



SMT 100

Modbus Quickstart Guide

Interface: RS485 (Modbus)



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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>Parity:</i>	<i>Even</i>
<i>Broadcast address:</i>	<i>253 (this address is fixed and cannot be altered by the user)</i>
<i>Register 0:</i>	<i>16-Bit temperature value (°C)</i>
<i>Register 1:</i>	<i>16-Bit soil moisture value (volumetric water content)</i>
<i>Register 2:</i>	<i>16-Bit permittivity value (dielectric coefficient)</i>
<i>Register 3:</i>	<i>16-Bit count value (raw measurement data)</i>

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

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.