

TerraSense

Soil Moisture and Soil Temperature Sensor

PS-0050-JB PS-0089-EG PS-0055-FC

Soil moisture and temperature sensor

- Water volumetric Content measurement
- Operating principle: FDR dielectric constant measurement
- Soil temperature measurement
- Output modes: WSCOMM, MODBUS RTU, voltage (0-1 V), current (4-20 mA)
- Factory calibration for each individual sensor
- No metal parts exposed
- Robust, immersion proof and compatible with field operations

APPLICATIONS:

- Irrigation management
- Precision Agriculture
- Soil Temperature monitoring



Description

The TerraSense sensor, combining the measurement of temperature and soil moisture, is now produced in a new version with a number of innovative features.

Each sensor can be configured in four output modes: RS485 WSCOMM, RS485 MODBUS, voltage output (0-1V) and current output (4-20 mA).

The sensor measures the volumetric amount of water present in the soil surrounding by measuring the relative dielectric constant.

Each measurement is done after a calibration of the internal sensor, carried out automatically, aiming at removing any error or inaccuracy due to temperature changes or to natural decay of the components.

The innovative "4-fork" design is specially designed to obtain more accurate measurements.

The special manufacturing technique covers the sensor with a protective layer, to make it immune to effects of ions and dissolved salts in the soil. The sensor can be integrated with the wireless units of VineSense™ stations, MeteoSense™ and MeteoSense PRO™.

TerraSense

Soil Moisture and Soil Temperature Sensor

PS-0050-JB PS-0089-EG PS-0055-FC

Technical specification:

Size: 50 x 141 (cable not included)
Electrode thickness: 1,5 mm
Material: vetronite, ABS and epoxy resin
Environmental protection: IP67
Standard cable length: 300 cm (other length on request)

The sensor performs a self-calibration before each measurement to minimize reading errors.
The sensor output is also already corrected for thermal variations of the soil.

Water volume Content (WVC) measurement:

Operating range: - 40 + 60 °C
Accuracy: <2 % (from 0% to 50%)
Resolution: 0.1 %
Output: from 0% to saturation

Soil temperature measurement:

Accuracy : 1 %
Resolution : 0.1 ° C
Output range: - 20 + 50 ° C

Electrical specification and wiring:

	OUTPUT MODE			
	RS485	4-20mA(1 Out)	4-20mA(2 Outs)	0-1V
Power supply MAX(V):	18	15	12	15
Power supply MIN(V):	3.5			
Output load Min:	-	47 Ohm	5000 Ohm	
Output load typical:	120 Ohm	56 Ohm	10000 Ohm	
Output load Max:	-	100 Ohm	50000 Ohm	
Supply current Max (mA)	< 60 mA			
Wiring				
WHITE	GROUND			
BROWN	VCC			
GREEN	RS485 B			
YELLOW	RS485 A			
BLUE	GROUND			
GREY	SOIL WVC ANALOG OUTPUT			
PURPLE	SOIL TEMP ANALOG OUTPUT			

WARNING: Pay attention in correctly connecting the power cables, reverse polarity could affect the integrity of the sensor and cause irreversible damage.

Conversion formulas (analog output versions):

4 - 20mA	$WVC(\%) = (I_{out}(mA) - 4mA) / 0,2$
	$Soil\ Temp(^\circ C) = ((I_{out}(mA) - 4mA) / 0,228571) - 20$
0 - 1V	$WVC(\%) = (V_{out}(V) - 0,05V) / 0,011875$
	$Soil\ Temp(^\circ C) = ((V_{out}(V) - 0,05V) / 0,013571428) - 20$

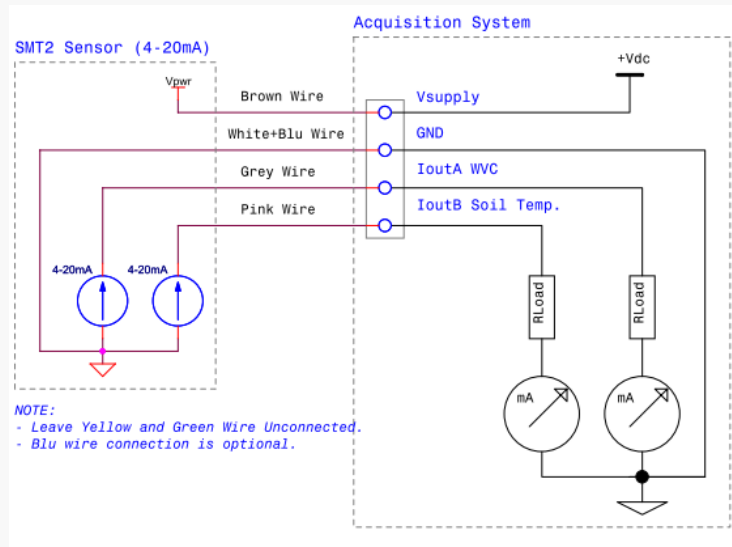
TerraSense

Soil Moisture and Soil Temperature Sensor

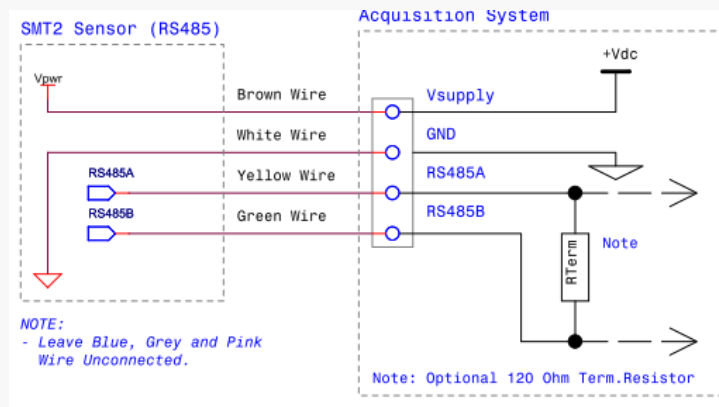
PS-0050-JB PS-0089-EG PS-0055-FC

Wiring diagram

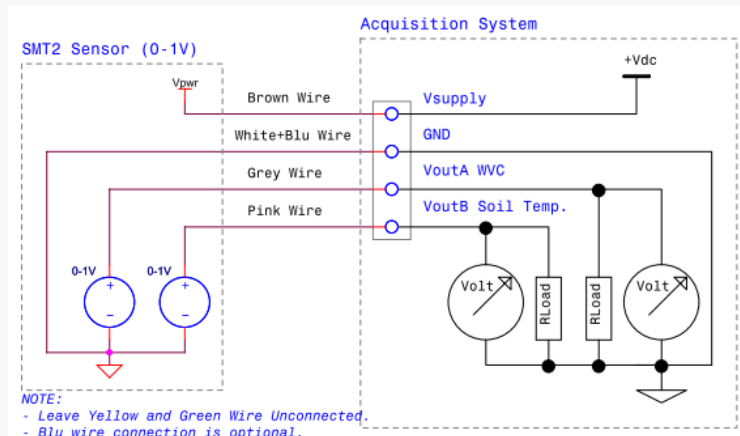
4-20 mA version



RS485 version



0-1 V version



TerraSense

Soil Moisture and Soil Temperature Sensor

PS-0050-JB PS-0089-EG PS-0055-FC

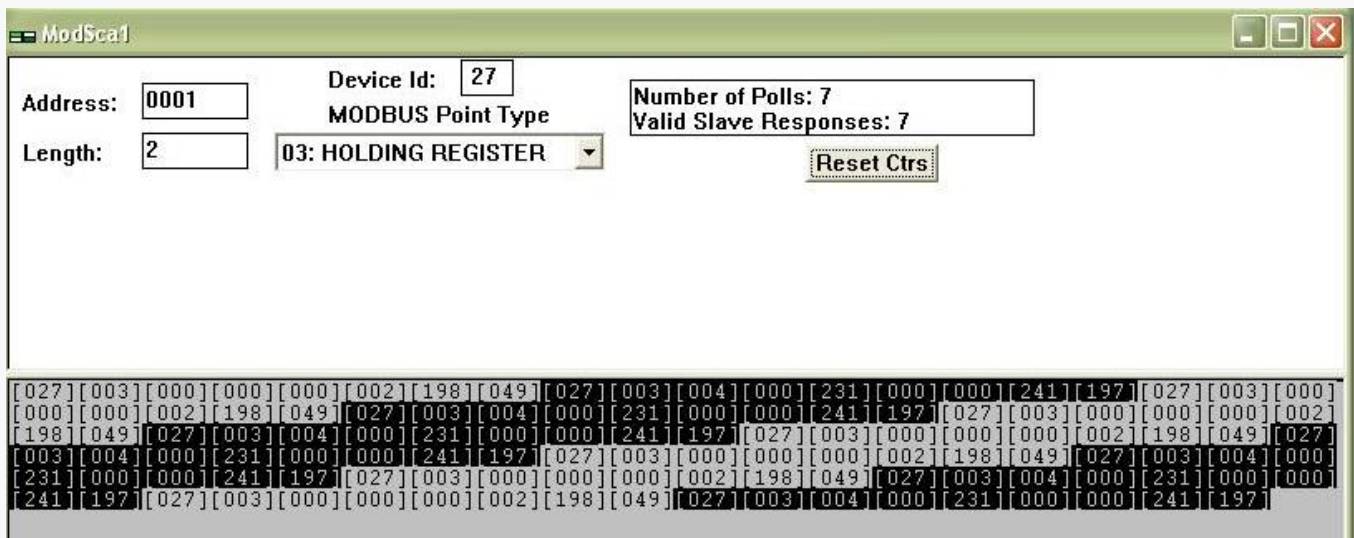
RTU Modbus configuration:

TerraSense sensor may be ordered in RTU Modbus – RS485 version. Configuration parameters as follows:

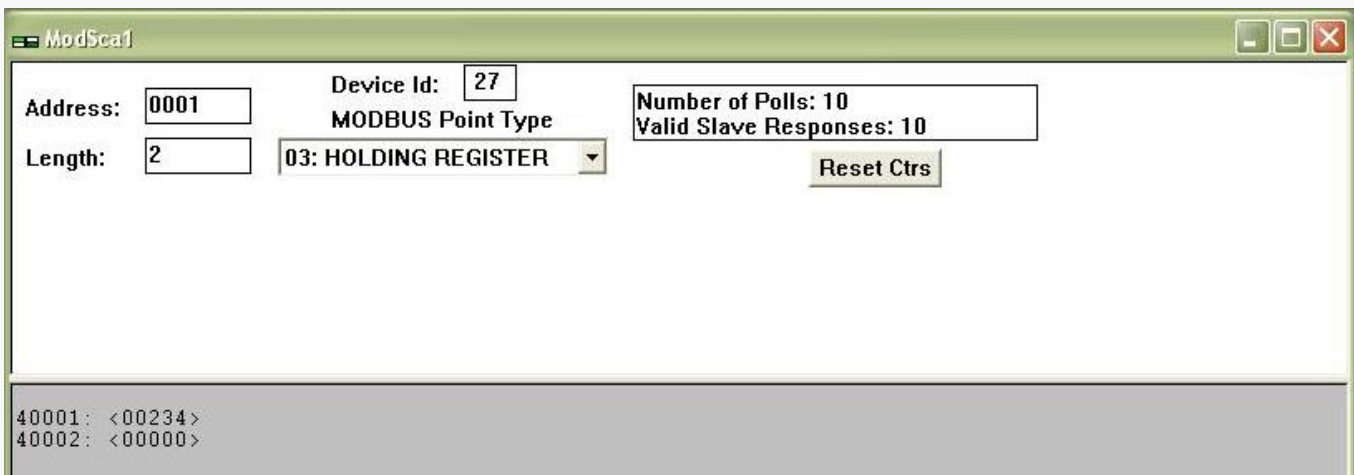
- Serial interface: 115200,n,8,1
- Modbus device ID: 27
- Data registers: from register 1 to 10, UINT16 (0x0000 > 0xFFFF)
- Output data conversion:
Channel 1: temperature x 10
Channel 2: WVC x 100

Example:

Channel 1, value 201 > T=20.1°C
Channel 2, value 1817 > WVC=18.17%



Example screenshot: the MODBUS Master request (Grey) and TerraSense response (black)



Example screenshot: MODBUS registers read out (T=23.4 °C, WVC=0.00%)

TerraSense

Soil Moisture and Soil Temperature Sensor

PS-0050-JB PS-0089-EG PS-0055-FC

Experimental results:

In the following table the results of laboratory test conducted at Università di Pisa – Dipartimento di Biologia delle Piante Agrarie are reported.

Soil type	Error at FP	Error at 1/3	Error at 2/3	Error at FC	Average error
Sandy	2.39%	1.97%	2.52%	1.49%	2.09%
Silty	2.89%	2.43%	2.02%	1.42%	2.19%
Clay	1.85%	0.89%	0.67%	0.25%	0.92%
Total average					1.76%

Note:

Results processed through Topp regression (implemented in the instrument).

The tests were conducted with nutrient solutions with conductivity values between 0 and 4 dS / m.

Installation:

The soil moisture and soil temperature sensor is designed to be installed in the soil at different depths to measure the percentage volume of water present in the surface or deep layers around the root system of plants.

Thanks to the plastic housing that covers the electronics and special insulating paint coating, the sensor is completely sealed and immune to attacks and dissolved salts in the soil.

- For proper operation, during installation you must take care to meet the following requirements:
Drill a hole in the soil depth to be achieved and a diameter of 20 cm.
- Grasp the sensor from the plastic (cable side) and insert the sensor into the side of the hole, making it fully penetrate into the ground.
- Ensure that the sensor will not cause water stagnation
- Take care that the earth adheres to the sensor, to ensure uniformity of measurement.
- Only in the case of ground very dry, moisten with water.
- Cover the sensor with the ground up to fill the hole.

In case of mechanized operations, please signal the sensor position in order to allow operators to avoid damaging the sensor.

Traceability, packaging and shipping:

Each sensor is individually tested and a unique serial number identification is assigned, which allows tracking over time; this code can be printed on the shipping carton, on the sensor itself or alternatively on the appropriate section of the user manual. Please keep this code carefully, to be communicated to the technician in case of failure or replacement.

The sensors are sold individually equipped with its own package, which will protect the sensor during transport.

If the box is open or visibly damaged, don't accept delivery by courier. Do not open the box with knives, cutter blades, which could damage the sensor or its cable.

Ordering codes:

PS-0050-JB	Soil moisture and temperature sensor, RS485 (WSCOMM), cable 3 m.
PS-0050-JB-M	Soil moisture and temperature sensor, RS485 (MODBUS), cable 3 m.
PS-0089-EG-1	Soil moisture and temperature sensor, 4-20 mA, cable 3 m.
PS-0089-EG-2	Soil moisture and temperature sensor, 0-1 V, cable 3 m.
PS-0055-FC	Soil moisture and temperature sensor, HandySense version, cable 3 m.

TerraSense

Soil Moisture and Soil Temperature Sensor

PS-0050-JB PS-0089-EG PS-0055-FC

Warranty:

Netsens s.r.l. warrants that the above described components will be free from defects in material and workmanship for the following time period from the purchasing:

- Two years for items purchased by final users for non professional use;
- One year for items purchased by companies and organizations for professional use.

This warranty is valid only if all the components are used accordingly to the Manufacturer's indication and to the recommendations included in this User Manual.

This warranty does not cover: batteries, fuses, lights and any other consumable equipment. Also this warranty does not apply for damages due to neglect, misuse, contamination, alteration, accident or abnormal conditions of operation or handling, including failures caused by use outside Manufacturer specifications.

This warranty covers the original purchaser and it is not transferable.

If one or more components are supposed to be defective, contact Netsens s.r.l. or your local reseller in order to obtain a valid return authorization.

Netsens s.r.l. shall not be liable for any special, indirect, incidental or consequential damages or losses, arising from any cause.

Please contact Netsens s.r.l. for any additional information concerning warranty.

Disposal of Waste Electrical & Electronic Equipment:



The symbol (crossed out wheeled-bin) on your product indicates that the product shall not be mixed or disposed with your household waste at their end of use.

The product shall be handed over to your local community waste collection point for recycling of the product.

For more information, please contact your Government Waste Disposal department in your country.

Inappropriate waste handling could possibly have a negative effect on the environment and human health due to potential hazardous substances.

With your cooperation in the correct disposal of this product, you contribute to reuse, recycle and recover the product and our environment will be protected.

Revisions:

Date	Version	Page(s)	Notes
22-12-2009	1.0	1-3	First Release
16-07-2012	1.1	1-4	Analog version
08-07-2014	1.2	1-4	Multi output mode
09-12-2014	1.3	1-5	Details on RTU mode
18-01-2016	1.4	1-5	7 wires wiring
18-07-2017	1.5	2	Analog output formulas
09-10-2017	1.6	3-6	Modbus examples; ordering codes table update

© Copyright Netsens s.r.l. 2008-2017
COD. DCO0285906I