ADU-500

Autonomous RTU/Data Logger

In situ measurement of soil moisture with SDI-12 sensors

Version: 1.0 – November 2013

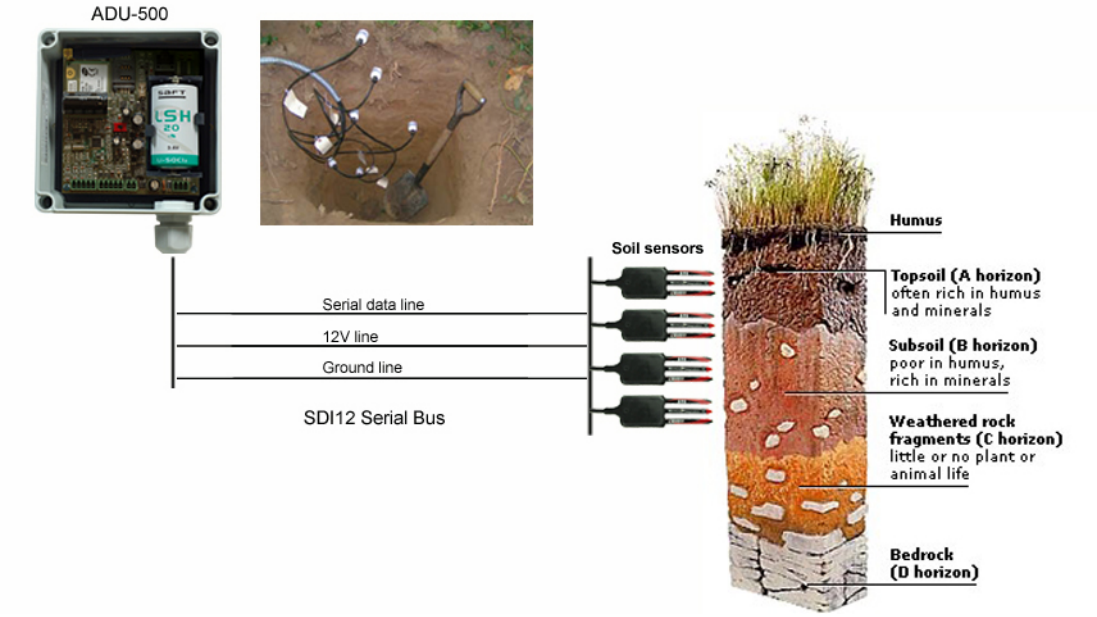
Introduction

Soil moisture measurements are important for a number of applications and for a number of different reasons. Applications include land slide studies, erosion, water shed studies, climate studies, predicting weather, flood warning, crop quality and yield optimization, irrigation, and soil remediation to name a few.

Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. Not only are farmers able to generally use less water to grow a crop, they are able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages.

In situ soil electrical conductivity monitoring is very important in agriculture because the salinity levels in soil moisture can have dramatic effects on crop health and yields. Agricultural soils over time may become sodic or saline and this may dramatically effect the health and yields of the crops. There are techniques that can remove the sodium to improve soil quality and increase crop production.

Time domain transmissometry (TDT) and time domain reflectometry (TDR) is widely used to measure soil moisture content and electrical conductivity. TDT and TDR sensors are available from many manufacturers. Most of them use the SDI-12 serial protocol, allowing for multiple sensors to be connected to a data logger via a single cable.



ADU-500 Application

ADU-500 RTU/Data Logger can address up to 9 SDI-12 soil sensors for a total of 48 measurement parameters (channels). Powered only by the internal 3.6V Lithium Thionyl battery, it can provide 12V excitation for all connected soil sensors.

The restriction for the total current draw of the SDI-12 bus is:

$(n-1)*I_{IDLE}+I_{ACT} < 200mA$, at 12V

where,

n: Nr. of sensors
I_{IDLE}: Sensor idle current (quiescent current)
I_{ACT}: Sensor active current (during measurement)

Case study

In the following example the Lithium Thionyl battery lifetime is calculated for different sensor types. ADU-500 performs data collection from 6 soil sensors according to the selected sampling rate (e.g. every 15 minutes). The sampled data is logged and sent to an internet server via FTP, according to the selected sending rate (e.g. every 6 hours).

Parameters per sensor: Moisture [wfv], Conductivity [dS/m], Temperature [°C]
Nr. of recorded channels: 18
Sampling interval: 15 minutes
Logging rate: 1 (every sample = 15 minutes)
Sending rate: 24 (every 24 logs = 6 hours)

Manufacturer	**Stevens**	**Decagon**		**Acclima**	**Campbell Scientific**	
Soil sensor	Hydra Probe II	5TE	GS3	SEN-SDI	CS650	CS655
Type	TDR	TDR	TDR	TDT	TDR	TDR
Nr. of connected sensors	6	6	6	6	6	6
I_{IDLE} [mA]	0.8	0.3	0.3	0.015	0.135	0.135
I_{ACT} [mA]	30	10	25	30	45	45
Warm up time [sec]	3	3	3	3	3	3
Measurement Time [sec]	0.5	0.15	0.15	0.45	0.003	0.003
Battery Lifetime [Years]*	**1.9**	**5.7**	**4.6**	**2.7**	**8**	**8**

*) Calculations are based on the sensor manufacturers' specifications.