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»Product: SMT100
»Interface: RS485
(Modbus)

» Application Note AN002
SMT100 Modbus Quickstart
Guide

english



Application Note AN002

Introduction

The SMT100 is a soil moisture sensor capable of measuring soil moisture and soil temperature. The SMT100 is available with a RS485 Modbus interface with the following configuration.

Modbus configuration

The SMT100 Modbus uses the Modbus RTU protocol for communication with these settings:

Baudrate: 9600

Number of data bits 8

Parity: Even

Number of stop bits 1

Broadcast address: 253

Slave address: 1-247 (configurable)

Recommended

minimum timeout 500 ms (read holding register command starts measurement, measurement value is returned)

Holding register 0: 16-Bit unsigned temperature value

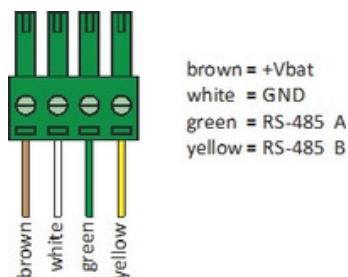
Holding register 1: 16-Bit unsigned soil moisture value (volumetric water content)

Holding register 2: 16-Bit unsigned permittivity value (dielectric coefficient)

Holding register 3: 16-Bit unsigned count value (raw measurement data)

For conversion formulas of 16-Bit values into physical parameters see examples below

Connector pin assignment SMT100



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Modbus slave address information

Each sensor has two addresses:

- broadcast address (253)
- unique slave address (1-247)

The broadcast address is 253 for all sensors. Therefore connect only one sensor at a time to the bus when using the broadcast address. The broadcast address can be used for reading from and writing to a single sensor when its address is unknown.

The unique slave address can be set using the broadcast address when a single sensor is on the bus. The unique slave address is also used for reading data from several sensors sharing the bus each with a unique slave address.

Modbus examples

The following communication examples are explained in detail

- Read temperature value from SMT100 sensor via broadcast address 253
- Read soil moisture value from SMT100 sensor via sensor address 1
- Read permittivity (dielectric coefficient) from SMT100 sensor via sensor address 1
- Read count value (raw measurement data) from SMT100 sensor via sensor address 1
- Change Modbus address of SMT100 sensor

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Read temperature value from SMT100 sensor via broadcast address 253

Full Modbus communication represented in hexadecimal numbers:

```
Master      -->   SMT100      :   FD0300 0000 0190 36
SMT100      -->   Master       :   00030231 FD51 95
```

Explanation of telegram from Master to SMT100 (request):

0xFD = Address of SMT100-Modbus sensor (0xFD = 253 decimal)
0x03 = Modbus function (0x03 = "Read Holding Registers")
0x00 00= Start address (in SMT100 Modbus the temperature is at address 0x0000)
0x00 01= Number of registers to read (temperature value is one 16-bit register)
0x90 36= CRC16 checksum over Modbus telegram according to Modbus specification

Explanation of telegram from SMT100 to Master (response):

0x00 = Address of SMT100-Modbus sensor (0x00 was stored as address)
0x03 = Modbus function (0x03 = "Read Holding Registers")
0x02 = Number of following databytes
0x31 FD= 16-bit temperature value (example: 0x31FD = 12797 dec. = 27.97 °C)
0x51 95= CRC16 checksum over Modbus telegram according to Modbus specification

Equation: temperature [°C]= (16Bit_temperature_value / 100)-100

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Read soil moisture value from SMT100 sensor via sensor address 1

Full Modbus communication represented in hexadecimal numbers:

```
Master      -->   SMT100      :   010300 0100 01D5 CA
SMT100      -->   Master      :   0103020D 70BD 30
```

Explanation of telegram from Master to SMT100 (request):

0x01 = Address of SMT100-Modbus sensor (0x01 = 1 decimal)
0x03 = Modbus function (0x03 = "Read Holding Registers")
0x00 01= Start address (in SMT100 Modbus the soil moisture is at address 0x0001)
0x00 01= Number of registers to read (soil moisture value is one 16-bit register)
0xD5 CA= CRC16 checksum over Modbus telegram according to Modbus specification

Explanation of telegram from SMT100 to Master (response):

0x01 = Address of SMT100 Modbus sensor (0x01 was stored as address)
0x03 = Modbus function (0x03 = "Read Holding Registers")
0x02 = Number of following databytes
0x0D 70= 16-bit soil moisture value (example: 0x0D70 = 3440 dec. = 34.40 vol.%)
0xBD 30= CRC16 checksum over Modbus telegram according to Modbus specification

Equation: soil moisture [vol.%]= (16Bit_soil_moisture_value / 100)

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Read permittivity (DK) from SMT100 sensor via sensor address 1

Full Modbus communication represented in hexadecimal numbers:

```
Master      -->   SMT100      :    01 0300 0200 0125 CA
SMT100      -->   Master       :    01030205 F0BB 50
```

Explanation of telegram from Master to SMT100 (request):

0x01 = Address of SMT100-Modbus sensor (0x01 = 1 decimal)
0x03 = Modbus function (0x03 = "Read Holding Registers")
0x00 02= Start address (in SMT100 Modbus the permittivity is at address 0x0002)
0x00 01= Number of registers to read (counts value is one 16-bit register)
0x25 CA= CRC16 checksum over Modbus telegram according to Modbus specification

Explanation of telegram from SMT100 to Master (response):

0x01 = Address of SMT100 Modbus sensor (0x01 was stored as address)
0x03 = Modbus function (0x03 = "Read Holding Registers")
0x02 = Number of following databytes
0x05 F0= 16-bit counts value (example: 0x05F0 = 1520 dec. ==> DK = 15.20)
0x BB 50= CRC16 checksum over Modbus telegram according to Modbus specification

Permittivity: Relative dielectric constant (DK) of the medium around the sensor

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Read count value from SMT100 sensor via sensor address 1

Full Modbus communication represented in hexadecimal numbers:

Master --> SMT100 : 010300 0300 0174 0A

SMT100 --> Master : 0103024E CEOC 70

Explanation of telegram from Master to SMT100 (request):

0x01 = Address of SMT100 Modbus sensor (0x01 = 1 decimal)

0x03 = Modbus function (0x03 = "Read Holding Registers")

0x00 03= Start address (in SMT100-Modbus the counts value is at address 0x0003)

0x00 01= Number of registers to read (counts value is one 16-bit register)

0x74 0A= CRC16 checksum over Modbus telegram according to Modbus specification

Explanation of telegram from SMT100 to Master (response):

0x01 = Address of SMT100 Modbus sensor (0x01 was stored as address)

0x03 = Modbus function (0x03 = "Read Holding Registers")

0x02 = Number of following databytes

0x4E CE= 16-bit count value (example: 0x4ECE = 20174 dec. = 20174 counts)

0x0C 70= CRC16 checksum over Modbus telegram according to Modbus specification

Counts: Raw measurement signal of the sensor, not calibrated, not used in normal applications, for scientific purpose or special calibration only!

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Change modbus address of SMT100 sensor from 1 (current address) to 2 (new address)

Full Modbus communication represented in hexadecimal numbers:

Master --> SMT100 : 010600 0400 0249 CA

SMT100 --> Master : 010600 0400 0249 CA

Explanation of telegram from Master to SMT100 (request):

0x01 = Current address of SMT100 Modbus sensor (0x01 = 1 decimal)

0x06 = Modbus function (0x06 = "Write Single Register")

0x00 04= Register address (in SMT100 Modbus the address is stored at 0x0004)

0x00 02= New Modbus address (0x00 02 = 2 dec.) which has to be stored in sensor

0x49 CA= CRC16 Checksum over Modbus telegram according to Modbus specification

Explanation of telegram from SMT100 to Master (response): simple echo of the telegram !

0x01 = current address of SMT100-Modbus sensor (0x01 = 1 decimal)

0x06 = Modbus function (0x06 = "Write Single Register")

0x00 04= Register-Address (in SMT100-Modbus the address is stored at 0x0004)

0x00 02= New Modbus-Address (0x00 02 = 2 dec.) which has to be stored in sensor

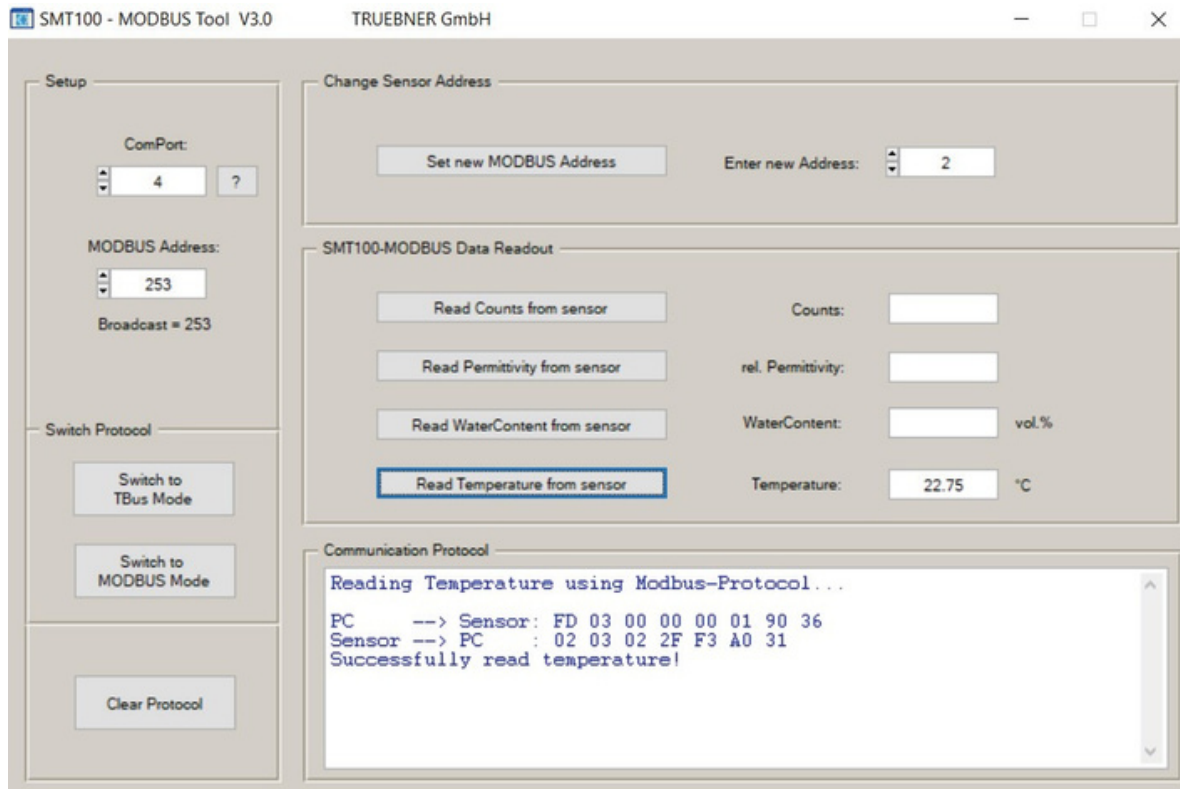
0x49 CA= CRC16 checksum over Modbus telegram according to Modbus specification

Important: In SMT100-Modbus the fixed broadcast address of all sensors is 253 ! Each single sensor can always be addressed by the address 253, independent of the stored individual sensor address. The broadcast address 253 cannot be altered.

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SMT100-Modbus Software for communication between SMT100 and PC

TRUEBNER GmbH provides a free PC software (Windows installer) for communication with the sensor SMT100 via Modbus. The software can be used to read out measurement values and for changing the Modbus address of the SMT100 sensor. The software can also be used to switch between TBUS and Modbus mode. When using the broadcast address 253 only one sensor shall be connected at a time.



Required Hardware and Setup

