APPLICATION NOTE

Sentry™ Visibility Sensor by EnviroTech

CAMPBELL SCIENTIFIC, INC.

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This application note describes the SVS1-E-2 Visibility Sensor, provides a datalogger program, and compares the SVS1's visibility measurements with Logan Airport's visibility measurements. The SVS1 is manufactured by EnviroTech to measure visibility only. Other visibility sensors are available that measure additional precipitation types and amounts. However, sensors with these capabilities are more expensive.

**The SVS1 was mounted facing north at approximately a 10 foot height
on a UT30 Tower (10 m).
The installation was located west of Campbell Scientific in Logan, UT.**

Test Procedure

Campbell Scientific tested an SVS1 between February 25, 2004 and March 5, 2004. The weather was a mixture of fog, rain, snow, and clear skies, which was optimum for the test.

Campbell Scientific used the sensor model that outputs 0 to 5 Vdc (0 to 10 Vdc, 4-20 mA, and RS-232 outputs also available). The sensor's voltage output is not linear. It decreases rapidly as the visibility increases. For example, when the output voltage decreases from 5.0 to 4.0 V, the visibility increases from 0.019 to

0.023 miles. When the output voltage decreases from 0.0125 to 0.0093 V, the visibility increases from 7.45 to 10.02 miles. Although the output voltage is not linear, the conversion to visibility units is fairly simple (i.e., visibility distance = n/voltage, where "n" = a constant provided by EnviroTech and "voltage" = the sensor's voltage output in volts).

A CR510 logger with a Pakbus OS measured the sensor's voltage output then converted the voltage measurement to miles of visibility (see datalogger program). However, before the CR510 could measure the sensor, the sensor's 5 Vdc output needed to be reduced to 2.5 Vdc (the CR510's maximum input voltage). A VDIV2:1 voltage divider was used for this purpose.

The SVS1's measurements were compared with the Logan Airport's visibility measurements (see the "Test Result" section). The airport's visibility measurements were obtained by calling the Logan Airport's automated weather station at random intervals.

Datalogger Program

The following are the datalogger instructions used to measure the sensor and convert the measurement to miles of visibility.

NOTE

This is not a complete datalogger program. A complete datalogger program would include instructions for saving the measurements in a table or final storage.

; Measure the sensor.

```
3: Volt (SE) (P1)
  1: 1        Reps
  2: 0        Auto Slow Range
  3: 1        SE Channel
  4: 4        Loc [visibility   ]
  5: 2        Mult
  6: 0        Offset
```

; If using a datalogger with a 5 volt maximum input, such as the
; CR23X or CR5000, the multiplier needs to be 1, and the
; VDIV2:1 is not required.

; Create the initial variable.

4: Z=X (P31)
  1: 4   X Loc [visibility   ]
  2: 8   Z Loc [visinitial   ]

; Change millivolts to volts for the conversion.

5: Z=X*F (P37)
  1: 4   X Loc [visibility   ]
  2: .001   F
  3: 4   Z Loc [visibility   ]

; Convert the measurement to miles using the value provided by
; EnviroTech.

6: Z=F x 10^n (P30)
  1: .0932   F; provided by EnviroTech
  2: 0   n, Exponent of 10
  3: 5   Z Loc [constant   ]

7: Z=X/Y (P38)
  1: 5   X Loc [constant   ]
  2: 4   Y Loc [visibility   ]
  3: 4   Z Loc [visibility   ]

; The next 3 instructions limit the value to 10 miles, the SVS1's
; maximum range.

8: If (X<=>F) (P89)
  1: 1   X Loc [visibility   ]
  2: 3   >=
  3: 10   F
  4: 30   Then Do

9: Z=F x 10^n (P30)
  1: 10   F
  2: 0   n, Exponent of 10
  3: 1   Z Loc [visibility   ]

10: End (P95)

Test Results

Some of the differences between the airport's value and the sensor's value are attributed to the geographical distance between the

sensors. Logan Airport's automated weather station was located 1.7 miles away from the SVS1. Because Logan experienced patchy fog and precipitation during the test, visibility varied significantly over fairly short distances.

	RECNBR	SVS1 visibility (miles)	visinitial (mV)	airportvis (miles)
2/25/2004 7:34	4	0.031	2970	<0.25
2/25/2004 9:18	56	0.409	227.9	0.5
2/25/2004 13:58	196	2.071	45	1.5
2/25/2004 16:48	281	2.542	36.66	2.5
2/26/2004 8:18	746	7.68	12.14	7
2/26/2004 10:14	804	3.289	28.34	4
2/27/2004 8:26	1470	5.781	16.12	8
2/27/2004 13:52	1633	4.616	20.19	9
3/1/2004 8:26	3630	4.221	22.08	1.5
3/1/2004 15:20	3837	9.27	10.06	6
3/3/2004 7:44	5049	1.086	85.8	<0.25
3/4/2004 9:22	5818	6.321	14.74	6

In the table above, "visibility" is the value obtained after applying the constant given by EnviroTech; "visinitial" is the actual measurement in millivolts; and "airportvis" is the visibility reported by the Logan Airport.