LTS6 Low-power tilt sensor

Product manual

V3.0-20260602

Technical Highlights

❖Six installation methods;

❖ Zero point can be set on-site;

❖ Output methods: RS 232 / RS 485 / TTL ;

❖ High vibration resistance >3500g.

Product Introduction

The LTS 6 digital output series tilt sensor is a high-performance, cost-effective all-attitude angle measurement device developed based on independent core technologies . This product utilizes an innovative anti-interference structural platform. Integrating next-generation MEMS sensing elements It features wide operating temperature range, excellent resistance to mechanical vibration, and long-term operational stability. It is designed to have a service life of up to 10 years.

This product is based on the principle of non-contact measurement. It detects the Earth's gravity vector component through a built-in high-precision capacitive MEMS sensor unit, and calculates and outputs the tilt angle in real time using a dedicated algorithm. Its installation is flexible and convenient; it can be directly fixed to the surface of the object being measured without the need for additional mechanical shafts or fixing systems. Supports multiple installation options It can fully meet the measurement needs of different industrial scenarios, and is particularly suitable for attitude monitoring applications in industrial fields such as engineering machinery and agricultural equipment.

Application Scope

❖ Agricultural machinery and equipment
❖ Aerial work platform
❖ Electric vehicle control system
❖ Construction hoisting equipment
❖ Medical equipment leveling
❖ Woodworking machinery

Performance Parameters

LTS6	parameter
resolution	0.1°
Measurement accuracy	±0.2° (@ 25℃)
response time	0.05s
Temp drift characteristics	±0.5° (-40℃~+85℃)
Output load	> 500 megaohms
insulation resistance	>100 megaohms
Anti-vibration	10grms、10~1000Hz
impact-resistant	100g@11ms Triaxial (half sine wave)
Connector	M12 * 1.0-5 core male head
cable	M12 * 1.0-5 core female head Standard 2-meter long, wear-resistant, oil resistant, wide temp, shielded cable
Shell size	L64.5×W50×H18.5mm
Shell material	Anodized aluminum
Weight	≤200g

Ordering Selection

Model	Axis	Range		Signal Output	Communication Protocol		Installation Direction
LTS6	X: X-axis	10: ±10°	-	232: RS232	SP: Serial Protocol	-	H:Horizontal installation
	Y: Y-axis	15: ±15°		485: RS485	MB: MODBUS Protocol		HD:Horizontal downwards
	D: Dual axis	30: ±30°		TTL: UART TTL			V:Vertical installation
		45: ±45°					VD:vertically downward
		60: ±60°					VL:Vertical leftwards
		90: ±90°					VR:Vertical rightwards
		180: ±180°					
		360: 0°~360°					
		397: -3°~+97°					

E.g: LTS6X10-232MB-H: X-axis, ±10° Range, RS232 signal output, MODBUS protocol, horizontal installation.

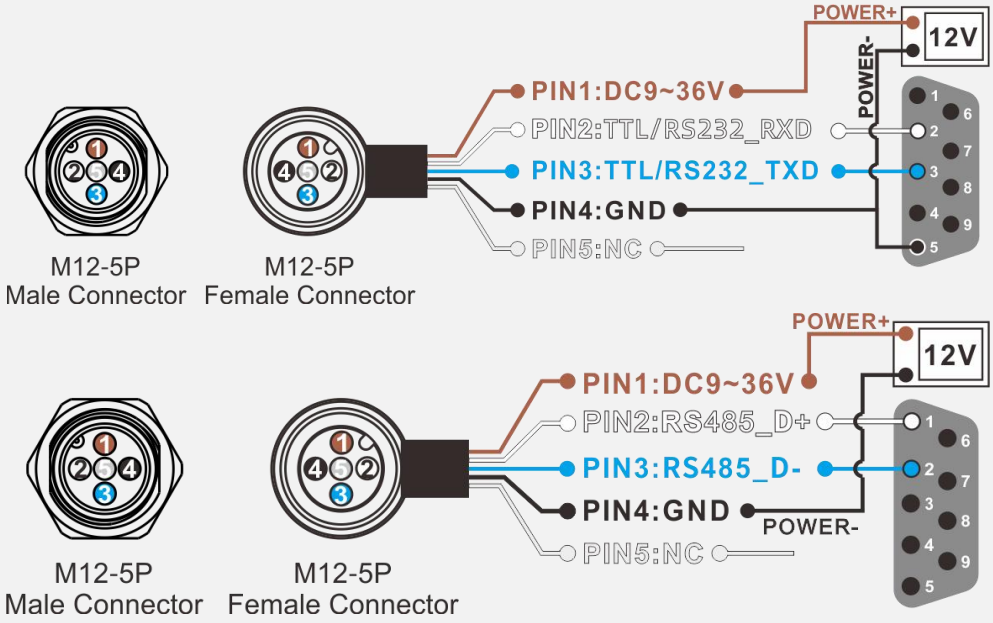
Note: The measurement range of 0°~360° is limited to single axis X-axis (clockwise rotation measurement), and the installation method can only be selected for vertical upward installation.

Product dimensions

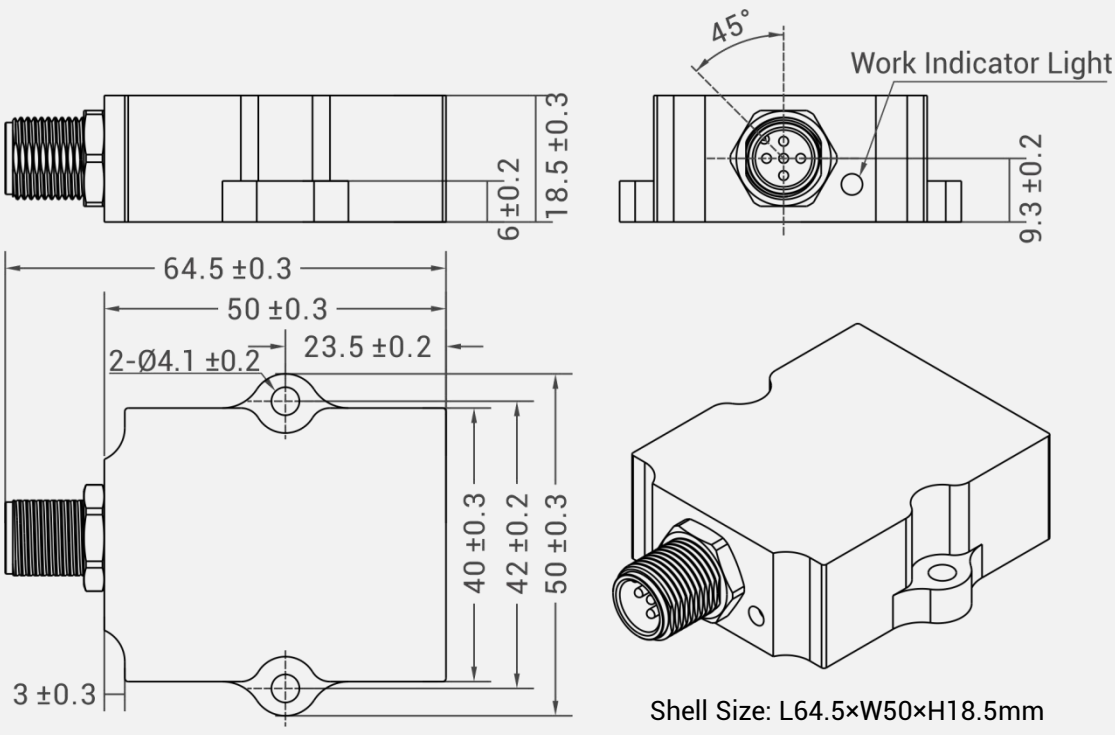
1.Gravity-based tilt sensor. Align its sensing axis parallel to the target tilt axis with flat, tight mounting surfaces for precision.
2.Mount per factory preset orientation. Send zero command after power-up to set current position as zero; parameters auto-save to internal memory.
3.IP67 rated against rain and high-pressure spray. Do not submerge long-term. Water damage repair available at customer expense.
4.Isolate signal wires from power positive to avoid short circuits. Common ground design: securely link sensor GND to acquisition unit GND.

Interface Definition

Pin/wire color	Pin definition	Description
PIN1/Brown	9~36V	positive power terminal
PIN2/White	RS232_RXD/RS485_D+	Receive data
PIN3/Blue	RS232_TXD/RS485_D-	Send data
PIN4/Black	GND	negative terminal of power supply
PIN5/Grey	NC	No connection



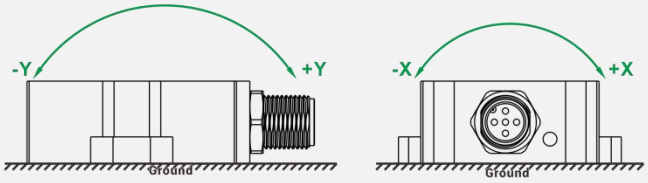
Product dimensions



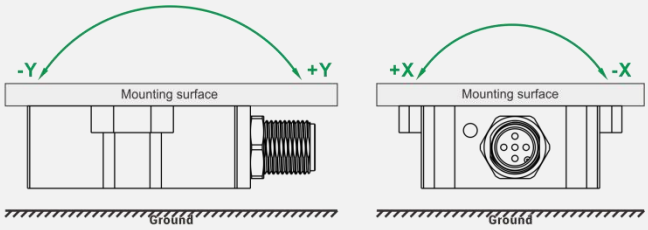
Shell Size: L64.5×W50×H18.5mm

Recommended screws: 2 M4 screws

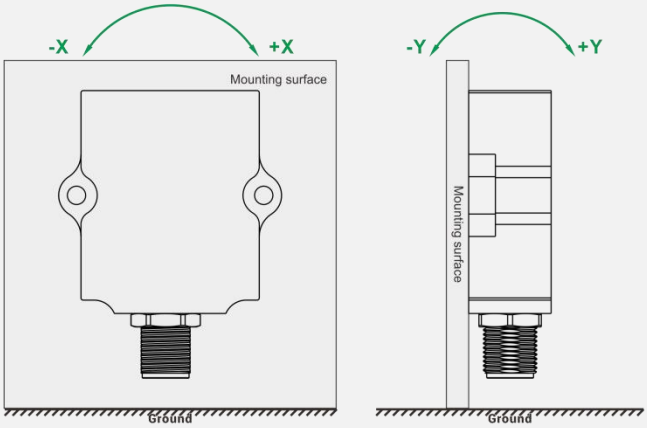
Measurement direction



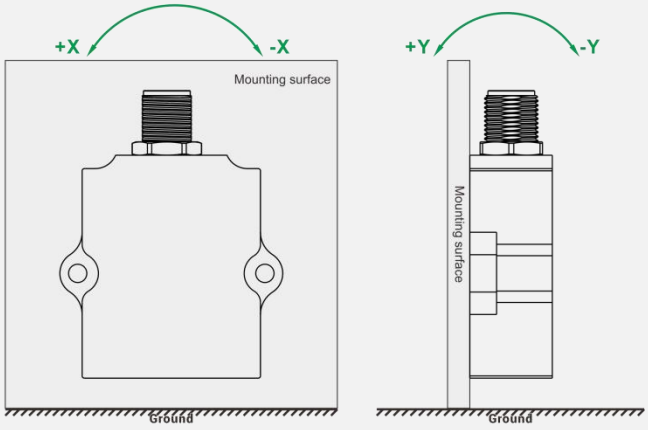
Horizontal installation



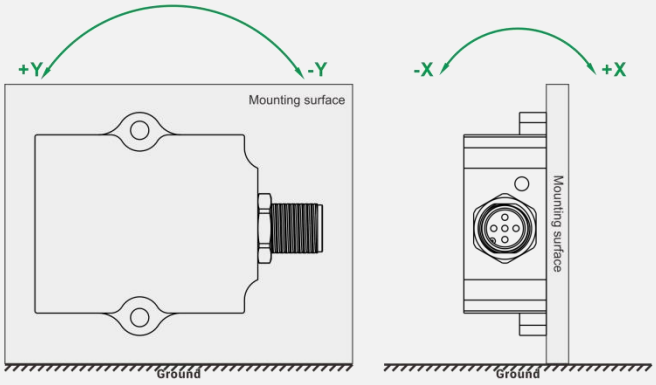
Horizontal downwards



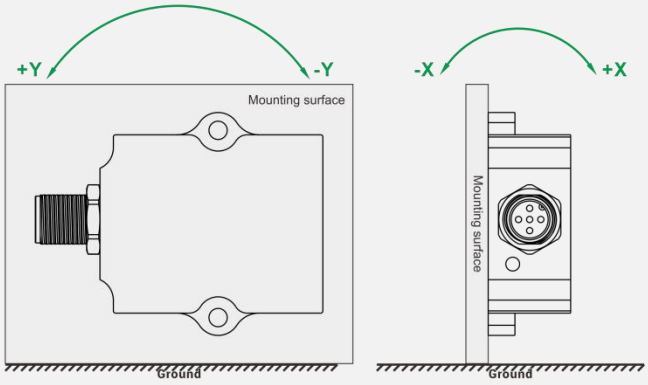
Vertical installation



Vertically downward



Vertical leftwards



Vertical rightwards

Serial Communication Protocol

1. Data frame format: (8-bit data bits, 1-bit stop bit, no checksum, default rate 9600)

Identifier (1byte)	data length (1byte)	Address code (1byte)	Command word (1byte)	Data domain	Checksum (1byte)
68					

Data format: hexadecimal;
Identifier: fixed at 68;
Data length: the length from data length to checksum (including checksum);
Address code: The address of the collection module, which defaults to 00;
The data domain varies according to the content and length of the command word;
Checksum: The sum of data length, address code, command word, and data field does not consider carry.

2. Command word parsing

CMD	Meaning/Example	Explanation
0X04	**Simultaneously read X and Y angle commands** **E.g: 68 04 00 04 08**	Data Domain (0byte) Command without data domain
0X84	Sensor response reply command **E.g: 68 0A 00 84 00 20 10 10 05 20 F3**	Data Domain (9 bytes) **AA AB BB CC CD DD** **AA AB BB**: 3 characters representing X-axis; **CC CD DD**: 3 characters representing Y-axis; The angle format is analyzed using the same method as the X-axis or Y-axis The angle in the left example is: X-axis 20.10 °, Y-axis -0.52 °.
0X05	**Set relative/absolute zero point:** The current angle can be set to 0° for relative measurement, or set to absolute factory 0° for power-off saving. **E.g: 68 05 00 05 00 0A**	Data Domain (1 byte) 00: Absolute zero point 01: Relative zero point
0X85	Sensor response reply command **E.g: 68 05 00 85 00 8A**	Data Domain (1 byte) The numbers in the data domain represent the results of the sensor response 00: Setting successful FF: Setting failed
0X0B	**Set communication speed** **E.g: 68 05 00 0B 03 13** This command setting must be restarted after power failure to take effect, and the power failure saving function must also be activated.	Data field (1 byte) baud rate 00 represents 2400 01 represents 4800 **02 represents 9600 (default value)** 03 represents 19200 04 represents 38400 05 represents 115200
0X8B	Sensor response reply command **E.g: 68 05 00 8B 00 90**	Data Domain (1 byte) The numbers in the data domain represent the results of the sensor response 00: Setting successful FF: Setting failed
0X0C	**Set sensor output mode** Response system: The upper computer needs to send a	Data Domain (1 byte) **00 Response System (default value)** 01 5Hz automatic output mode

	command to read the angle before the sensor responds to the relative angle; Automatic output system: After the sensor is powered on, it automatically outputs X and Y angles, and the output frequency is set as shown in the table on the right. (This function can save power off) **E.g: 68 05 00 0C 00 11**	02 10Hz automatic output mode 03 15Hz automatic output mode 04 20Hz automatic output mode
0X8C	Sensor response reply command E.g: **68 05 00 8C 00 91**	Data Domain (1 byte) The numbers in the data domain represent the results of the sensor response 00: Setting successful FF: Setting failed
0X0F	**Set module address command** The default address of the sensor is 00, 1.If multiple sensors are connected to a set of buses at the same time, such as RS485, each sensor needs to be set to a different address to achieve separate control and response angles. 2.If the new address is successfully changed, all subsequent commands and response packets must have their address codes replaced with the new address code to be valid, otherwise the sensor will not respond to the command. This command is for power-off saving function. **E.g: 68 05 00 0F 01 15** Set the address as 01 **68 05 FF 0F 00 13** Reset the address to 00 using a universal address.	Data Domain (1 byte) XX module address, ranging from 00 to EF. Note: All products have a common address: **FF. If you forget the set address during operation, you can use the FF address to operate the product and still respond normally.**
0X8F	Sensor response reply command **E.g: 68 05 00 8F 00 94**	Data Domain (1 byte) The numbers in the data domain represent the results of the sensor response 00: Setting successful FF: Setting failed
0X0D	**Query relative/absolute zero point** Used to query whether the current zero mode of the sensor is relative zero or absolute zero	Data Domain (0byte) Command without data domain

	E.g: 68 04 00 0D 11	
0X8D	Sensor response reply command **E.g: 68 05 00 8D 00 92**	Data Domain (1 byte) The numbers in the data domain represent the results of the sensor response 00: Absolute Zero 01: Relative Zero

MODBUS Communication Protocol

Attention, please read the following items carefully before use:
1) Due to the MODBUS protocol, the time between two data frames should be greater than 3.5 bytes (e.g. at 9600 baud rate, this time is 3.5 x (1/9600) x 11=0.004s). But in order to leave enough margin, this sensor has increased this time to 10ms, so please leave at least 10ms of time interval between each data frame.
Host sends command → 10ms idle → Slave replies command → 10ms idle → Host sends command
2) The MODBUS protocol specifies the relevant content of broadcast address -0, and this sensor can also accept broadcast address content, but will not reply (except for the function of reading address codes). So the broadcast address 0 can be used for the following purposes, for reference only.
1. Set all the addresses of the tilt sensors of this model mounted on the bus to a certain address.
2. Set all tilt sensors of this model mounted on the bus to relative/absolute zero points.
3. Test the sensor of this model on the entire bus, that is, if the host sends a 0 address inquiry angle command to the bus and the communication indicator light flashes, the communication is normal.
3) In order to improve the reliability of the system, the address command, absolute/relative command, and baud rate must be set twice in a row to be effective. 'Sending twice in a row' refers to sending successfully twice (with a response from the slave each time), and the two question and answer sessions must be consecutive, meaning that the host cannot insert other data frames in between. Otherwise, this command will be locked. The setting process is as follows:
Send setting address command → Wait for successful setting command sent by the slave → Send setting address command again → Wait for successful setting command sent by the slave → Modify successfully
4) After power on, the above two setting commands can only be set once each. If you need to set them again, you need to power on again.
5) When normal communication accumulates to a certain number of times, the communication indicator light will flash once.

1. Data frame format:
RTU mode;
Communication parameters: baud rate 9600 bps (factory default);
Data frame: 1 start bit, 8 data bits, even parity check, 1 stop bit.

2. Read angle data: MODBUS function code 03H

Host query command:		Slave response:		
Sensor address	01H	Sensor address	01H	
function code	03H	function code	03H	
Accessing the first address of the register	00H	Data length of 8 bytes	08H	
	02H	Data word 1, lower 8 bits	50H	X-axis data
Data length of 4 words	00H	Data word 1, high 8 bits	46H	
	04H	Data word 2, lower 8 bits	00H	
CRC	E5C9H	Data word 2, high 8 bits	00H	

		Data word 3, lower 8 bits	23H	Y-axis data
		Data word 3, high 8 bits	20H	
		Data word 4, lower 8 bits	00H	
		Data word 4, high 8 bits	00H	
		CRC	BD61H	

Example of application of command to read measurement data 1:								
Host sends	01H	03H	00H	02H	00H	04H	E5H	C9H
Reply from the machine	01H	03H	08H	50H	46H	00H	00H	23H
	20H	00H	00H	BDH	61H			

Note: The data fields of the slave reply frame are 50H, 46H, 00H, 00H, 23H, 20H, 00H, 00H, The X-axis represents the first to fourth bytes of the data field, the Y-axis represents the fifth to eighth bytes of the data field, and the lower bytes come first. The representation method of angle is point based representation, where one point corresponds to 0.01 °, and 0.01 × (point offset) is the angle. If the measurement range is ± 90 °, the total number of points is 18000. So 0 corresponds to -90°, 18000 corresponds to+90 °, and 9000 corresponds to 0 °.
Taking the above data frame as an example: the process of angle conversion is as follows:

1）Get the current angle point count, note that the low byte comes first, the X-axis is 4650H, and the Y-axis is 2023H.

2）Convert to decimal, X-axis: 4650H → 18000, Y-axis: 2023H → 8227.

3）Subtract the offset of 9000 (note: this value is a quantity related to the measurement range),X-axis: 18000-9000=9000, Y-axis: 8227-9000=-773.

4）Obtain the final angle, X-axis: 9000 × 0.01=90.00 °, Y-axis: -773 × 0.01=-7.73 °.

Example of application of command to read measurement data2:								
Host sends	01H	03H	00H	02H	00H	04H	E5H	C9H
Reply from the machine	01H	03H	08H	00H	00H	00H	00H	00H
	23H	00H	00H	64H	1DH			

Assuming the measurement range of the sensor in this example is ± 45 °, the total number of points is 9000.
So 0 corresponds to -45 °, 9000 corresponds to+45 °, 4500 corresponds to 0 °, and the angle conversion process is as follows:
1) Obtain the current angle point count, with the low byte at the beginning, and the X-axis is 0000H and the Y-axis is 2300H.
2) Convert to decimal, X-axis: 0000H → 0, Y-axis: 2300H → 8960.
3) Subtract the offset of 4500 (note: this value is a quantity related to the measurement range),
X-axis: 0-4500=-4500, Y-axis: 8960-4500=4460.
4) Obtain the final angle, X-axis: -4500 × 0.01=-45.00 °, Y-axis: 4460 × 0.01=44.60 °

3. Set the relative/absolute zero point of the sensor: Modbus function code 06H

Set relative/absolute zero command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	06H	function code	06H
Accessing the first address of the register	00H	register address	00H
	10H		10H
If the character is non-zero, it is a relative zero point,	00 H	If the character is non-zero, it is a relative zero point,	00H
	FFH / 00H Relative/Absolute		FFH / 00H Relative/Absolute

and if it is zero, it is an absolute zero point		and if it is zero, it is an absolute zero point	
CRC	C84FH/ 880FH	CRC	C84FH/ 880FH

The command must be sent twice in a row to be effective

Example of setting relative/absolute zero command application:								
Host sends	01 H	06 H	00 H	10 H	00 H	FFH	C8H	4FH
Reply from the machine	01 H	06 H	00 H	10 H	00 H	FFH	C8 H	4FH

Note: 0010 is the register address, which controls whether the sensor output is relative zero or absolute zero. If it is non-zero (as in the example above, 00FFH is written), then the output is a relative zero point. On the contrary, if it is zero (changing the 5th and 6th bytes to 00H), it is an absolute zero. The last two bytes are the CRC checksum.

4. Set the sensor address (sensor address defaults to 1 at the factory)

Set sensor address code command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	06H	function code	06H
Address	00H	Register Address	00H
	11H		11H
New address for sensor	00 H	New address for sensor	00 H
	04H		04H
CRC	D80C	CRC	D80C

The command must be sent twice in a row to be effective

Example application of setting sensor address command:								
Host sends	01 H	06 H	00 H	11 H	00 H	04H	D8H	0CH
Reply from the machine	01 H	06 H	00 H	11 H	00 H	04H	D8 H	0CH

Note: 0011H is the register address, which controls the sensor address. In the above example, the address of the sensor is changed to 0004H, and the last two bytes are the CRC checksum.

5. Set sensor communication character format: (Factory default is even parity)

Set sensor communication character format command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	06H	function code	06H
Address	00H	Register Address	00H
	09H		09H
Sensor changes communication character format	00H	New format for sensors	00H
	01H		01/00H
CRC	9800/59C8	CRC	9800/59C8

Example application of setting sensor communication character format command:								
Host sends	01 H	06 H	00 H	09 H	00 H	01H	98H	08H
Reply from the machine	01 H	06 H	00 H	09 H	00 H	01H	98 H	08H

The above example is to set the byte format to: one start bit+8 data bits without parity+1 stop bit

Effective after re powering on. The factory default is a start bit+8 data bit parity+1 stop bit.

Note: 0009 is the register address, which controls the communication character format of the sensor.
0000H: One start bit+8 data bit parity checks+1 stop bit
0001 H: One start bit+8 data bits without checksum+1 stop bit

6. Set sensor baud rate: (Factory default is 9600bps)

Set sensor baud rate command:		Slave response:	
Sensor address	01H	Sensor address	01H
function code	06H	function code	06H
Address	00H	Register Address	00H
	08H		08H
The baud rate of the sensor	00H	The baud rate of the sensor	00H
	A2H		A2H
CRC	B9B1	CRC	B9B1

XX : A0H:4800 A1H:9600 A2H:19200 A3H:38400 A4H:115200

The command must be sent twice in a row to be effective

Example application of setting sensor baud rate command:								
Host sends	01H	06H	00H	08H	00H	A2H	89H	B1H
Reply from the machine	01H	06H	00H	08H	00H	A2H	89H	B1H

A1H:4800 A2H:9600 A3H:19200 A4H:38400 A5H:115200