SMM Water Matric Potential Sensor Interface Operation Manual

ICT International Part No. TM229-SMM

Features (interface software version x.04)

1. Connects between a Campbell Scientific Water Matric Potential Sensor, type CS229 and the ICT International Smart Logger.

2. Controls the heater current and calculates and reports the temperature rise (dT) to facilitate an individual user calibration of dT and soil matric potential.

3. Operates from 5 to 20 Volts, and can operate over 1 Kilometre of cable. The 5 to 20 Volts is typically supplied by a 12 Volt rechargeable battery and solar panel system in the field for remote continuous logging or a 12 V wall charger power supply. This is connected to the databus.

4. Very low power consumption. The SMM interface typically draws 1 mA average current when making one measurement per hour and 0.5 mA between heating cycles.

5. Optionally reports soil temperature immediately prior to heating (T0) in addition to temperature rise (dT).

6. Heat cycle interval is set to 1 time per hour.

7. Start times of sensors are automatically staggered to insure only one heater is operating at any time. Sensor clocks are automatically synchronized with the logger clock. To make use of this facility SMM interfaces must have consecutive serial numbers. There can be up to 180 x TM229-SSM sensors reporting dT or 90 x TM229-SSM reporting both dT and T0 operated from a single ICT International Smart logger if they are powered from a 12 volt power supply connected to the databus.

A sensor report is available at any time. Example shown below.

```
Press 0 for report - (this report is for the sensor in air)

Address is o
 Type of sensor is SMM
 Serial number is 6A003
 Date of last cal was 13 Oct06
 Software version is x.04

 time is  15:13,
 current reading is    3.64 °C,  22.41 °C,
                maximum       minimum       average
     Today:     3.647,        3.621,        3.630 °C,
 Yesterday:     3.650,        3.617,        3.635 °C,
```

Interface Placement and Temperature Measurement

The temperature rise is measured after a precisely timed 30 second heat pulse of 50 mA of heater current. The low noise amplifiers in the SMM interface enable the temperature rise to be measured to a resolution of one thousandth of one degree Centigrade and with an accuracy of one hundredth of one degree Centigrade.

The TM229 contains a single thermocouple junction in the heater needle. The reference junction thermocouple for the temperature measurement is inside the SMM interface as is a precision thermistor to for measurement of the physical temperature of the reference junction. This enables calculation of the true temperature of the TM229. This is normal engineering procedure. Provided care is taken the results can be good, especially if the reference junction temperature is close to the TM229 temperature. Long leads and a greater temperature difference are potentially sources of error and loss of accuracy.

It is important that the temperature difference between the SMM interface and the thermal matric sensor TM229 are similar, but not varying by more than 15 deg C. This can be achieved by burying the SMM interface near or at the same depth as the thermal matric sensor TM229 or locating the SMM interface on the surface but shaded to avoid large daily fluctuations from direct heating by the sun. In a laboratory situation these issues will not occur in the relatively stable temperature environment.

Operation Manual for TM229-SSM

First Screen at Smart Logger Connection to Hyperterminal

```
05/11/2006 15:04:40

    Press 1 to see a list of sensors connected
    Press 2 to read the current values of the sensors
    Press 3 to download the stored data
    Press 4 to change the logger settings
    Press 5 to see the current page and each new entry
    Press 6 to see any page in memory
    Press 7 for one-touch download
    Press 8 to repeat the last one-touch download
    Press 9 to exit
```

Press 1 to see a list of sensors connected – (from first screen)

```
No.  address    schedule  Type of sensor    Serial No.   Last cal
___  _______    ________  ______________    __________   ________
  1   ]           m        Battery voltage   BV000000
  2   l           m        Soil moisture     SMM6A012     13 Oct 06
  3   o           m        Soil moisture     SMM6A003     13 Oct 06

    Press 1 to begin new search
    Press 2 to read the current values of the sensors
    Press * to re-log all sensors
    Press any other key to start again
```

Notes:
The two sensors connected are reporting only temperature rise (dT).
The optional temperature immediately prior to heating (T0) has not been turned on in this illustration.
Press 2 to read the current values of the sensors

```
No.   address   schedule      Type of sensor      current reading
___   _______   ________      ______________      _______________
  1    ]         m            Battery voltage      6.10 Volts
  2    l         m            Soil moisture        0.85 °C
  3    o         m            Soil moisture        3.64 °C

    Press 2 to refresh readings
    Press 3 to refresh repeatedly
    Press 4 for maximum minimum report
    Press any other key to start again
```

Note: sensor with address “l” is in water and sensor with address “o” is in air.
These are typical temperature rise values expected from the TM229 sensor.

Press 4 to change the logger settings – (from first screen)

```
Press 0 to change logger's name
Press 1 to change logger's time
Press 2 to change logger's date
Press 3 to change logger's baud speed
Press 4 to change the times when the sensors are logged
Press 5 to change the user assigned schedules
Press 6 to change the option registers
Press 7 to talk to the sensors
Press 8 to set-up sensors
Press 9 to add comments to the log
Press any other key to start again
```

Press 8 to set-up sensors – (from screen above)

```
Enter the address of the sensor you wish to set-up
    "o"
```

Press escape 3 times to start again

```
Welcome to setup of SMM6A003

  Press 0 for report
  Press 1 to change threshold A
  Press 2 to change threshold B
  Press 3 to set filters
  Press 4 to set display mode
  Press 5 to change Address
  Press 6 to auto zero
  Press 7 to set the time
  Press 8 to change config
  Press 9 to exit setup
```

Notes:
The menu items in italics are not functional with this sensor.
Press 0 for report – (this report is for the sensor in air)

```
Address is o
 Type of sensor is SMM
 Serial number is 6A003
 Date of last cal was 13 Oct06
 Software version is x.04

 time is  15:13,
 current reading is    3.64 °C,  22.41 °C,
                maximum      minimum      average
    Today:      3.64,        3.62,        3.63 °C,
Yesterday:      3.65,        3.61,        3.63 °C,

               threshold A   threshold B
  "on" level   10.00         10.00
 "off" level   -0.20         -0.23
```

Note: sensor with address “o” is in air.

dT is 3.64 deg C and T0 is 22.41 deg C.

Temperature rise values expected from the TM229 sensor in air are typically from 2.5 to 4.5 deg C. Note the differences between daily maximum and minimum in a relatively constant room temperature environment.

Time is synchronised with the Smart logger each midnight.

Ignore threshold A and B information.

```
Press 0 for report - (this report is for the sensor in water)

Address is 1
Type of sensor is SMM
Serial number is 6A012
Date of last cal was 13 Oct06
Software version is x.04

time is  15:15,
current reading is    0.85 °C  22.38 °C,
                maximum      minimum      average
    Today:      0.84,        0.85,        0.85 °C,
Yesterday:      0.85,        0.83,        0.84 °C,

               threshold A   threshold B
  “on” level   10.00         10.00
 “off” level   -0.16         -0.19
```

Notes:

Sensor with address “o” is in water and has been in the water for 7 days.

dT is 0.85 deg C and T0 is 22.38 deg C.

Temperature rise values expected from the TM229 sensor in water are typically from 0.5 to 2.0 deg C. Note the differences between daily maximum and minimum in a relatively constant room temperature environment.

Time is synchronised with the Smart logger each midnight.

Ignore threshold A and B information as this belongs to control application of interface.

Press 8 to change config

```
Enter the address of the sensor you wish to set-up
  “o”

Press 1 to switch average mode on
Press 2 to switch second channel on
Press 3 to switch economy mode off
Press 4 to switch LCD on
Press 5 to return to main menu
Press any other key to exit setup
```

Notes:

Press 2 to switch second channel on. When the second channel is on the optional T0 is recorded as well as dT.

The interface is heating the CS229 every hour even if the logging interval is less frequent such as every 4 hours. Then the economy mode performs no function. The value of dT and T0 are available on the databus for logging and will change every hour with each heating pulse. Logging more frequently than hourly will result in the same values being recorded by the logger and logging less frequently than hourly will result in heating pulses not being recorded.