SUCH

Waterproof Noise Sensor, TTL RS485

User Manual



SUCH

I. Overview

It supports functions such as reading the sound pressure level and configuring the address, communication mode, baud rate, and response interval of the module.

II. Active Mode

1.1 Overview

Once the device is powered on, data is automatically transmitted without the need to send a read command.

1.2 Data Packet Format

Start Bytes + Command + Data + Checksum
Start Bytes: BB AA, 2 bytes (0xBB, 0xAA).
Command: 1 byte.
01: Command indicating returned sound pressure level data.
Data: 2 bytes.
The sound pressure level data is stored in these two bytes, with the low byte first and the high byte second.
Checksum: 1 byte.
The checksum is the arithmetic sum of the start bytes, command, and data bytes. Any overflow beyond 256 is ignored.

1.3 Communication Command Description

Example: BB AA 01 C8 01 2F
Start Bytes: BB AA
Indicates the beginning of a data frame.
Command: 01
Indicates that this frame contains returned sound pressure level data.
Data: C8 01
Indicates the detected sound pressure level. The low byte comes first and the high byte comes second, giving:0x01C8
Each unit represents 0.1 dB, so: 0x01C8 = 456
Therefore, the sound pressure level is: 45.6 dB
Checksum: 2F
This is the arithmetic checksum of: BB AA 01 C8 01

III. Passive Mode

2.1 Overview

All communication is initiated by the host sending a command frame, and the device returns the corresponding response frame.
The protocol supports:

Reading device information and sound pressure level
Setting the device address
Setting the baud rate
Setting the communication mode
Setting the response interval
The frame format is as follows:
Address (1 byte) + Command (1 byte) + Data (4 bytes) + CRC16 Checksum (2 bytes)
The total packet length is 8 bytes.
Factory default communication settings:
Baud Rate: 115200
Parity: None
Stop Bit: 1 bit

Address

Specifies the address of the device. The configurable address range is 1 – 247.
Address 0 is the broadcast address and can be used to read device information. For details, refer to the command descriptions below.
The factory default device address is 1.

Command

Specifies the commands that the host can use to perform different functions on the device. The supported commands are as follows:

Command Function	Command Code
Read Device Information	1
Read Sound Pressure Level	2
Set Device Address	3
Set Baud Rate	4
Set Device Communication Mode	5
Set Device Response Interval	6

Data

Defines the contents of the data fields in the command frame and response frame, as shown below.

Command	Command Frame Data Field	Response Frame Data Field
Read Device Information	00 00 00 00	Success: 00 [Version] [Address] [(Bits 7 – 6: Response Interval) (Bits 5 – 4: Mode) (Bit 3: Reserved) (Bits 2 – 0: Baud Rate)]
		Failure: 01 [Error Code] 00 00
Read dB Value	00 00 00 00	Success: 00 [Low Byte of dB Value] [High Byte of dB Value] 00
		Failure: 01 [Error Code] 00 00
Set Device Address	[Address] 00 00 00	Success: 00 [Address] 00 00
		Failure: 01 [Error Code] 00 00
Set Device Baud Rate	[Baud Rate Code] 00 00 00	Success: 00 [Baud Rate Code] 00 00

Command	Command Frame Data Field	Response Frame Data Field
		Failure: 01 [Error Code] 00 00
Set Device Mode	[Mode Code] 00 00 00	Success: 00 [Mode Code] 00 00
		Failure: 01 [Error Code] 00 00
Set Device Response Interval	[Response Interval Code] 00 00 00	Success: 00 [Response Interval Code] 00 00
		Failure: 01 [Error Code] 00 00

CRC16 Checksum

The CRC16 checksum is calculated from the address, command, and data fields using the CRC16_MODBUS algorithm.

The byte order is:

Low byte first, high byte second.

2.2 Communication Command Description

The following description uses a device with address 1 as an example.

2.2.1 Read Device InformationThe command frame to be sent is as follows:

Address	Command	Data	CRC16
00	01	00 00 00 00	3D DB

Address: 00 indicates that broadcast address 00 is used.

Command: 01 indicates the Read Device Information command.

Data: 00 00 00 00. All four data bytes are 00 and have no specific meaning.

CRC16: 3D DB is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation is successful, the response frame is as follows:

Address	Command	Data	CRC16
01	01	00 12 01 65	5D B4

Address: 01 indicates the address of the responding device.

Command: 01 indicates the command being responded to.

Data:

Byte 1: 00, indicating that the operation was successful.

Byte 2: 12, indicating firmware version V1.2.

Byte 3: 01, indicating that the device address is 1.

Byte 4: 65, which is 0110 0101 in binary:

bits 2 – 0: indicate a baud rate of 115200

bit 3: reserved

bits 5 – 4: indicate Passive Mode

bits 7 – 6: indicate a response interval of 300 ms

For the detailed definition of each data bit, refer to Appendix 1.

CRC16: 5D B4 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation fails, for example due to a CRC16 checksum error, the response frame is as follows:

Address	Command	Data	CRC16
01	01	01 02 00 00	36 9C

Address: 01 indicates the address of the responding device.

Command: 01 indicates the command being responded to.

Data:

Byte 1: 01, indicating that the operation failed.

Byte 2: 02, indicating a CRC16 checksum error.

Bytes 3 and 4: 00 00, reserved and have no specific meaning.

CRC16: 36 9C is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

2.2.2 Read Device Sound Pressure Level

When reading the sound pressure level, the command frame to be sent is as follows:

Address	Command	Data	CRC16
01	02	00 00 00 00	78 0A

Address: 01 indicates that the sound pressure level is to be read from the device with address 1.

Command: 02 indicates that the current command is Read Sound Pressure Level.

Data: 00 00 00 00. All four data bytes are 00 and have no specific meaning.

CRC16: 78 0A is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation is successful, the response frame is as follows:

Address	Command	Data	CRC16
01	02	00 DC 01 00	B8 60

Address: 01 indicates the address of the responding device.

Command: 02 indicates that the response corresponds to the Read Sound Pressure Level command.

Data:

Byte 1: 00, indicating that the operation was successful.

Bytes 2 and 3: DC 01. The low byte comes first and the high byte comes second. The combined hexadecimal value is 0x01DC, which equals 476 in decimal. Each unit represents 0.1 dB, so the measured sound pressure level is 47.6 dB.

Byte 4: 00, reserved and has no specific meaning.

CRC16: B8 60 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation fails, for example due to a CRC16 checksum error, the response frame is as **follows:**

Address	Command	Data	CRC16
01	02	01 02 00 00	D8 36

Address: 01 indicates the address of the responding device.

Command: 02 indicates that the response corresponds to the Read Sound Pressure Level command.

Data:

Byte 1: 01, indicating that the operation failed.

Byte 2: 02, indicating a CRC16 checksum error.

Bytes 3 and 4: 00 00, reserved and have no specific meaning.

CRC16: D8 36 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

2.2.3 Set Device Address

When setting the address of a device with address 1 to 2, the command frame to be sent is as follows:

Address	Command	Data	CRC16
01	03	02 00 00 00	44 72

Address: 01 indicates that the operation is performed on the device with address 1.

Command: 03 indicates that the current command is Set Device Address.

Data:

Byte 1: 02, indicating that the device address is to be set to 2.

Bytes 2 to 4: 00 00 00, reserved and have no specific meaning.

CRC16: 44 72 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation is successful, the response frame is as follows:

Address	Command	Data	CRC16
02	03	00 02 00 00	E4 39

Address: 02 indicates the address of the responding device.

Command: 03 indicates that the response corresponds to the Set Device Address command.

Data:

Byte 1: 00, indicating that the operation was successful.

Byte 2: 02, indicating that the device address has been set to 02.

Bytes 3 and 4: 00 00, reserved and have no specific meaning.

CRC16: E4 39 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation fails, for example due to an invalid address range, the response frame is as follows:

Address	Command	Data	CRC16
01	03	01 04 00 00	05 F7

Address: 01 indicates the address of the responding device.

Command: 03 indicates that the response corresponds to the Set Device Address command.

Data:

Byte 1: 01, indicating that the operation failed.

Byte 2: 04, indicating that the specified device address is outside the valid range.

Bytes 3 and 4: 00 00, reserved and have no specific meaning.

CRC16: 05 F7 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

2.2.4 Set Device Baud Rate

If the device baud rate needs to be changed to 9600, the command frame to be sent is as follows:

Address	Command	Data	CRC16
01	04	01 00 00 00	F1 F6

Address: 01 indicates the address of the device to be configured.

Command: 04 indicates that the current command is Set Baud Rate.

Data:

Byte 1: 01, indicating that the baud rate is to be set to 9600.

Bytes 2 to 4: 00 00 00, reserved and have no specific meaning.

CRC16: F1 F6 is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation is successful, the response frame is as follows:

Address	Command	Data	CRC16
01	04	00 01 00 00	A1 CA

Address: 01 indicates the address of the responding device.

Command: 04 indicates that the response corresponds to the Set Baud Rate command.

Data:

Byte 1: 00, indicating that the operation was successful.

Byte 2: 01, indicating that the currently configured baud rate is 9600.

Bytes 3 and 4: 00 00, reserved and have no specific meaning.

CRC16: A1 CA is the CRC16 value calculated from the address, command, and data. The low byte comes first, followed by the high byte.

When the operation fails, for example due to an invalid baud rate range/code, the response frame is as follows:

Address	Command	Data	CRC16
01	04	01 06 00 00	11 F7

Address: 01 indicates the address of the responding device.

Command: 04 indicates that the response corresponds to the Set Baud Rate command.

Data:

Byte 1: 01, indicating that the operation failed.

Byte 2: 06, indicating that the configured baud rate is out of range.

Bytes 3 and 4: 00 00, reserved, no meaning.

CRC16: 11 F7 — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.

Note: After the baud rate is successfully written, the device must be powered off and restarted for the new setting to take effect.

2.2.5 Setting the Communication Mode

To change the device communication mode to Passive Mode, send the following command:

Address	Command	Data	CRC16
01	05	02 00 00 00	CC 72

Address: 01 indicates the address of the device to be operated.

Command: 05 indicates that the command to be executed is Set Communication Mode.

Data:

Byte 1: 02, indicating that the communication mode to be set is Passive Mode.

Bytes 2 – 4: 00 00 00, reserved, no meaning.

CRC16: CC 72 — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.

If the operation is successful, the response frame is as follows:

Address	Command	Data	CRC16
01	05	00 02 00 00	6C 0A

Address: 01 indicates the address of the responding device.

Command: 05 indicates that the response corresponds to the Set Communication Mode command.

Data:

Byte 1: 00, indicating that the operation was successful.

Byte 2: 02, indicating that the configured communication mode is Passive Mode.

Bytes 3 and 4: 00 00, reserved, no meaning.

CRC16: 6C 0A — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.

If the operation fails, for example due to an invalid communication mode setting, the response frame is as follows:

Address	Command	Data	CRC16
01	05	01 08 00 00	4D F4

Address: 01 indicates the address of the responding device.

Command: 05 indicates that the response corresponds to the Set Communication Mode command.

Data:

Byte 1: 01, indicating that the operation failed.

Byte 2: 08, indicating that the configured communication mode is invalid.

Bytes 3 and 4: 00 00, reserved, no meaning.

CRC16: 4D F4 — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.

Note: After the communication mode is successfully written, the device must be powered off and restarted for the new setting to take effect.

2.2.6 Setting the Device Response Period

To set the device response period to 300 ms, send the following command:

Address	Command	Data	CRC16
01	06	01 00 00 00	88 36

Address: 01 indicates the address of the device to be operated.

Command: 06 indicates that the command to be executed is Set Response Period.

Data:

Byte 1: 01, indicating that the response period to be set is 300 ms.

Bytes 2 – 4: 00 00 00, reserved, no meaning.

CRC16: 88 36 — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.

If the operation is successful, the response frame is as follows:

Address	Command	Data	CRC16
01	06	00 01 00 00	D8 0A

Address: 01 indicates the address of the responding device.

Command: 05 indicates that the response corresponds to the Set Response Period command.

Data:

Byte 1: 00, indicating that the operation was successful.
Byte 2: 01, indicating that the currently configured response period is 300 ms.
Bytes 3 and 4: 00 00, reserved, no meaning.
CRC16: D8 0A — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.
If the operation fails, for example because the configured response period is out of range, the response frame is as follows:

Address	Command	Data	CRC16
01	06	01 0A 00 00	A8 34

Address: 01 indicates the address of the responding device.
Command: 05 indicates that the response corresponds to the Set Response Period command.
Data:
Byte 1: 01, indicating that the operation failed.
Note: In the original Chinese document, the explanatory text below the response tables says Command: 05, while the tables show Command: 06. This appears to be a typo in the source document; based on this section and the command frames, 06 is likely the correct command code.
Byte 2: 08, indicating that the configured response period is out of range.
Bytes 3 and 4: 00 00, reserved, no meaning.
CRC16: A8 34 — CRC16 calculation result of the address, command, and data. The low byte comes first, followed by the high byte.
Note: After the response period is successfully written, the device must be powered off and restarted for the new setting to take effect.

4. Modbus RTU Mode

3.1 Overview

This sensor communicates using the Modbus RTU standard protocol. It supports reading the sound pressure value and firmware version, as well as read/write operations for the device address, baud rate, communication mode, and response period.

3.2 Function Codes

The supported function codes are as follows:

Function Code	Function
0x03	Read Holding Registers
0x06	Write Single Holding Register

Function code 0x03 is mainly used to read the sound pressure value, firmware version, device address, baud rate, communication mode, and response period.
Function code 0x06 is mainly used to modify the device address, baud rate, communication mode, and response period.

3.3 Register Addresses

Register Address	Description	Attribute
0x0000	Sound Pressure Value Holding Register	Read-only
0x0001	Firmware Version Holding Register	Read-only
0x0030	Device Address Holding Register	Read/Write
0x0031	Baud Rate Holding Register	Read/Write
0x0032	Communication Mode Holding Register	Read/Write
0x0033	Response Period Holding Register	Read/Write

Among these registers, 0x0000 and 0x0001 are read-only and do not allow data to be written. Registers 0x0030 – 0x0033 are read/write registers and support both data reading and writing. Function code 0x03 supports reading multiple registers with consecutive addresses.

3.4 Communication Command Description

The following examples assume a baud rate of 115200, parity set to “NONE”, and a device address of 1. If a communication error occurs, the module returns a data frame in accordance with the standard Modbus RTU protocol to indicate the communication exception. For details of the exception codes, refer to Appendix 6.

3.4.1 Reading the Device Sound Pressure Value

The master request frame is as follows:

Address	Function Code	Register Address Hi	Register Address Lo	Register Count Hi	Register Count Lo	CRC16 Lo	CRC16 Hi
01	03	00	00	00	01	84	0A

If no error occurs, the device returns the following data:

Address	Function Code	Byte Count	Register Value Hi	Register Value Lo	CRC16 Lo	CRC16 Hi
01	03	02	01	F7	F8	62

The register value is 0x01F7, which is 503 in decimal. Each unit represents 0.1 dB, so the sound pressure value is 50.3 dB.

3.4.2 Reading Device Version Information

To query the device firmware version, the master sends the following data frame:

Address	Function Code	Register Address Hi	Register Address Lo	Register Count Hi	Register Count Lo	CRC16 Lo	CRC16 Hi
01	03	00	01	00	01	D5	CA

If no error occurs, the module returns the following data:

Address	Function Code	Byte Count	Register Value Hi	Register Value Lo	CRC16 Lo	CRC16 Hi
01	03	02	00	10	B9	88

The register value is 0x0010. The high byte is 0x00 and is reserved. In the low byte, the upper 4 bits are converted to decimal as 1, and the lower 4 bits are converted to decimal as 0, indicating firmware version V1.0.

3.4.3 Reading the Device Address

The master request frame is as follows:

Address	Function Code	Register Address Hi	Register Address Lo	Register Count Hi	Register Count Lo	CRC16 Lo	CRC16 Hi
01	03	00	30	00	01	84	05

If no error occurs, the module returns the following data:

Address	Function Code	Byte Count	Register Value Hi	Register Value Lo	CRC16 Lo	CRC16 Hi
01	03	02	00	01	79	84

The register value is 0x0001, indicating that the module address is 1.

3.4.4 Reading the Device Baud Rate

The master sends the following request frame:

Address	Function Code	Register Address Hi	Register Address Lo	Register Count Hi	Register Count Lo	CRC16 Lo	CRC16 Hi
01	03	00	31	00	01	D5	C5

If no error occurs, the module returns the following data:

Address	Function Code	Byte Count	Register Value Hi	Register Value Lo	CRC16 Lo	CRC16 Hi
01	03	02	00	05	78	47

The register value is 0x0005, indicating that the module baud rate is 115200. For other baud rate codes, refer to Appendix 2.

3.4.5 Reading the Device Mode

The master sends the following request frame:

Address	Function Code	Register Address Hi	Register Address Lo	Register Count Hi	Register Count Lo	CRC16 Lo	CRC16 Hi
01	03	00	32	00	01	25	C5

If no error occurs, the module returns the following data:

Address	Function Code	Byte Count	Register Value Hi	Register Value Lo	CRC16 Lo	CRC16 Hi
01	03	02	00	03	F8	45

The register value is 0x0003, indicating that the device is operating in Modbus RTU mode. For other mode codes, refer to Appendix 3.

3.4.6 Reading the Response Period

The master sends the following request frame:

Address	Function Code	Register Address Hi	Register Address Lo	Register Count Hi	Register Count Lo	CRC16 Lo	CRC16 Hi
01	03	00	33	00	01	74	05

If no error occurs, the module returns the following data:

Address	Function Code	Byte Count	Register Value Hi	Register Value Lo	CRC16 Lo	CRC16 Hi
01	03	02	00	00	B8	44

The register value is 0x0000, indicating that the device response period is 400 ms. For other response period codes, refer to Appendix 4.

3.4.7 Writing the Device Address

To change the module address from 1 to 2, the master sends the following data frame:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	30	00	02	08	04

If no error occurs, the module returns the following data:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	30	00	02	08	04

3.4.8 Writing the Device Baud Rate

To change the module baud rate from 115200 to 9600, the master sends the following data frame:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	31	00	01	19	C5

The data value is 0x0001, indicating a baud rate of 9600. For other baud rate codes, refer to Appendix 2.

If no error occurs, the module returns the following data:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	31	00	01	19	C5

Note: After the baud rate is successfully written, the device must be powered off and restarted for the new setting to take effect.

3.4.9 Writing the Device Mode

To change the device from Modbus RTU mode to Active Mode, the master sends the following data frame:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	32	00	01	E9	C5

The data value is 0x0001, indicating Active Mode. For other mode codes, refer to Appendix 3.

If no error occurs, the module returns the following data:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	32	00	01	E9	C5

Note: After the mode is successfully written, the device must be powered off and restarted for the new setting to take effect.

3.4.10 Writing the Response Period

To change the device response period to 100 ms, the master sends the following data frame:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	33	00	03	39	C4

The data value is 0x0003, indicating 100 ms. For other response period codes, refer to Appendix 4.

If no error occurs, the module returns the following data:

Address	Function Code	Register Address Hi	Register Address Lo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
01	06	00	33	00	03	39	C4

Note: After the response period is successfully written, the device must be powered off and restarted for the new setting to take effect.

Appendix 1

The meaning of each bit in the 4th byte of the data field in the device information response frame is described below:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Response Period		Communication Mode		Reserved	Baud Rate		
00: 400 ms		01: Active Mode			001: 9600		
01: 300 ms		10: Passive Mode			010: 19200		
10: 250 ms		11: Modbus RTU			011: 38400		
					100: 57600		
					101: 115200		

More clearly, the bit allocation is:

Bit7 – Bit6: Response Period

Bit5 – Bit4: Communication Mode

Bit3: Reserved

Bit2 – Bit0: Baud Rate

Appendix 2

The baud rate codes supported by the device are as follows:

Baud Rate	Baud Rate Code
9600	1
19200	2
38400	3
57600	4
115200	5

Appendix 3

The communication mode codes supported by the device are as follows:

Communication Mode	Communication Mode Code
Active Mode	1
Passive Mode	2
Modbus RTU	3

Appendix 4

The response period codes supported by the device are as follows:

Response Period	Response Period Code
400 ms	0
300 ms	1
250 ms	2

Appendix 5

The error codes returned by the device are as follows:

Error Description	Error Code
Command Error	1
CRC Error	2
Failed to Save Address	3
Address Out of Range	4
Failed to Save Baud Rate	5
Baud Rate Out of Range	6
Failed to Save Communication Mode	7
Invalid Communication Mode	8
Failed to Save Response Period	9
Invalid Response Period Parameter	10

Appendix 6

When communicating using the standard Modbus RTU protocol, if the request frame sent by the master contains an error, the device returns data in the following format:

Address	Exception Function Code	Exception Code	CRC16 Lo	CRC16 Hi
XX	Function Code + 0x80	0x01, 0x02, 0x03, or 0x04	XX	XX

The exception codes are defined as follows:

Exception Code	Meaning
0x01	Illegal Function
0x02	Illegal Data Address
0x03	Illegal Data Value
0x04	Slave Device Failure