
APPLICATION NOTE

AN0103

Setup via Modbus RTU for E+E Transmitters 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 numbers 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 | Communication Address | | Quantity of Coils | | CRC | |
|----------------|---------------|-----------------------|----|-------------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 01 | YY | YY | YY | YY | CC | CC |

Response from the E+E Modbus device:

| Modbus Address | Function Code | Byte Count | N * Coil Status | | CRC | |
|----------------|---------------|------------|-----------------|----|-----|----|
| | | | HB | LB | LB | HB |
| YY | 01 | YY | YY | YY | CC | CC |

2.1 Example: Reading Status

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

Request:

| Modbus Address | Function Code | Communication Address | | Quantity of Registers | | CRC | |
|----------------|---------------|-----------------------|----|-----------------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 01 | 00 | XX | 00 | 08 | CC | CC |

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 |
| YY | 01 | 01 | YY | CC | CC |

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

Request:

| Modbus Address | Function Code | Communication Address | | Quantity of Registers | | CRC | |
|----------------|---------------|-----------------------|----|-----------------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 03, 04 | YY | YY | YY | YY | CC | CC |

Response from the E+E Modbus device:

| Modbus Address | Function Code | Byte Count | N * Registers | | CRC | |
|----------------|---------------|------------|---------------|----|-----|----|
| | | | HB | LB | LB | HB |
| YY | 03, 04 | YY | YY | YY | CC | CC |

3.1 Example: Reading Temperature

This example demonstrates reading the temperature (float value) from address 0x19. A float value consists of 4 Bytes.

Request:

| Modbus Address | Function Code | Communication Address | | Quantity of Registers | | CRC | |
|----------------|---------------|-----------------------|----|-----------------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 03 | 00 | 25 | 00 | 02 | CC | CC |

Response from the E+E Modbus device:

| Modbus Address | Function Code | Byte Count | 2 Registers (4 Byte) | | | | CRC | |
|----------------|---------------|------------|----------------------|----|----|----|-----|----|
| | | | HB | LB | HB | LB | LB | HB |
| YY | 03 | 04 | YY | YY | YY | YY | CC | CC |

4 Packet format for write coil code 0x05

Request:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 05 | YY | YY | YY | YY | CC | CC |

Response from the E+E Modbus device:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 05 | YY | YY | YY | YY | CC | CC |

The supported 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 | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 06 | YY | YY | YY | YY | CC | CC |

Response from the E+E Modbus device:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 06 | YY | YY | YY | YY | CC | CC |

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 and address 0x00.

Request:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| XX | 06 | 00 | 00 | 00 | YY | CC | CC |

XX...current Modbus address

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

Response from the E+E Modbus device:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| XX | 06 | 00 | 00 | 00 | YY | CC | CC |

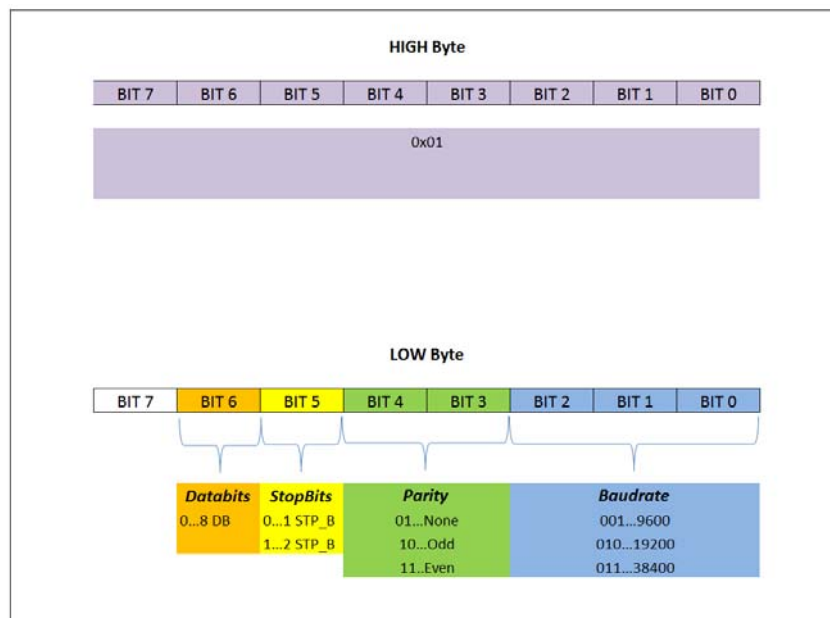
Please note: The register of slave ID and of baud rate cannot be read by any function code!

5.2 Example: Changing the communication settings

The baud rate, parity and stop bit can be changed using the 0x06 function code and address 0x01.

Request:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 06 | 00 | 01 | 01 | YY | CC | CC |



Response from the E+E Modbus device:

| Modbus Address | Function Code | Communication Address | | Register Value | | CRC | |
|----------------|---------------|-----------------------|----|----------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 06 | 00 | 01 | 01 | YY | CC | CC |

Note: The register of baud rate cannot be read!

6 Packet format for write multiple function code 0x10

Request:

| Modbus Address | Function Code | Communication Address | | Quantity of Registers | | Byte Count | N * Register Values | | CRC | |
|----------------|---------------|-----------------------|----|-----------------------|----|------------|---------------------|----|-----|----|
| | | HB | LB | HB | LB | | HB | LB | LB | HB |
| YY | 16 | YY | YY | YY | YY | YY | YY | YY | CC | CC |

Response from the E+E Modbus device:

| Modbus Address | Function Code | Communication Address | | Quantity of Registers | | CRC | |
|----------------|---------------|-----------------------|----|-----------------------|----|-----|----|
| | | HB | LB | HB | LB | LB | HB |
| YY | 16 | YY | YY | YY | YY | CC | CC |

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

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).

7.1 IEEE 754 format

The IEEE standard definition of floating point values:

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

S ... Sign
 E ... Exponent
 M ... 23 Bit Mantissa

7.2 Modbus floating point format

E+E devices use the Modbus floating point 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 |

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