Soil Moisture Probes

Overview

This procedure covers the installation and programming (Campbell CR10X) for CS615 and CS616 Water content reflectometer (soil moisture probes).

Installation

The probe can be inserted vertically into the soil surface or buried at any orientation to the surface. A probe inserted vertically will give an indication of the water content in the upper 30cm of soil. A probe installed at an angle of 30 degrees will give an indication of the water content in the upper 15cm of soil. The probe can be installed horizontal to the surface to detect the passing of wetting fronts or other water fluxes.

The probe rods should be kept as close to parallel as possible when installed to maintain the design wave guide geometry. The sensitivity of this measurement is greater in the regions closest to the rod surface than at distances away from the surface. Try to avoid air voids around the probes as this will reduce accuracy.

Logger Code

CR10X Programming for CS615

```
1:  Do (P86)
 1: 45          Set Port 5 High

2:  Period Average (SE) (P27)
 1: 1           Reps
 2: 4           200 kHz Max Freq @ 2 V Peak to Peak, Period Output
 3: 5           SE Channel
 4: 10          No. of Cycles
 5: 5           Timeout (units = 0.01 seconds)
 6: 49          Loc [ Period_SM ]
 7: 0.001       Mult
 8: 0.0         Offset

3:  Do (P86)
 1: 55          Set Port 5 Low

4:  Polynomial (P55)
 1: 1           Reps
 2: 49          X Loc [ Period_SM ]
 3: 6           F(X) Loc [ SoilM_Now ]
 4: -0.187      C0
 5: 0.037       C1
 6: 0.335       C2
 7: 0.0         C3
 8: 0.0         C4
 9: 0.0         C5

; For display

5:  Z=X*F (P37)
 1: 6           X Loc [ SoilM_Now ]
 2: 100         F
 3: 6           Z Loc [ SoilM_Now ]
```

Yellow highlight indicates a logger dependent parameter

CR10X Programming for CS616

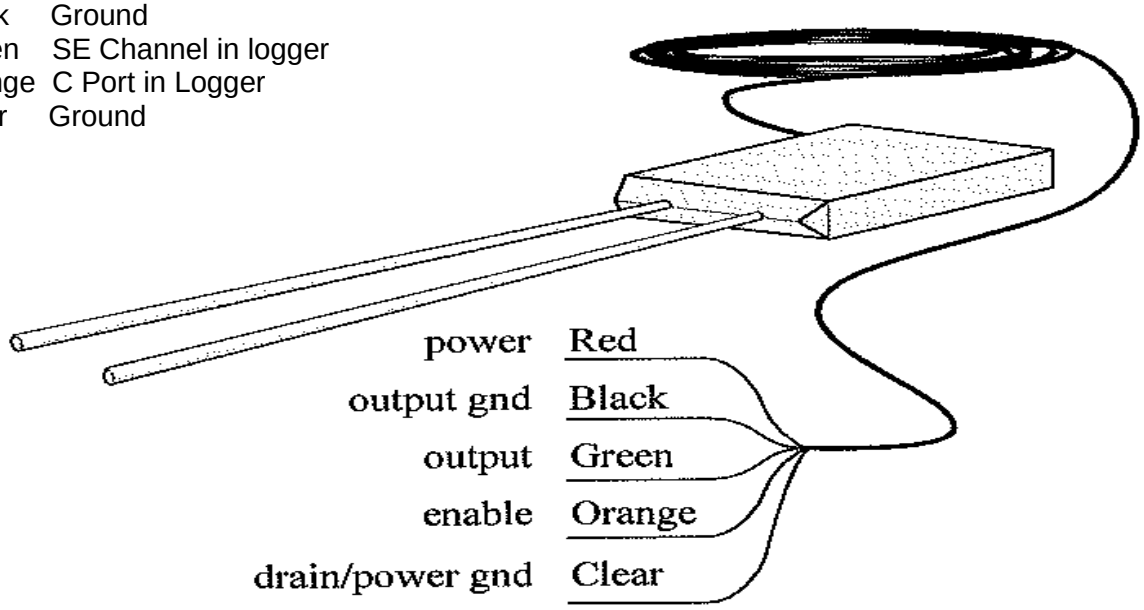
```
1:  Do (P86)
    1: 45           Set Port 5 High

2:  Period Average (SE) (P27)
    1: 1            Reps
    2: 4            200 kHz Max Freq @ 2 V Peak to Peak, Period Output
    3: 5            SE Channel
    4: 100          No. of Cycles
    5: 1            Timeout (units = 0.01 seconds)
    6: 70           Loc [ Period_SM ]
    7: 1            Mult
    8: 0.0          Offset

3:  Polynomial (P55)
    1: 1            Reps
    2: 70           X Loc [ Period_SM ]
    3: 6            F(X) Loc [ SoilM_Now ]
    4: -0.0663      C0
    5: -0.0063      C1
    6: 0.0007       C2
    7: 0.0          C3
    8: 0.0          C4
    9: 0.0          C5

4:  Do (P86)
    1: 55           Set Port 5 Low

; For display

5:  Z=X*F (P37)
 1: 6           X Loc [ SoilM_Now ]
 2: 100         F
 3: 6           Z Loc [ SoilM_Now ]
```

Yellow highlight indicates a logger dependent parameter

Soil Moisture Probes

Wiring

Red +12 Volts
Black Ground
Green SE Channel in logger
Orange C Port in Logger
Clear Ground



Operation

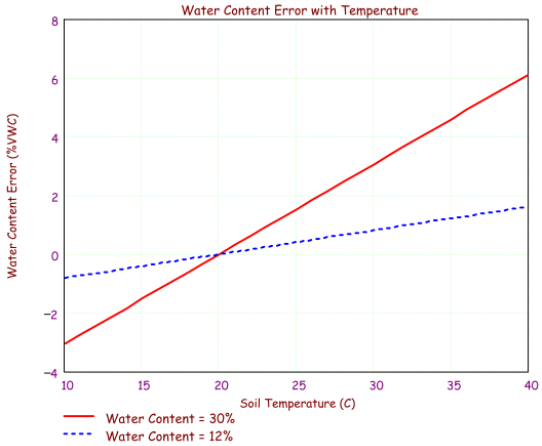
Once installed, soil moisture probes should not be moved. They give a reading relative to the point where they are installed. Consideration should be given at the time they are deployed as to whether the results are representative of the area being measured. Avoid cliffs, pools, run off area's, or flood zones. Flat ground or a small slope is preferred away from public walking areas. Protect the sensor where possible with a fence or barrier (waratah etc).

Soil Temperature

The error in measured volumetric water content does vary with temperature. Newer probes will correct for temperature (e.g. CS650), but our current CS 615 & CS 616 sensors do not correct for soil temperature.

All soil moisture sites must collect soil temperature ideally in close proximity to the soil moisture probe.

Soil Temperature correction can be done in the sensor, or in hilltop through a VM.



$$\tau_{corrected}(T_{soil}) = \tau_{uncorrected} + (20 - T_{soil}) * (0.526 - 0.052 * \tau_{uncorrected} + 0.00136 * \tau_{uncorrected}^{2})$$

Soil Moisture Probes

Temperature corrected virtual model for soil moisture

```
'This VM calculates temperature corrected soil moisture.
'Written 26/08/2011 -David Brown

get "Soil Temperature" as ST
get "Soil Moisture" as SM

Corrected = SM + (20 - ST) * (0.526 - 0.052 * SM + 0.00136 * SM^2)

put corrected
```

Serial Numbers

Soil moisture probes do not come with independent serial numbers. When they arrive from the supplier a serial number needs to be engraved on the sensor. Use the following format: 1YYMMDD-XXX, where XXX is the sequential number of the sensor issued by Horizons.

Fill out the required documentation for our asset tracking system.