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# APPLICATION NOTE

**AN0103**

## **Setup via Modbus RTU for E+E Devices and Probes. Supported function codes & packet format**

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### **Relevant for:**

This application note describes how to set the address and the baud rate for E+E devices with Modbus RTU interface.

### **Summary:**

The application note provides support for setting individually the slave address and the communication. Additionally it describes the data encoding of floating point values and the Modbus function codes supported by the E+E devices.

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## 1 Supported function codes

Following function codes are supported:

- 0x01 Read Coil Register
- 0x03 Read Holding Registers
- 0x04 Read Input Registers
- 0x05 Write Coil Register
- 0x06 Write Single Register
- 0x10 Write Multiple Registers

The measured values can be read by using 0x03 and 0x04 codes. The register address and the corresponding physical quantities are listed in the datasheet and in the operation manual of the specific E+E device.

## 2 Packet format for read coil code 0x01

Request:

Modbus Address	Function Code	Starting Address		Quantity of Coils		CRC	
		HB	LB	HB	LB	LB	HB
XX	01	XX	XX	XX	XX	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Byte Count	N * Coil Status		CRC	
			HB	LB	LB	HB
XX	01	XX	XX	XX	XX	XX

### 2.1 Example: Reading Status

This example demonstrates reading the device status from a desired register address. The supported register addresses can be found in the datasheet and in the operation manual of the specific E+E device.

Request:

Modbus Address	Function Code	Starting Address		Quantity of Registers		CRC	
		HB	LB	HB	LB	LB	HB
XX	01	00	XX	00	08	XX	XX

Quantity of Coils = 8 ... 1 Byte (8Bit)

Response from the E+E Modbus device:

Modbus Address	Function Code	Byte Count	Coil Status	CRC	
				LB	HB
XX	01	01	XX	XX	XX

## 3 Packet format for read function codes 0x03 and 0x04

Request:

Modbus Address	Function Code	Starting Address		Quantity of Registers		CRC	
		HB	LB	HB	LB	LB	HB
XX	03, 04	XX	XX	XX	XX	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Byte Count	N * Registers		CRC	
			HB	LB	LB	HB
XX	03, 04	XX	XX	XX	XX	XX

### 3.1 Example: Reading Temperature

This example demonstrates reading the temperature (float value) from register address 0x19. A float value consists of 4 Bytes<sup>1</sup>. The byte order of the floating point value is specified in section 7.2.

Request:

Modbus Address	Function Code	Starting Address		Quantity of Registers		CRC	
		HB	LB	HB	LB	LB	HB
XX	03	00	19	00	02	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Byte Count	2 Registers (4 byte)				CRC	
			XX	XX	XX	XX	LB	HB
XX	03	04	XX	XX	XX	XX	XX	XX

## 4 Packet format for write coil code 0x05

Request:

Modbus Address	Function Code	Starting Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	05	XX	XX	XX	XX	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Starting Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	05	XX	XX	XX	XX	XX	XX

The supported register addresses can be found in the datasheet and in the operation manual of the specific E+E device.

## 5 Packet format for write function code 0x06

Request:

Modbus Address	Function Code	Register Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	06	XX	XX	XX	XX	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Register Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	06	XX	XX	XX	XX	XX	XX

<sup>1</sup> It is highly recommended to request a floating point number with a single command. Otherwise, you may get the upper and lower part of the floating point value from two different measurements.

## 5.1 Example: Setting a new Slave ID (Modbus address)

The new Slave ID (Modbus address) can be set in the range of 1 to 247 by using the 0x06 function code<sup>2</sup> and register address 0x00.

Request:

Modbus Address	Function Code	Register Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	06	00	00	00	YY	XX	XX

XX...current Modbus address

YY...new Modbus address (1-247)

Response from the E+E Modbus device:

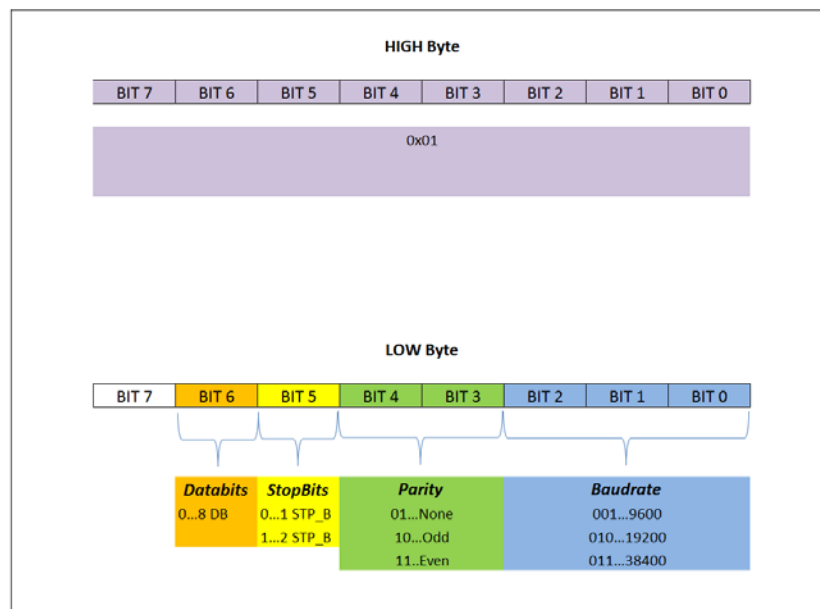
Modbus Address	Function Code	Register Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	06	00	00	00	YY	XX	XX

## 5.2 Example: Changing the communication settings

The baud rate, parity and stop bit can be changed using the 0x06 function code<sup>3</sup> and register address 0x01.

Request:

Modbus Address	Function Code	Register Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	06	00	01	01 <sup>4</sup>	XX <sup>5</sup>	XX	XX



Response from the E+E Modbus device:

<sup>2</sup> The slave ID cannot be read

<sup>3</sup> The register of baud rate cannot be read

<sup>4</sup> The devices EE800 and EE10 expect this value as 00

<sup>5</sup> The bit 7 of the lower byte must always be zero

Modbus Address	Function Code	Register Address		Register Value		CRC	
		HB	LB	HB	LB	LB	HB
XX	06	00	01	01	XX	XX	XX

## 6 Packet format for write multiple function code 0x10

Request:

Modbus Address	Function Code	Starting Address		Quantity of Registers		Byte Count	N * Register Values		CRC	
		HB	LB	HB	LB		HB	LB	LB	HB
XX	10	XX	XX	XX	XX	XX	XX	XX	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Starting Address		Quantity of Registers		CRC	
		HB	LB	HB	LB	LB	HB
XX	10	XX	XX	XX	XX	XX	XX

The supported addresses can be found in the datasheet and in the operation manual of the specific E+E device.

### 6.1 Example: Write pressure compensation value

Set the pressure compensation to 1013.25 mbar (address 0x1388, decimal 5000). The byte order of the floating point value is specified in section 7.2.

Modbus Address	Function Code	Starting Address		Quantity of Registers		Byte Count	2 Registers (4 byte)				CRC	
		HB	LB	HB	LB						LB	HB
XX	10	13	88	00	02	04	49	9a	44	7d	XX	XX

Response from the E+E Modbus device:

Modbus Address	Function Code	Starting Address		Quantity of Registers		CRC	
		HB	LB	HB	LB	LB	HB
XX	10	13	88	00	02	XX	XX

## 7 Data encoding of float values

The Modbus standard allows for flexible word order, values larger than 16 bits, such as floating point values (32 bit and 64 bit).

### 7.1 IEEE 754 format

The IEEE standard definition of single precision floating point values (32 bit, float).

SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
Byte 1	Byte 2	Byte 3	Byte 4

The IEEE standard definition of double precision floating point values (64 bit, double).

SEEEEEEE	EEEEMMMM	MM...M	MM...M	MM...M	MM...M	MM...M	MM...M
Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

	Description	Single precision	Double precision
S	Sign	1 bit	1 bit
E	Exponent	8 bit	11 bit
M	Mantissa	23 bit	52 bit

## 7.2 Modbus floating point format

E+E devices use the Modbus floating point formats. For the single precision format the byte pairs 1, 2 and 3, 4 are inverted as follows.

MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
Byte 3	Byte 4	Byte 1	Byte 2

For the double precision format the byte pairs from 1 to 8 are inverted as follows.

MM...M	MM...M	MM...M	MM...M	MM...M	MM...M	SEEEEEEE	EEEEMMMM
Byte 7	Byte 8	Byte 5	Byte 6	Byte 3	Byte 4	Byte 1	Byte 2

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