

# THWP sensor

Temperature  
Humidity  
Wind Speed, Wind Direction  
Atmospheric Pressure



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## 1. Design

<b>Mark</b>	<b>MPL3115A2 Sensor</b>	<b>HWS version</b>	<b>Comment</b>
<b>THWPX</b>	<b>YES</b>	<b>THWPx*</b>	
<b>THWPy</b>	<b>NO</b>	<b>THWPy*</b>	<b>Reserved</b>

## 2. Hardware

2.1 Hardware parameters			
	Value	Range	Comments
<b>Measurement</b>	Temperature	-30°C ÷ 60°C	In tenth of °C
	Relative Humidity	0 ÷ 99.9%	In tenth of %
	Wind Speed	0 ÷ 70.0 m/s	Resolution 0.1 m/s
	Wind Direction	0 ÷ 359 °	Resolution 1°
	Atmospheric pressure	200.0 ÷ 1100.0 hPa	Resolution 0.1 hPa
<b>Power</b>	8 - 26V DC/ max 0,4W, 24V – 15 mA		
<b>Interface</b>	RS485 - MODBUS RTU or other		
<b>Hardware</b>	SHT21 TH sensor, MPL3115 pressure sensor, ING01 micro ultrasonic sensor		
<b>Comm. speed</b>	9600 or 115200 Bd		
<b>Dimensions</b>	Φ105 x 162 mm radiation cover		
<b>Design</b>	Exterior		
<b>Setup</b>	Via software Bootloader or via ModBus directly		

2.2 Sending parameters to RS485 after RESET		
	Parameter	Comments
<b>1.row</b>	112:RESET=4<cr><lf>	112 – address (dec), 4 – com. Protocol
<b>2.row</b>	112:USOUND=1<cr><lf>	112 – address (dec), 1 – OK, 0 – NOOK
<b>3.row</b>	112:MPL=1<cr><lf>	112 – address (dec), MPL3115A2 – OK, 0 - NOOK
<b>4.row</b>	112:SHT=1<cr><lf>	112 – address (dec), SHT35 – OK, 0 – NOOK

## 3. Wiring, standard cable length: 3 m

Wire color	Comment
<b>Green</b>	<b>Ground</b>
<b>White</b>	<b>12-24V DC</b>
<b>Yellow</b>	<b>RS485 +</b>
<b>Brown</b>	<b>RS485 -</b>

## 4. ModBus RTU communication protocol

4.1 Command 0x03 Read Registers	
Register	Parameter
<b>0</b>	Temperature in tenth of degrees from SHT35
<b>1</b>	Relative humidity in tenth of % from SHT35
<b>2</b>	Dew point in tenth of degrees from SHT35
<b>3</b>	♦ Calculated atmospheric pressure in 10 Pa from MPL3115 above sea level
<b>4</b>	Wind speed in tenth of m/s
<b>5</b>	Minimum Wind speed in tenth of m/s during the last 1 minute

<b>6</b>	Maximum Wind speed in tenth of m/s during the last 1 minute
<b>7</b>	Wind Direction in degrees

♦ if register 108 is set to 0 then value in register 3 is equal with absolute atm. pressure in 10 Pa

<b>4.2 Command 0x03 Read Configuration Registers</b>			
<b>Register</b>	<b>Register name</b>	<b>Description</b>	<b>Units/Notes</b>
<b>100</b>	Address	1 – 247	
<b>101</b>	Communication speed	0 – 115200, 1 - 9600	Bd
<b>102</b>	HWS version 0	Read Only	TH
<b>103</b>	HWS version 1	Read Only	WP
<b>104</b>	HWS version 2	Read Only	x*
<b>105</b>	HWS version 3	Read Only	:1
<b>106</b>	HWS version 4	Read Only	.0
<b>107</b>	Communication protocol		1 ÷ 5
<b>108</b>	Altitude above sea level in meter		0 – 4000

<b>4.3 Command 0x06 Write Registers</b>			
<b>Register</b>	<b>Register name</b>	<b>Description</b>	<b>Units/Notes</b>
<b>100</b>	Address	1 – 247	
<b>101</b>	Communication speed	0 – 115200, 1 - 9600	Bd
<b>102-106</b>	Read Only		
<b>107</b>	Comm. Protocol	1 - INGSIMON 2 - HTML 3 - MODBUS ASCII 4 – MODBUS RTU 5 – MODBUS TCP	Default: MODBUS RTU (4)
<b>108</b>	Altitude above sea level in meter	0 to 4000	Default 0. Can be set from 0 to 4000

<b>4.4 Default parameters</b>		
<b>Parameter</b>	<b>Value</b>	<b>Comment</b>
<b>Address</b>	0x70h (112d)	
<b>Communication speed</b>	115200, N, 8,1	
<b>Communication Protocol</b>	0x04	MODBUS RTU
<b>Altitude above sea level in meter</b>	0	

<b>4.5 Range of addresses</b>	
<b>Address [dec]</b>	<b>Comment</b>
<b>1 - 247</b>	For sensors
<b>248 - 254</b>	Reserve
<b>255</b>	Universal address – used only to read registers Writing to registers does not work with this address

## 5. Examples for Modbus RTU

<b>Example 5.1</b>		
<b>Set the communication speed from 115200 Bd to 9600 Bd for Address 0x70 (112 dec)</b>		
<b>Poll</b>	70 06 00 65 00 01 52 F4	Response with 115200 Bd. In next communication will use 9600 Bd
<b>Response</b>	70 06 00 65 00 01 52 F4	

**Example 5.2**

<b>Set the communication speed from 9600 Bd to 115200 Bd for Address 0x70 (112 dec)</b>		
<b>Poll</b>	70 06 00 65 00 00 93 34	Response with 9600 Bd. In next communication will use 115200 Bd
<b>Response</b>	70 06 00 65 00 00 93 34	

**Example 5.3**

<b>Read 9 registers from 100 from Address 0x70 (112 dec)</b>		
<b>Poll</b>	70 03 00 64 00 09 CE F2	
<b>Response</b>	70 03 12 00 70 00 00 54 48 57 50 78 2A 3A 31 2E 30 00 04 00 00 FC 2A	
<b>Meaning:</b>		
<b>Byte [hex]</b>	<b>Description</b>	<b>Comment</b>
<b>70</b>	Address	
<b>03</b>	function code	Read holding register
<b>12</b>	count of bytes (18dec)	
<b>00 70</b>	Address	
<b>00 00</b>	communication speed	115200 Bd
<b>54 48</b>	TH	Temperature, Humidity
<b>57 50</b>	WP	Wind, Pressure
<b>78 2A</b>	x*	version, * - reserve
<b>3A 31</b>	:1	
<b>2E 30</b>	.0	
<b>00 04</b>	communication protocol	4 - MODBUS RTU
<b>00 00</b>	Altitude above sea level	
<b>FC 2A</b>	Checksum	

**Example 5.4**

<b>Getting the current address of the sensor with universal address 0xff</b> <b>Be care, that only 1 equipment ss connected on the Modbus network.</b>		
<b>Poll</b>	FF 03 00 64 00 01 D0 0B	<b>Read register 100</b>
<b>Response</b>	FF 03 02 00 <b>70</b> 90 74	<b>70 – equipment’s address</b>

**Example 5.5**

<b>Changing the address from 70h to 1h.</b> <b>Will care, that on the MODBUS is connect only 1 equipment.</b>		
<b>Poll</b>	70 06 00 64 00 <b>01</b> 03 34	<b>Write to register 100 value 1</b>
<b>Response</b>	70 06 00 64 00 <b>01</b> 03 34	<b>01 – equipment’s new address</b>
<b>The next communication with equipment will be with address 1</b>		

**Example 5.6**

<b>Changing the address from 1h to 2h.</b> <b>Will care, that on the MODBUS is connect only 1 equipment.</b>		
<b>Poll</b>	01 06 00 64 00 <b>02</b> 49 D4	<b>Write to the register 100 value 2</b>
<b>Response</b>	01 06 00 64 00 <b>02</b> 49 D4	<b>02 – equipment’s new address</b>
<b>The next communication with equipment will be with address 2</b>		

**Example 5.7**

<b>How to set the Altitude to the value 128 m. Address 70h. Register 108</b>		
<b>Poll</b>	70 06 00 6C 00 <b>80</b> 42 96	<b>Write to the register 108 value 128</b>

<b>Response</b>	<b>70 06 00 6C 00 80 42 96</b>	<b>80h (128d) altitude in m</b>
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**Example 5.8**

<b>How to set the Altitude to the value 128 m using universal CRC (XX). Address 70h. R.108</b>		
<b>Poll</b>	<b>70 06 00 6C 00 80 58 58</b>	<b>Write to the register 108 value 128</b>
<b>Response</b>	<b>70 06 00 6C 00 80 58 58</b>	<b>80h (128d) altitude in m</b>

**Example 5.9**

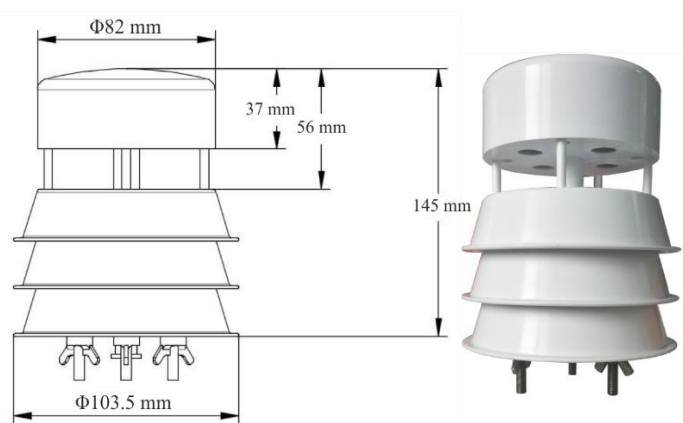
<b>Reading measured values from 0. register, 8 registers. Address 70h.</b>		
<b>Poll</b>	<b>70 03 00 00 00 08 4E ED</b>	<b>Read 8 R.</b>
<b>Response</b>	<b>70 03 10 00 CE 01 A7 00 43 27 1B 00 18 00 05 00 22 00 81 26 B3</b>	

**Meaning:**  
 70 – address  
 03 – function  
 10 – count of bytes (16 dec)  
 00 CE →  $0*256 + 12*16 + 14 = 206 \rightarrow 20.6 \text{ }^\circ\text{C}$   
 01 A7 →  $1*256 + 10*16 + 7 = 423 \rightarrow 42.3 \text{ \%Rh}$   
 00 43 →  $0*256 + 4*16 + 3 = 67 \rightarrow 6.7 \text{ }^\circ\text{C}$  dew point  
 27 1B →  $2*4096 + 7*256 + 1*16 + 11 = 10011 \rightarrow 100110 \text{ Pa} \rightarrow 1001.1 \text{ hPa}$   
 00 18 →  $0 * 256 + 1 * 16 + 8 = 24 \rightarrow 2.4 \text{ m/s}$   
 00 05 →  $0 * 256 + 0 * 16 + 5 = 5 \rightarrow 0.5 \text{ m/s}$   
 00 22 →  $0 * 256 + 2 * 16 + 2 = 37 \rightarrow 3.7 \text{ m/s}$   
 00 81 →  $0 * 256 + 8 * 16 + 1 = 129 \rightarrow 129 \text{ }^\circ$   
 26 B3 CRC

**6. Used sensors**

**6.1 Ultrasound anemometer ING01**

- Ultrasound sensor
- Best performance-to-price ratio
- Dimensions:  $\Phi 103.5 \text{ mm} \times 165 \text{ mm}$
- Measurement range: 0–70 m/s 0-359°
- Accuracy Low wind speed:  $\pm 0.5 \text{ m/s}$
- Accuracy High wind speed:  $\pm 1 \text{ m/s}$
- Accuracy Low wind speed:  $\pm 5^\circ$
- Accuracy High wind speed:  $\pm 3^\circ$
- Resolution 0.1m/s 0.1°



**6.2 Humidity and Temperature Sensor IC**

- Accuracy tolerance  $\pm 2 \text{ \%RH}$
- Repeatability  $\pm 0.1 \text{ \%RH}$
- Hysteresis  $\pm 1 \text{ \%RH}$
- Operating Range extended 0 to 100 %RH



**6.3 MPL3115A2 precision pressure sensor**

- Pressure absolute accuracy  $\pm 0.4 \text{ kPa}$ , 50 ÷ 110 kPa over  $-10 \text{ }^\circ\text{C}$  to  $70 \text{ }^\circ\text{C}$
- Temperature accuracy @25 °C  $\pm 1 \text{ }^\circ\text{C}$ , over temperature range  $\pm 3 \text{ }^\circ\text{C}$



## 7. Mechanical dimensions - holders

### Via customer

For example

