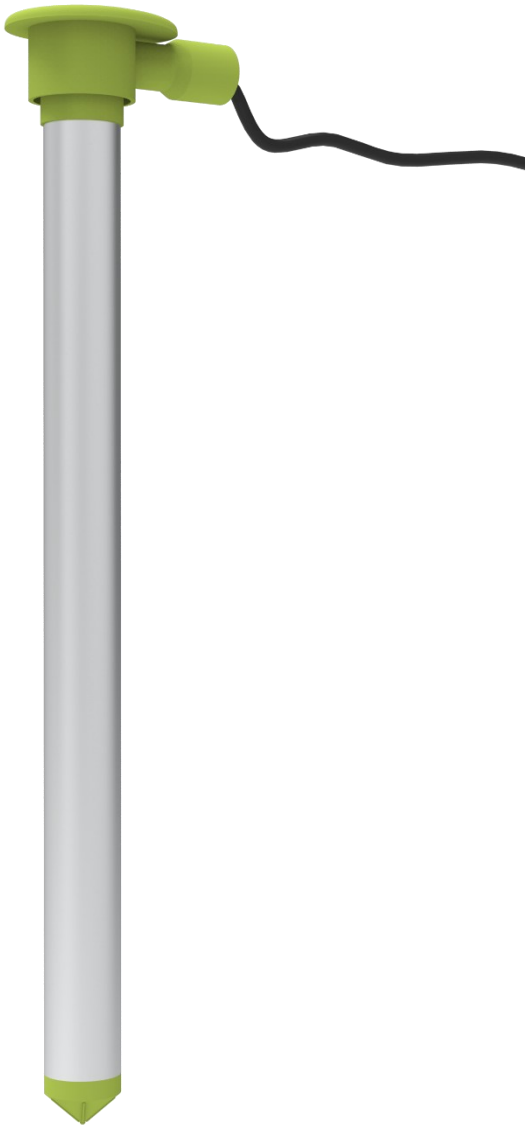
100 years Since 1925 SIAP+MICROS Environmental Monitoring Solutions

t003t – SMP

Soil Moisture Profiler



User Manual (V.03)

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1 STATEMENT OF COMPLIANCE

1.1 ELECTRO-MAGNETIC COMPLIANCE

The sensor has been tested and found to comply with the limits for digital devices in this class, in accordance with the requirements of CE standards. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to other radio communications.

1.2 EMC APPROVALS

The probe moisture sensor has been tested and found to comply with the following EMC guidelines:

EMISSIONS:

- ETSI EN 300 220-2 V2.4.1
- 47 CFR 15C - RSS 210
- 47 CFR 15C – 15.247 (a)(2), (b)(3), (d), (e)
- 47 CFR 15C – 15.31(e)
- 47 CFR 15B – 15.109 (Class B)
- AS/NZ 4268 (2012)
- CISPR (Class B) radiated and conducted emissions

1.3 IMMUNITY TESTING: ETSI EN 301 489-3 V1.4.1 / ESTI EN 302 489-1 V1.9.2

- Radiated Immunity - EN 61000-4-2/3/4/5/6

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Probes are intended to operate buried in the soil. If operated in free air, it may cause interference to radio communication devices. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) the device may not cause interference, and
(2) the user of the device must accept any interference received, even if the interference is likely to compromise the functioning.

Changes or modifications made to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide

reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

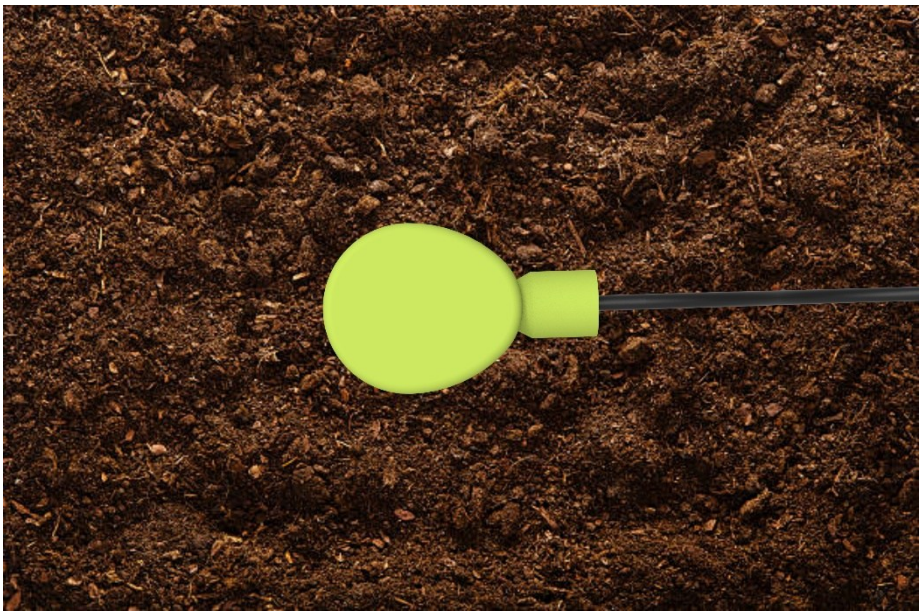
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

2 FOREWORD - SUBSURFACE AND CLASSIC PROBES

Siap+Micros offers a wide range of underground (below ground) and classic (above ground) probes. Below is a table showing the standard depth and distance of the sensors.

	Probe Length (mm)	Probe Length (inch)	Sensors (n)	SKU #	100mm (4")	200mm (8")	300mm (12")	400mm (16")	500mm (20")	600mm (24")	700mm (28")	800mm (32")	900mm (36")	1000mm (40")	1100mm (44")	1200mm (48")	1300mm (52")	1400mm (56")	1500mm (60")	1600mm (64")
1	200mm	8"	2	11XX-0202	●	●														
2	400mm	16"	2	11XX-0204	–	●	–	●												
3	400mm	16"	4	11XX-0404	●	●	●	●												
4	600mm	24"	4	11XX-0406	●	●	–	●	–	●										
5	600mm	24"	6	11XX-0606	●	●	●	●	●	●										
6	800mm	32"	4	11XX-0408	–	●	–	●	–	●	–	●								
7	800mm	32"	6	11XX-0608	●	●	●	●	–	●	–	●								
8	800mm	32"	8	11XX-0808	●	●	●	●	●	●	●	●								
9	1000mm	40"	6	11XX-0610	●	●	–	●	–	●	–	●	–	●						
10	1000mm	40"	8	11XX-0810	●	●	●	●	●	●	–	●	–	●						
11	1000mm	40"	10	11XX-1010	●	●	●	●	●	●	●	●	●	●						
12	1200mm	48"	6	11XX-0612	–	●	–	●	–	●	–	●	–	●	–	●				
13	1200mm	48"	8	11XX-0812	●	●	●	●	–	●	–	●	–	●	–	●				
14	1200mm	48"	10	11XX-1012	●	●	●	●	●	●	●	●	–	●	–	●				
15	1200mm	48"	12	11XX-1212	●	●	●	●	●	●	●	●	●	●	●	●				
16	1400mm	56"	8	11XX-0814	●	●	–	●	–	●	–	●	–	●	–	●	–	●		
17	1400mm	56"	10	11XX-1014	●	●	●	●	●	●	–	●	–	●	–	●	–	●		
18	1400mm	56"	12	11XX-1214	●	●	●	●	●	●	●	●	●	●	–	●	–	●		
19	1400mm	56"	14	11XX-1414	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
20	1500mm	60"	15	11XX-1515	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
21	1600mm	64"	8	11XX-0816	–	●	–	●	–	●	–	●	–	●	–	●	–	●	–	●

● SENSOR AT THIS DEPTH – NO SENSOR



3 OVERVIEW AND OPERATIONAL DESCRIPTION

The Subsurface and Classic probe ranges are supplied with wire ends or connectors to communicate and power the probe. There are two hardware options: SDI and RS485. RS485 is a “special order” and must be specified on the order; it is not field changeable. There are also two software “protocols” available, SDI-12 and MODBUS. The possible configurations are thus SDI-12, SDI-12 over RS485, MODBUS over SDI or MODBUS over RS485.

Subsurface and Classic probes are provided standard with a 6m cable. On request, connectors can be fitted to the cable end, and/or the cable length can be adjusted to specific needs.

For SDI-12 and MODBUS communication protocols, please contact Siap+Micros for further information.

4 ABOUT THE CALIBRATION PROCESS

The probes was in a controlled air bath and water bath. This ensures that all probes have the same performance under the same conditions.

For V39 onwards, the sensors are calibrated to read 0 in air and 100 in water. At calibration time, this is done within +- 1%. This means a sensor may read -1 to +1 post-calibration (the controller must cope with values less than 0 and greater than 100).

If conversion is required to read moisture in volumetric units, then a “soil calibration formula” will need to be used. Users must note that soil calibrations are very specific to the particular soil type. If the user requires very accurate volumetric readings, then an “in-filed” calibration would be highly advised. A 2-point calibration for each sensor may be required (near dry or WP and near field capacity). The calibration method would depend on the soil consistency at the installed profile. Due to the variability that capacitance technology exhibits in different soil textures, it is impossible to specify an absolute accuracy for volumetric readings. However, the repeatability and resolution will follow those in the specifications. Typically, one can expect a 5% to 7% overall accuracy without further calibration, provided the calibration equation accurately reflects the soil type and the recommended installation is followed. A further caution must be added in the case where either the soil type differs down the profile or a different slurry is used – the slurry will affect the overall soil texture and cause the calibration function to be inaccurate. Using a different slurry will, however, NOT affect the probe’s performance, but keep in mind that the composition of the slurry could change over time if it is significantly different in texture to the soil around it. In this case, a follow-up re-evaluation of the management lines may be needed once the soil has settled.

5 SPECIFICATIONS

Parameter	Value or meaning
Supply Voltage (absolute maximum)	3.3V to 14V (5V to 14V for RS485, Note RS485 will function properly between 3.3V and 5V, but the driver may not achieve the EIA standard of 4000ft)
Cable or connector	Subsurface and Classic probes are supplied standard with 6M 4-core cable. Standard or customer-specific connectors can be fitted
SDI communication port	ESD protection fitted
RS485 Communication port (Order option)	ESD Protection / TIA/EIA485 compliant
Baud rate SDI-12 mode	1200 7-bit Even parity, one stop bit
Supply Current Active Read (about 2 seconds for 6 sensor probe)	23mA
Supply Current idle	<0.1mA for SDI, <0.3mA for RS485
Temperature measurement	-20 to +50 degrees centigrade
Sensor calibration	AIR (RH less than 75%) and distilled water calibrated to read 0 (+-1) in air and 100 (+-1) in water
Sensor stability	The maximum drift of 3% over the warranty period, as measured under those same calibration conditions
Sensor Resolution	Moisture 0.01 & Temp 0.1
Repeatability	Moisture 0.05 & Temp 0.2
Sensor drift with temperature.	Less than 0.1% per degree Centigrade over the range +5 °C to +40 °C

6 PROBE CABLE

6.1 HALOGEN-FREE TYPE COMMUNICATION CABLE

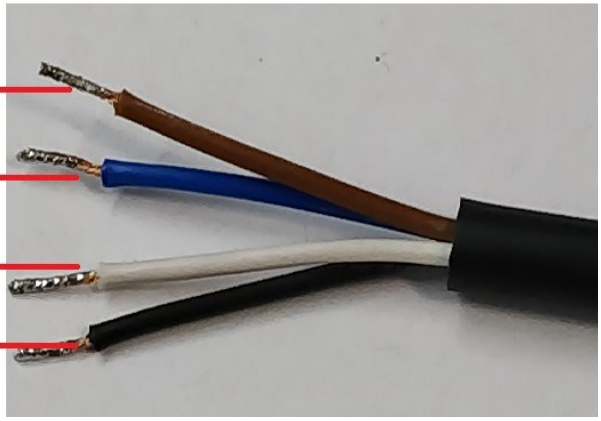
Please note: As of April 2019, Subsurface probes have moved to a halogen-free (PUR) cable and phased out the PVC cable. The following halogen-free cables are now in use:

Cable Part numbers:

- HELUKABEL Sensor-Aktor: 7023341
- HELUKABEL Sensorflex-H: 76285 or 76301
- LAPP UNITRONIC SENSOR FD: 7038884

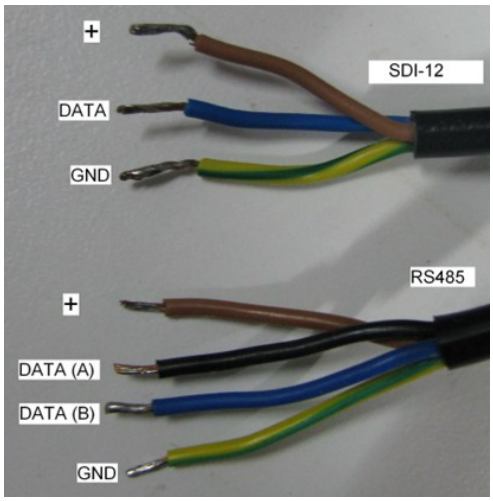
– for datasheets for these cables, please get in touch with Siap+Micros.

<table>
<tr><th rowspan="2">TELEMETRY</th><th colspan="2">PROBE</th></tr>
<tr><th>SDI</th><th>RS485</th></tr>
<tr><td>+ OUT</td><td colspan="2">+ supply to probe</td></tr>
<tr><td>SDI-12 DATA</td><td>DATA</td><td>DATA-B</td></tr>
<tr><td>COUNTER</td><td>N/C</td><td>DATA-A</td></tr>
<tr><td colspan="3">GND</td></tr>
</table>



6.2 PHASED-OUT PVC CABLE (used pre-April 2019):

Signal (PVC – Cabtyre/Alvern)		SDI-12 open ended	RS485 open ended	Classic male plug SDI	Classic male plug RS485
Supply Voltage	B	Brown	Brown	1	1
Data (or Data B)	B	Blue	Blue	2	3
Data A		-	Black	-	2
Ground		Green/Yellow	Green/Yellow	3	4



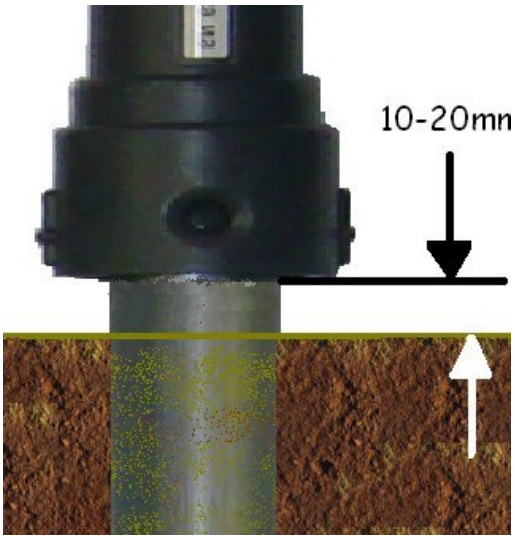
7 PROBE INSTALLATION GUIDE

7.1 DETERMINE THE CORRECT DEPTH OF THE ACCESS HOLE

Lay both the soil auger and capacitance probe flat on the ground parallel to each other and align the bottom tips. For a Sub-surface probe, locate the probe head position and make a mark about 10 to 30 mm above the head on the shaft of the soil auger. In case of a Classic probe, the position just below the probe head should be used as a reference as the head of this type of probe will be sticking out above the soil after installation. Alternatively, the correct lengths can be determined with a measurement tape and marked on the soil auger shaft as described above.

To achieve the desired sensor depths, the Sub-surface probes are installed at depths of 10-30mm below the ground surface.

Classic probes are to be installed with the lower collar 10-20mm above the ground surface.



7.2 DETERMINE THE CORRECT DEPTH OF THE ACCESS HOLE

Identify and mark the appropriate position in the field where the probe will be installed. Use the soil auger to drill the access hole to the desired depth (Figure 1). Regularly pull up the soil auger and carefully empty the excess soil into a bucket before continuing. It is important to drill the hole as straight as possible with minimal sideways movement. Where the soil is very dry and compacted, a small amount of water can be added to the hole to facilitate the process.

Figure 1. Drilling the access hole – A soil auger with 32 mm drill bit should be used. In dry compacted soils water can be added to ease the process.

7.3 PREPARING THE SLURRY MIXTURE

Excess soil collected in a bucket during the drilling process is mixed with the desired amount of water to obtain a slurry mixture which is neither too thick nor too watery (Figure 2). Remove any small stones and/ or foreign material from the mixture. Clean the entrance of the hole carefully to allow the slurry mix to easily enter and run down the hole when poured.

Figure 2. Preparing the slurry mixture – Soil collected during drilling is mixed with water to form a slurry. Carefully pour the mixture to avoid air pockets

7.4 INSTALLING THE PROBE

Give the slurry a final mix and pour it on the outside rim of the hole from where it can freely enter the hole without entrapping any air bubbles (Figure 3). Fill the hole to just below the rim and immediately insert the probe by firmly pressing down on the head of the probe. Sustain pressure until the probe is fully inserted. Remove excess slurry which has been ejected from the access hole during installation.

Figure 3. Installing the probe – Gently press down on the probe until it has reached the desired depth. Remove any access slurry.

7.5 CONCEALING THE PROBE CABLE

Use a spade to dig a shallow trench between the installed probe and the position of the data logger (Figure 4). Measure and cut an appropriate length of the conduit. Thread the probe cable through the conduit and insert one end of the conduit into the probe socket. Cover with soil and lightly compact the surface.

Figure 4. Concealing the probe cable – Make use of plastic conduit to conceal and protect the probe cable. Cover up the trench with loose soil and lightly compact.