



- » Product: SMT100
- » Interface: RS485 (Modbus)

## » Application Note AN002

### SMT100 Modbus Quickstart Guide

english



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### 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:

<i>Baudrate:</i>	<i>9600</i>
<i>Number of data bits</i>	<i>8</i>
<i>Parity:</i>	<i>Even</i>
<i>Number of stop bits</i>	<i>1</i>
<i>Broadcast address:</i>	<i>253 (this address is fixed and cannot be altered by the user)</i>
<i>Holding register 0:</i>	<i>16-Bit unsigned temperature value</i>
<i>Holding register 1:</i>	<i>16-Bit unsigned soil moisture value (volumetric water content)</i>
<i>Holding register 2:</i>	<i>16-Bit unsigned permittivity value (dielectric coefficient)</i>
<i>Holding register 3:</i>	<i>16-Bit unsigned count value (raw measurement data)</i>

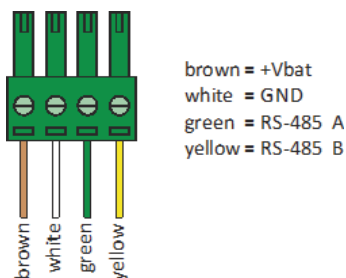
*For conversion formulas of 16-Bit values into physical parameters see examples below*

### 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

### Connector pin assignment SMT100



### Read temperature value from SMT100 sensor via broadcast address 253

Full Modbus communication represented in hexadecimal numbers:

Master        -->    SMT100        :        FD 03 00 00 00 01 90 36  
SMT100       -->    Master        :        00 03 02 31 FD 51 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**

### Read soil moisture value from SMT100 sensor via sensor address 1

Full Modbus communication represented in hexadecimal numbers:

Master        -->    SMT100        :        01 03 00 01 00 01 D5 CA  
SMT100       -->    Master        :        01 03 02 0D 70 BD 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)**

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

Full Modbus communication represented in hexadecimal numbers:

Master        -->    SMT100        :        01 03 00 02 00 01 25 CA  
SMT100       -->    Master        :        01 03 02 05 F0 BB 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**

### Read count value from SMT100 sensor via sensor address 1

Full Modbus communication represented in hexadecimal numbers:

```
Master      -->   SMT100      :   01 03 00 03 00 01 74 0A
SMT100      -->   Master       :   01 03 02 4E CE 0C 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!

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

Full Modbus communication represented in hexadecimal numbers:

Master            -->    SMT100            :        01 06 00 04 00 02 49 CA  
SMT100           -->    Master            :        01 06 00 04 00 02 49 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

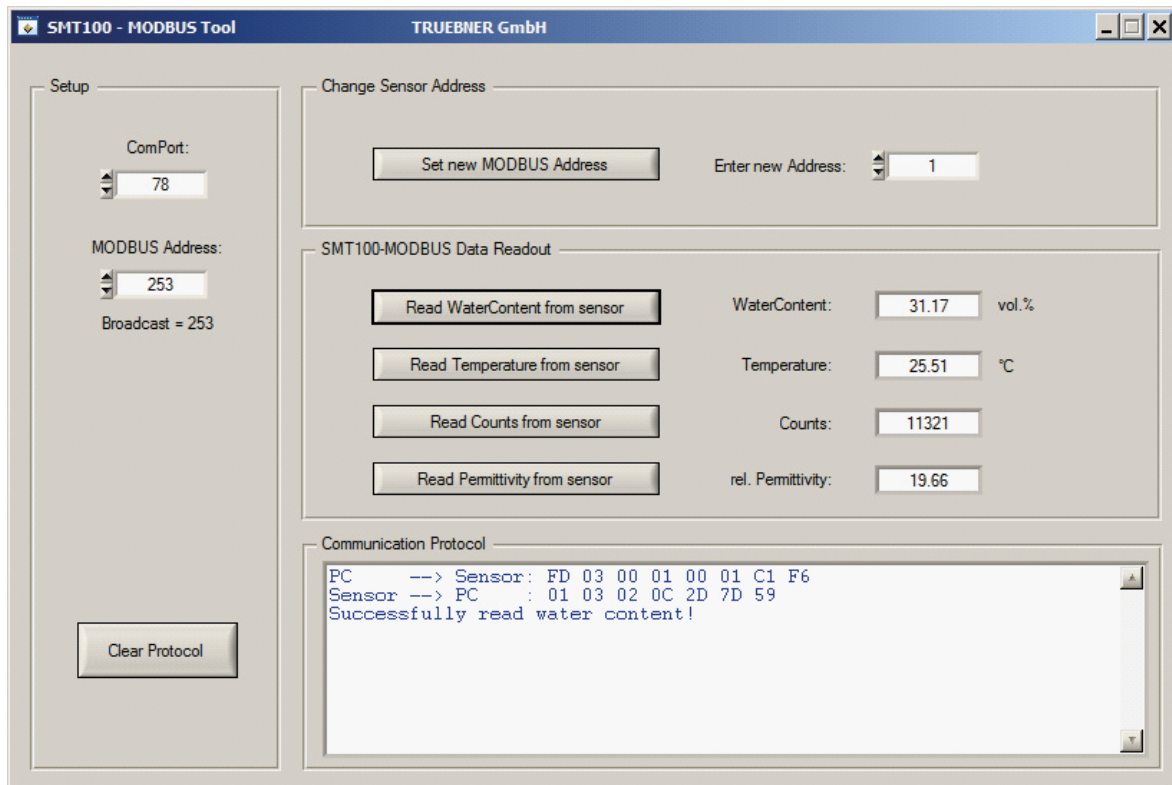
Explanation of telegram from SMT100 to Master (response): simple echo of the telegram !

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.**

## 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.



## Required Hardware and Setup

