023/09/07	Modify example1,2 Add factory default description
V1.0.5	2023/11/21	Cancel Register 9C99H
V1.0.6	2025/03/24	Add Historical Records

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1.Modbus

1.1 Parameters

Code	8 bits binary
Data bits	8
Parity	None
Stop	1
Checksum	CRC (polynomial 0x8005)
Baud rate	User Define (default 9600 bps)

1.2 Data Frame Definition

Host Inquiry:

Address	Function	Start register address	Register size	CRC LSB	CRC MSB
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave Reply:

Address	Function	Payload	Data Set 1	Data Set 2	Data Set N	CRC LSB	CRC MSB
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	1 byte	1 byte

1.3 Register

Register Address	Function	W/R	Description
0160 H	Device name	RO	Device code (90 H)
0161 H	Data Rate	RW	1:4800 2:9600

Register Address	Function	W/R	Description
			3:19200 4:115200
0162 H	Device Address	RW	1~252
0163 H	Device ID MSB	RO	
0164 H	Device ID LSB	RO	
0165 H	Light	RO	Value in hex Light=value*10 (Range: 0lux -> 300,000lux) If invalid fill with 0xFFFF
0166 H	UVI	RO	Value in hex UVI = value/10 (Range: 0 -> 150) If invalid fill with 0xFFFF
0167 H	Temperature	RO	Value in hex 10.5 C = 1F9h -10.5 C = 127h with 400 offset added (Range: -40.0C -> 60.0C) If invalid fill with 0xFFFF
0168 H	Humidity	RO	data in hex (Range: 1% - 99%) If invalid fill with 0xFFFF
0169 H	Wind Speed	RO	Value in hex If invalid fill with 0xFFFF. Wind Speed = WIND value*0.1m/s(0~40m/s)
016A H	Gust Speed	RO	Value in hex If invalid fill with 0xFFFF. Gust Speed = GUST value*0.1m/s(0~40m/s)
016B H	Wind Direction	RO	Value in hex (Range: 0°- 359°) If invalid fill with 0xFFFF
016C H	Rainfall	RO	Value in hex Rain = value*0.1mm 1.8mm=12H
016D H	ABS Pressure	RO	Value in hex ABS = value*0.1hPa 1002.6hPa=272AH If invalid fill with 0xFFFF
016E H	RainCounter	RO	data in hex Rain = value*0.01mm 0.18mm=12H
9C92 H	Measuring light	RO	Value in hex Light=value*10 (Range: 0lux -> 300,000lux) If invalid fill with 0xFFFF (Measurement rate 113ms)
9C93 H	Measuring UVI	RO	Value in hex Uvi=UVI value/10 (Range: 0 -> 150) If invalid fill with 0xFFFF (Measurement rate 113ms)
9C94 H	Measuring temperature	RO	Value in hex 10.5 C = 1F9h -10.5 C = 127h with 400 offset added (Range: -40.0C -> 60.0C) If invalid fill with 0xFFFF (Measurement rate 31ms)
9C95 H	Measuring	RO	data in hex

Register Address	Function	W/R	Description
	humidity		(Range: 1% - 99%) If invalid fill with 0xFFFF (Measurement rate 31ms)
9C96 H	Measuring wind speed	RO	Value in hex If invalid fill with 0xFFFF. Wind Speed = WIND value*0.1m/s(0~40m/s) (Measurement rate 31ms)
9C97 H	Measuring gust speed	RO	Value in hex If invalid fill with 0xFFFF. Gust Speed = GUST value*0.1m/s(0~40m/s) (Measurement rate 31ms)
9C98 H	Measuring wind direction	RO	Value in hex (Range: 0°- 359°) If invalid fill with 0xFFFF (Measurement rate 31ms)
9C99 H	Reserve	Reserve	Reserve
9C9A H	Measuring ABS pressure	RO	Value in hex ABS = value*0.1hPa 1002.6hPa=272AH If invalid fill with 0xFFFF (Measurement rate 136ms)

Remark:

1) register 016CH and 016EH are rain counter register. 016CH is with 0.1mm resolution, and 016E is with 0.01mm resolution. 016CH should be used for most cases.

2) 0165H~0168H、016CH~016EH register data updated every 8.75s, Register 0169H~016BH data updated every 2s.

3) 9C92H~9C9AH are commands for start a measurement. Time for solar reading needs 113ms; temperature and wind measurement needs 31ms before data can be read. ;
Barometer reading needs 136ms.

Historical Data Register:

Records one data point per minute and stores historical data for the last 30 minutes.

Register Address	Function	W/R	Description
9B14H,9B15H...9B31H	Maximum Light Intensity per Minute: A total of 30 values are stored. Address 9B14H represents the maximum light intensity of the most recent minute, and so on. Address 9B31H represents the maximum light intensity from 30 minutes ago.	RO	Value in hex. Light=value*10 (Range: 0lux -> 300,000lux) If invalid fill with 0xFFFF
9B32H,9B33H...9B4FH	Maximum UVI per Minute: A total of 30 values are stored. Address 9B32H represents the maximum UVI of the most recent minute, and so on. Address 9B4FH represents the maximum UVI from 30 minutes ago.	RO	Value in hex. UVI = value/10 (Range: 0 -> 150) If invalid fill with 0xFFFF
9B50H,9B51H...9B6DH	Average Temperature per	RO	Value in hex.

Register Address	Function	W/R	Description
	Minute: A total of 30 values are stored. Address 9B50H represents the average temperature of the most recent minute, and so on. Address 9B6DH represents the average temperature from 30 minutes ago.		10.5 C = 1F9h -10.5 C = 127h with 400 offset added (Range: -40.0C -> 60.0C) If invalid fill with 0xFFFF
9B6EH,9B6FH...9B8BH	Average Humidity per Minute: A total of 30 values are stored. Address 9B6EH represents the average humidity of the most recent minute, and so on. Address 9B8BH represents the average humidity from 30 minutes ago.	RO	data in hex. (Range: 1% - 99%) If invalid fill with 0xFFFF
9B8CH,9B8DH...9BA9H	Average Wind Speed per Minute: A total of 30 values are stored. Address 9B8CH represents the average wind speed of the most recent minute, and so on. Address 9BA9H represents the average wind speed from 30 minutes ago.	RO	Value in hex. If invalid fill with 0xFFFF. Wind Speed = value*0.1m/s (Range: 0 - 40m/s)
9BAAH,9BABH...9BC7H	Maximum Gust Speed per Minute: A total of 30 values are stored. Address 9BAAH represents the maximum gust speed of the most recent minute, and so on. Address 9BC7H represents the maximum gust speed from 30 minutes ago.	RO	Value in hex. If invalid fill with 0xFFFF. Gust Speed = value*0.1m/s (Range: 0 - 40m/s)
9BC8H,9BC9H...9BE5H	Average Wind Direction per Minute: A total of 30 values are stored. Address 9BC8H represents the average wind direction of the most recent minute, and so on. Address 9BE5H represents the average wind direction from 30 minutes ago.	RO	Value in hex. (Range: 0°- 359°) If invalid fill with 0xFFFF
9BE6H,9BE7H...9C03H	Rainfall per Minute: A total of 30 values are stored. Address 9BE6H represents the rainfall of the most recent minute, and so on. Address 9C03H represents the rainfall from 30 minutes ago.	RO	Value in hex. Rain = value*0.1mm 1.8mm=12H
9C04H,9C05H...9C21H	Average ABS Pressure per Minute: A total of 30 values are stored. Address 9C04H represents the average ABS pressure of the most recent minute, and so on. Address 9C21H represents the average ABS pressure from 30 minutes ago.	RO	Value in hex. ABS = value*0.1hPa 1002.6hPa=272AH If invalid fill with 0xFFFF
9C22H,9C23H...9C3FH	Average Battery Voltage per Minute: A total of 30 values are stored. Address 9C22H represents the average battery voltage of the most recent minute, and so on. Address 9C3FH represents the average	RO	Value in hex. BatteryVoltage = value*0.01V 320=3.20V If invalid fill with 0xFFFF

Register Address	Function	W/R	Description
	battery voltage from 30 minutes ago.		
9C40H,9C41H...9C5DH	Average Capacitance Voltage per Minute: A total of 30 values are stored. Address 9C40H represents the average capacitance voltage of the most recent minute, and so on. Address 9C5DH represents the average capacitance voltage from 30 minutes ago.	RO	Value in hex. CapacitanceVoltage = value*0.1V 50 = 5.0V If invalid fill with 0xFFFF

1.4 Example

1.4.1 Normal

Example 1: Read Light.

Inquiry:

Address	Function	Register address	Payload size	CRC LSB	CRC MSB
0x90	0x03	0x01 0x65	0x00 0x01	0x89	0x68

Reply:

Address	Function	Payload size	Light data	CRC LSB	CRC MSB
0x90	0x03	0x02	0x07 0xB0	0x46	0x1D

Light is 19680 Lux.

Example2: Read light, UVI, temperature, humidity, wind speed, gust speed, wind direction and rainfall.

Inquiry:

Address	Function	Register address	Payload size	CRC LSB	CRC MSB
0x90	0x03	0x01 0x65	0x00 0x09	0x88	0xAE

Reply:

Address	Function	Payload size	payload	CRC LSB	CRC MSB
0x90	0x03	0x10	0x06E7 0x000D 0x0296 0x003C 0x0000 0x0000 0x0096	0x19	0xDA

Address	Function	Payload size	payload	CRC LSB	CRC MSB
			0x0000 0x271A		

Data:

Light= 17670 Lux

UVI= 1.3

Temperature= 26.2°C

Humidity= 60%

Wind speed= 0 m/s

Gust speed= 0 m/s

Wind direction= 150°

Rinfall= 0 mm

ABS Pressure=1001.0 hPa

Example 3: Change to 4800 Baud Rate.

Inquiry:

Address	Function	Register address	Data	CRC LSB	CRC MSB
0x90	0x06	0x01 0x61	0x00 0x01	0x04	0xA9

Reply:

Address	Function	Payload size	Payload	CRC LSB	CRC MSB
0x90	0x06	0x02	0x00 0x01	0x84	0x95

Example 4: Change device to 0x34.

Inquiry:

Address	Function	Register address	Data	CRC LSB	CRC MSB
0x90	0x06	0x01 0x62	0x00 0x34	0x34	0xBE

Reply:

Address	Function	Payload size	Payload	CRC LSB	CRC MSB
0x90	0x06	0x02	0x00 0x34	0x44	0x82

1.4.2 Special

In case setting has been messed up. This is the command to check for status.

Host Inquiry:

Prefix	Read/wr bps	Device address	CRC LSB	CRC MSB
3 bytes fixed: 0xFDFDFD	1 byte 0:read bps 1:set to bps 4800 2:set to bps 9600 3:set to bps 19200	1 byte 0: read device address 1~252: set device address to	1 byte	1 byte

Prefix	Read/wr bps	Device address	CRC LSB	CRC MSB
	4:set to bps 115200			

Slave Reply:

Prefix	bps	Device address	CRC LSB	CRC MSB
3 bytes fixed: 0xFDFDFD	1 byte 1: bps 4800 2: bps 9600 3: bps 19200 4: bps 115200	1 byte	1 byte	1 byte

Example 5: read baud rate and device address.

Inquiry:

Prefix	Code:Read bps	Code:Read Device address	CRC LSB	CRC MSB
0xFDFDFD	0x00	0x00	0xE9	0x88

Reply:

Prefix	BPS	Device address	CRC LSB	CRC MSB
0xFDFDFD	0x01	0x90	0xE8	0x74

BPS: 4800, Device address: 0x90.

Example 6: Set BPS to 9600.

Inquiry:

Prefix	Code:Set bps	Code:Read Device address	CRC LSB	CRC MSB
0xFDFDFD	0x02	0x00	0xE8	0xE8

Reply:

Prefix	BPS	Device address	CRC LSB	CRC MSB
0xFDFDFD	0x02	0x90	0xE8	0x84

Set to 9600 BPS, and read device address as 0x90.

Example 7: Set device address to 0x01.

Inquiry:

Prefix	Code:Read bps	Code:Set Device address	CRC LSB	CRC MSB
0xFDFDFD	0x00	0x01	0x28	0x48

Reply:

Prefix	BPS	Device address	CRC LSB	CRC MSB
0xFDFDFD	0x02	0x01	0x29	0x28

Set device address to 0x01, read data rate as 9600.

1.5 Error code

Error code	Content	Description
01	Illegal function	Code is not 0x03 or 0x06
02	Illegal address	Not in the range
03	Illegal data	Data length is over the limit
08	CRC fail	CRC not pass

Reply to error code should add function code 0x80. example.

Example 8: Reply

Address	Code	Error code	CRC LSB	CRC MSB
0x90	0x83	0x08	0x11	0x1B

2.Wiring

Color	Description	Remark
Red	VCC	5~12V DC
Black	GND	GND
Green	485_A	485_A
White	485_B	485_B

3. Default

3.1 The slave address is set to 0x90 by default at the factory.

Appendix:

1. CRC tool

The Gexi CRC calculation tool is used for CRC calculations.

格西CRC计算器 1.0

算法: CRC16

多项式(HEX): 8005

初始值(HEX): FFFF

数据反转: LSB First

异或值(HEX): 0000

数据: HEX

90 03 01 65 00 08

结果: 6E49

检测到最新版本软件

计算

2. Ecowitt ModbusRTU PC software

Ecowitt Modbus RTU

Com: COM2

Close Open COM2

Clean

90 03 1c 00 90 00 02 00 90 00 00 2b 9b 00 27 00 00 02 5f 00 29 00 05 00 06 01 23 00 00 27 2a 56
 90 03 1c 00 90 00 02 00 90 00 00 2b 9b 00 27 00 00 02 5f 00 29 00 05 00 06 01 23 00 00 27 2a 56 5a
 90 03 1c 00 90 00 02 00 90 00 00 2b 9b 00 27 00 00 02 5f 00 28 00 05 00 05 00 fe 00 00 27 2a 8c
 90 03 1c 00 90 00 02 00 90 00 00 2b 9b 00 27 00 00 02 5f 00 28 00 05 00 05 00 fe 00 00 27 2a 8c
 90 03 1c 00 90 00 02 00 90 00 00 2b 9b 00 27 00 00 02 5f 00 28 00 05 00 05 00 fe 00 00 27 2a 8c 64

Model: 90

Ligth: 390 lux

UVI: 0.0

Temp: 20.7 C

Humi: 40 %

Wind speed: 0.5 m/s

Gust speed: 0.5 m/s

Wind direction: 254 °

Rinfall: 0.0 mm

Pressure : 1002.6 hpa

Baud 9600

Change

address(HEX) 90

Change

Read data