# Susitna Hydrology Project

# ESMFA115-1 Met Station

# Data Measurement and Recording Standards

Last Update: 01/14/2014

Last Update By: AMcHugh

**Meteorological Station**

Data-Collection Objectives: Meteorological data to evaluate the potential for hydro-electric power generation in the Susitna River region.

Time Recording Standard: **Always** Alaska Standard Time (UTC – 9).

Datalogger Scan Interval Standard: 60 seconds.

Time Measurement Standards:

* Hourly readings are recorded at the end of the hour; therefore, the hourly average water temperature, for example, with a 60-second scan interval and a time stamp of 14:00 is measured from 13:01 to 14:00:00. For a 60-second scan interval, the hourly average would be the average of 60 min = 60 values.
* Quarter-hourly readings are recorded every fifteen minutes starting at the top of the hour.
* Instantaneous readings are taken at the time specified by the time stamp.
* A day begins at midnight (00:00:00) and ends at midnight (23:59:55). All daily data are from the day prior to the date of the time stamp. For example, if the time stamp reads 09/09/2007 00:00 or 09/09/2007 12:00:00 AM, the data are from 09/08/2007.

Data Retrieval Interval: Data will be retrieved hourly.

Data Reporting Interval: Hourly

# Images

Camera: Moultrie Game camera; not connected to data logger.

Memory Card: 16GB SD Flash Memory Card

Flash Card Capacity: ~20,000 Images or over 1 year

Images Taken: On camera’s internal time interval.

Images Saved on Camera Memory Card: Half-hourly Lo-Resolution

Images Saved on Datalogger: Not connected to data logger.

Image Trigger Interval: 30-minutes

Data Retrieval: Manually, during station visits.

# Air Temperature

Sensor: HC2S3 AT/RH sensor (PT100 RTD, IEC 751 1/3 Class B, with calibrated signal conditioning).

Measurement Range: -40°C to +60°C.

Accuracy: ±0.1°C @23°C (~±0.3°C at -40°C).

Installation: In 10-plate radiation shield, non-aspirated.

Height: 2 meters.

Output Units: °C.

Scan Interval: 60 seconds.

Output to Tables:

* Hourly Table:
	+ Hourly Sample Air Temperature: Recorded at the top of each hour.
	+ Hourly Average Air Temperature: 60 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
	+ Hourly Maximum Air Temperature: The highest reading from the previous hour.
	+ Hourly Minimum Air Temperature: The lowest reading from the previous hour.
* Hourly Climate Table:
	+ Hourly Minimum Air Temperature: Recorded at the top of each hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Air Temperature: Fifteen-minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Air Temperature: Fifteen-minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Air Temperature: The highest reading from the previous fifteen minutes.
	+ Fifteen-Minute Minimum Air Temperature: The lowest reading from the previous fifteen minutes.
* Daily Table:
	+ Daily Average Air Temperature: Average of all temperature readings for the previous day ending at midnight AST.
	+ Daily Maximum Air Temperature: The highest reading taken during the previous day.
	+ Daily Minimum Air Temperature: The lowest reading taken during the previous day.

# Relative Humidity

# Sensor: HC2S3 AT/RH sensor (ROTRONIC Hygromer® IN1.

Operating Range: 0 to 100% RH.

Accuracy: ±0.8% @23°C (~±0.3% at -40°C).

Installation: In 12-gill radiation shield, non-aspirated.

Height: 2 meters

Output Units: % Relative Humidity

Scan Interval: 60 seconds

Output to Tables:

* Hourly Atmospheric Table:
	+ Hourly Sample Relative Humidity: Recorded at the top of each hour.
	+ Hourly Average Relative Humidity: 60 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
	+ Hourly Maximum Relative Humidity: The highest reading from the previous hour.
	+ Hourly Minimum Relative Humidity: The lowest reading from the previous hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Relative Humidity: Fifteen-minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Relative Humidity: Fifteen-minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Relative Humidity: The highest reading from the previous fifteen minutes.
	+ Fifteen-Minute Minimum Relative Humidity: The lowest reading from the previous fifteen minutes.
* Hourly Climate Table:
	+ Hourly Sample Relative Humidity: Recorded at the top of each hour.
* Daily Table:
	+ Daily Maximum Relative Humidity: the highest reading taken during the previous day.
	+ Daily Minimum Relative Humidity: the lowest reading taken during the previous day.

# Dew Point Temperature

Sensor: Calculated value from AT/RH

Scan Interval: N/A, calculated

Output to Tables:

* Hourly Table:
	+ Hourly Sample Dew Point: Calculated from the Sample Air Temperature and Relative Humidity values at the top of each hour.
	+ Hourly Average Dew Point: Average of the 60 values calculated from the 60-second Air Temperature and Relative Humidity values.
	+ Hourly Maximum Dew Point: The highest reading from the previous hour.
	+ Hourly Minimum Dew Point: The lowest reading from the previous hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Dew Point: Fifteen-minute sample (point) calculation recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Dew Point: Fifteen-minute average of all 15 calculations recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Dew Point: The highest reading from the previous fifteen minutes.
	+ Fifteen-Minute Minimum Dew Point: The lowest reading from the previous fifteen minutes.
* Hourly Climate Table:
	+ Hourly Sample Dew Point: Recorded at the top of each hour.
* Daily Table:
	+ Daily Maximum Dew Point: The highest calculated value during the previous day.
	+ Daily Minimum Dew Point: The lowest calculated value during the previous day.

# Vapor Pressure

Sensor: Vapor Pressure Actual, Saturated and Deficit calculated value from AT/RH

Scan Interval: N/A, calculated

Output to Tables:

* Hourly Table:
	+ Hourly Sample Dew Point: Calculated from the Sample Air Temperature and Relative Humidity values at the top of each hour.
	+ Hourly Average Dew Point: Average of the 60 values calculated from the 60-second Air Temperature and Relative Humidity values.
	+ Hourly Maximum Dew Point: The highest reading from the previous hour.
	+ Hourly Minimum Dew Point: The lowest reading from the previous hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Dew Point: Fifteen-minute sample (point) calculation recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Dew Point: Fifteen-minute average of all 15 calculations recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Dew Point: The highest reading from the previous fifteen minutes.
	+ Fifteen-Minute Minimum Dew Point: The lowest reading from the previous fifteen minutes.
* Hourly Climate Table:
	+ Hourly Sample Dew Point: Recorded at the top of each hour.
* Daily Table:
	+ Daily Maximum Dew Point: The highest calculated value during the previous day.
	+ Daily Minimum Dew Point: The lowest calculated value during the previous day.

# Wind Speed

Sensor: RM Young 05103-45 Wind Monitor (Alpine).

Operating Range: 0 to 100 m/s (0 to 224 mph).

Accuracy: ± 0.3 m/s (±0.6 mph) or 1% of reading.

Starting Threshold: 1 m/s (2.2 mph).

Installation: 30 m from nearest obstruction.

Height: 3 m.

Output Units: meters per second.

Scan Interval: 3s.

Output to Tables:

* Hourly Met Table:
	+ Instantaneous Wind Speed: The 3-second wind speed sampled at the top of the hour.
	+ Hourly Average Wind Speed: Hourly average of 1200 three-second wind speed readings for the previous hour.
	+ Hourly Peak Wind Speed: the highest recorded 3-second wind observation from the reporting interval of the past hour (max wind).
* Fifteen-Minute Met Table:
	+ Instantaneous Wind Speed: The 3-second wind speed sampled at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Wind Speed: Fifteen-minute average of all three hundred 3-second readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Peak Wind Speed: the highest recorded 3-second wind observation from the reporting interval of the past fifteen minutes (max wind).
* Two-Minute Wind Table:
	+ Two-Minute Average Wind Speed: 2-minute average of 3-second wind speeds.
	+ Two-Minute Peak Wind Speed: the highest recorded 3-second wind observation from the reporting interval of the past 2 minutes (max wind).
* Hourly Climate Table:
	+ Hourly Sample Wind Speed: Recorded at the top of each hour.
* Daily Table:
	+ Daily Average Wind Speed: The daily average of all 5-second wind speeds for the previous day.
	+ Daily Peak Wind Speed: The highest recorded 5-sec wind speed for the previous day.

# Wind Direction

Sensor: RM Young 05103-45 Wind Monitor (Alpine).

Operating Range: 0 to 360 deg (mechanical) True North (0 to 355 electrical, 5 deg open).

Accuracy: ±5°.

Starting Threshold: 1.1 m/s (2.4 mph) 10 deg displacement.

Installation: Align true north.

Height: 3 meters.

Output Units: degrees true north.

Scan Interval: 3s.

Output to Tables:

* Hourly Atmospheric Table:
	+ Instantaneous Wind Direction: Wind direction sample at the top of the hour.
	+ Hourly Average Wind Direction: Hourly average of 3-second wind direction vector for the previous hour.
* Fifteen-Minute Met Table:
	+ Instantaneous Wind Direction: The 3-second wind direction vector sampled at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Wind Direction: Fifteen-minute average of all three hundred 3-second readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
* Two-Minute Wind Table:
	+ Two-Minute Average Wind Direction: 2-minute average of 3-second wind direction vector.
* Hourly Climate Table:
	+ Hourly Sample Wind Direction: Recorded at the top of each hour.
* Daily Table:
	+ Daily Wind Direction: Vector mean of all wind direction readings for the previous day.

# Wind Direction Standard Deviation

Sensor: Calculated.

Scan Interval: 3s.

Output to Tables:

* Hourly Atmospheric Table:
	+ Hourly Wind Direction Standard Deviation: The standard deviation (computed by the datalogger) of the wind direction over the one hour recording period.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Wind Direction Standard Deviation: The standard deviation (computed by the datalogger) of the wind direction over the fifteen-minute recording period.
* Two-Minute Wind Table:
	+ Two-Minute Wind Direction Standard Deviation: The standard deviation (computed by the datalogger) of the wind direction over the 2-minute recording period)
* Daily Table:
	+ Daily Wind Direction Standard Deviation: The standard deviation (computed by the datalogger) of the wind direction for the previous 24 hours.

# Wind Chill Temperature

Sensor: Calculated from Air Temperature & Wind Speed. Wind Sensor

Output Units: °C.

Scan Interval: N/A, calculated.

Algorithms: WC = 35.74 + 0.6215 T - 35.75(V0.16) + 0.4275T(V0.16)

 where:

 WC = Wind Chill (°F)

 T = Air Temperature (°F)

 V = Wind Speed (mph)

 Source: Alaska Safety Handbook. 2006. p180.

 WC (°C) = (WC - 32) \* 5/9

 where:

 WC (°C) = Wind Chill (°C)

Output to Tables:

* Hourly Atmospheric Table:
	+ Instantaneous Wind Chill: Calculated from the Instantaneous Air Temperature and Wind Speed values sampled at the top of the hour.
	+ Hourly Average Wind Chill: Average of the 60 values calculated from the 60-second sample Air Temperature and the average of the 60 corresponding 3-second sample wind speed values.
	+ Hourly Maximum Wind Chill: The highest reading from the previous hour.
	+ Hourly Minimum Wind Chill: The lowest reading from the previous hour.
* Fifteen-Minute Met Table:
	+ Instantaneous Wind Chill: Calculated from the Instantaneous Air Temperature and Wind Speed values sampled at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Wind Chill: Average of the 15 values calculated from the 60-second sample Air Temperature and the average of the 15 corresponding 3-second sample wind speed values.
	+ Fifteen-Minute Maximum Wind Chill: The highest reading from the previous fifteen minutes.
	+ Fifteen-Minute Minimum Wind Chill: The lowest reading from the previous fifteen minutes.
* Hourly Climate Table:
	+ Hourly Sample Wind Chill: Recorded at the top of each hour.
* Daily Table:
	+ Daily Maximum Wind Chill: The highest calculated value during the previous day.
	+ Daily Minimum Wind Chill: The lowest calculated value during the previous day.

# Solar Radiation

Sensor: Campbell Scientific LI200X, LiCor LI200 pyranometer.

Height: 2 meters.

Output Units: mV, converted by datalogger to W/m2.

Scan Interval: 60 seconds.

Output to Tables:

* Hourly Met Table:
	+ Hourly Average Solar Radiation: 60 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
	+ Hourly Average Solar Radiation: 60 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Average Solar Radiation: Fifteen-minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
* Hourly Climate Table:
	+ Hourly Sample Solar Radiation: Recorded at the top of each hour.
* Daily Table:
	+ Daily Average Solar Radiation: The daily average of all solar radiation measurements for the previous day.

# Barometric Pressure

Sensor: Campbell Scientific CS100, Setra 278

Height: 2 meters.

Range: 600 to 1100mBar

Output Units: mBar, Not Corrected to sea level

Scan Interval: 60 seconds.

Output to Tables:

* Hourly Atmospheric Table:
	+ Hourly Sample Barometric Pressure: Recorded at the top of each hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Barometric Pressure: Fifteen-minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
* Hourly Climate Table:
	+ Hourly Sample Barometric Pressure: Recorded at the top of each hour.

# Net Radiation

Sensor: Kipp and Zonen NR Lite2 Net Radiometer

Height: 2 meters.

Output Units: mV converted by datalogger to W/m2, Wind Corrected W/m2

Scan Interval: 60 seconds.

Output to Tables:

* Hourly Met Table:
	+ Hourly Sample Net Radiation, Net Radiation w/ Wind Correction: Recorded at the top of each hour.
	+ Hourly Average Net Radiation, Net Radiation w/ Wind Correction: 60 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Net Radiation, Net Radiation w/ Wind Correction: Recorded at the top of each hour.
	+ Fifteen-Minute Average Net Radiation, Net Radiation w/ Wind Correction: Fifteen-minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
* Hourly Climate Table:
	+ Hourly Sample Net Radiation, Net Radiation w/ Wind Correction: Recorded at the top of each hour.
* Hourly Raw Table:
	+ Hourly Sample Sensor mV: Recorded at the top of each hour. "Raw" data in mV.
	+ Hourly Average Sensor mV: Average of the 60 one-minute readings for the previous hour. "Raw" data in mV.

# Air Temperature - Back Up

Sensor: Triplicate YSI Series 44033 thermistors

Operating Range: -80°C to +75°C

Installation: In 6-gill radiation shield, non-aspirated.

Height: 2 meters

Output Units: kΩ, °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Atmospheric Table:
	+ Hourly Sample Air Temperature: Recorded at the top of each hour. (three values, one for each thermistor).
	+ Hourly Average Air Temperature: Average of the 60 one-minute readings for the previous hour. (three values, one for each thermistor).
	+ Hourly Maximum Air Temperature: The highest reading from the previous hour.
	+ Hourly Minimum Air Temperature: The lowest reading from the previous hour.
* Hourly Climate Table:
	+ Hourly Sample Air Temperature: Recorded at the top of each hour. (three values, one for each thermistor).
* Fifteen-Minute Met Table:
	+ Fifteen-Minute Sample Air Temperature: Fifteen-minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Air Temperature: Fifteen-minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Air Temperature: The highest reading from the previous fifteen minutes.
	+ Fifteen-Minute Minimum Air Temperature: The lowest reading from the previous fifteen minutes.
* Hourly Raw Table:
	+ Hourly Sample Sensor Resistance: Recorded at the top of each hour. "Raw" data in kΩ. (three values, one for each thermistor)
	+ Hourly Average Sensor Resistance: Average of the 60 one-minute readings for the previous hour. "Raw" data in kΩ. (three values, one for each thermistor).
* Daily Table:
	+ Daily Average Air Temperature: Average of all temperature readings for the previous day ending at midnight AST. (three values, one for each thermistor).
	+ Daily Maximum Air Temperature: The highest reading from the previous day. (three values, one for each thermistor).
	+ Daily Minimum Air Temperature: The lowest reading from the previous day. (three values, one for each thermistor).

# Water Height

Sensor: One CS451 (Campbell Scientific, inc) pressure transducer, SDI-12 type sensor or one INW PT12 (Instruments North West) pressure transducer, SDI-12 type sensor.

Pressure Measurement Range: 0-7.25 psig

Output Units: cm, ft (water height above sensor), psig

Scan Interval: 60 seconds

Output to Tables:

* Fifteen-Minute Water Table:
	+ Fifteen-Minute Sample Water Height: Fifteen minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Water Height: Fifteen minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Water Height: Fifteen minute maximum of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Minimum Water Height: Fifteen minute minimum of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
* Hourly Climate Table:
	+ Hourly Sample Water Height: Sample at the top of each hour.
* Daily Table:
	+ Daily Average Water Height: Average of all readings for the previous day.
	+ Daily Maximum Water Height: Maximum water height for the previous day.
	+ Daily Minimum Water Height: Minimum water height for the previous day.

# Water Temperature

Sensor: One CS451 (Campbell Scientific, inc) SDI-12 sensor or one INW PT12 (Instruments North West) SDI-12 type sensor.

Operating Range: -10°C to 80°C

Output Units: °C

Scan Interval: 60 seconds

Output to Tables:

* Fifteen-Minute Water Table:
	+ Fifteen-Minute Sample Water Temperature: Fifteen minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Average Water Temperature: Fifteen minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour.
	+ Fifteen-Minute Maximum Water Temperature: The highest reading taken during the previous fifteen minutes.
	+ Fifteen-Minute Minimum Water Temperature: The lowest reading taken during the previous fifteen minutes.
* Hourly Climate Table:
	+ Hourly Sample Water Temperature: Sample at the top of each hour.
* Daily Table:
	+ Daily Average Water Temperature: Average of all readings for the previous day.
	+ Daily Maximum Water Temperature: the highest reading taken during the previous day.
	+ Daily Minimum Water Temperature: the lowest reading taken during the previous day.

# Soil Temperature Profile

Sensor: Twelve YSI Series 44033 thermistors

Operating Range: -80°C to +75°C

Installation: In back-filled bored hole.

Depths: 0, 5, 10, 15, 20, 30, 40, 60, 80, 100, 120, 150 cm, 1-12 thermistors (based on actual depth of bored drill hole)

Output Units: kΩ, °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Subsurface Table:
	+ Hourly Sample Soil Temperature: Recorded at the top of each hour. (twelve values, one for each thermistor).
	+ Hourly Average Soil Temperature: Average of the 60 one-minute readings for the previous hour. (twelve values, one for each thermistor).
* Hourly Raw Table:
	+ Hourly Sample Sensor Resistance: Recorded at the top of each hour. "Raw" data in kΩ. (twelve values, one for each thermistor)
	+ Hourly Average Sensor Resistance: Average of the 60 one-minute readings for the previous hour. "Raw" data in kΩ. (twelve values, one for each thermistor).
* Hourly Climate Table:
	+ Hourly Sample Soil Temperature: Recorded at the top of each hour. (twelve values, one for each thermistor).
* Daily Table:
	+ Daily Average Soil Temperature: Average of all temperature readings for the previous day ending at midnight AST. (twelve values, one for each thermistor).

# Soil Moisture Profile

Sensor: Four sensors: CSI 650 Unfrozen Soil-Moisture/Soil Temperature Probes

Installation: Horizontal orientation in back-filled hole

Depths: 10, 20, 30, 40 cm

Output Units: μs, volumetric soil water content (v/v). Electrical Conductivity

Scan Interval: Hourly

Output to Tables:

* Hourly subsurface Table:
	+ Hourly Instantaneous Soil Moisture: Hourly volumetric soil water content taken at the top of the hour (four values). Unitless volume ratio (water volume/soil volume).
* Hourly Raw Table:
	+ Hourly Instantaneous Soil Moisture: Hourly "raw" volumetric soil water content taken at the top of the hour (four values). Units are μs.
* Hourly Climate Table:
	+ Hourly Sample Soil Moisture: Recorded at the top of each hour(four values). Unitless volume ratio (water volume/soil volume).
* Daily Table:
	+ Daily Average Soil Moisture: Average of all readings for the previous day ending at midnight AST (four values).
* Hourly Raw Table:
	+ Hourly Sample Sensor Period: Recorded at the top of each hour. "Raw" data in μSec

# Soil Temperature Profile 2

Sensor: Four sensors: CSI 650 Unfrozen Soil-Moisture/Soil Temperature Probes

Installation: Horizontal orientation in back-filled hole

Depths: 10, 20, 30, 40 cm

Output Units: °C.

Scan Interval: Hourly

Output to Tables:

* Hourly subsurface Table:
	+ Hourly Instantaneous Soil Temperature: Hourly volumetric soil water content taken at the top of the hour (four values). Unitless volume ratio (water volume/soil volume).
* Hourly Climate Table:
	+ Hourly Sample Soil Temperature: Recorded at the top of each hour. (four values).
* Daily Table:
	+ Daily Average Soil Temperature: Average of all temperature readings for the previous day ending at midnight AST (four values).

# Soil Moisture Electrical Conductivity

Sensor: Four sensors: CSI 650 Unfrozen Soil-Moisture/Soil Temperature Probes

Installation: Horizontal orientation in back-filled hole

Depths: 10, 20, 30, 40 cm

Output Units: dS/m

Scan Interval: Hourly

Output to Tables:

* Hourly Subsurface Table:
	+ Hourly Instantaneous Soil Moisture Electrical Conductivity: Hourly soil water electrical conductivity taken at the top of the hour (four values).
* Hourly Climate Table:
	+ Hourly Sample Soil Moisture Electrical Conductivity: Recorded at the top of each hour(four values). Unitless volume ratio (water volume/soil volume).
* Daily Table:
	+ Daily Average Soil Moisture Electrical Conductivity: Average of all readings for the previous day ending at midnight AST (four values).

# Soil Heat Flux

Sensor: HFP01-L Hukseflux Soil heat Flux Plate

Operating Range: -2000 W/m2 to +2000 W/m2

Installation: Horizontally in back-filled bored hole.

Depth: 8 cm

Output Units: W/m2, mV

Scan Interval: 60 seconds

Output to Tables:

* Hourly Subsurface Table:
	+ Hourly Average Soil Heat Flux: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Sample Soil Heat Flux: Recorded at the top of each hour.
* Hourly Climate Table:
	+ Hourly Sample Soil Heat Flux: Recorded at the top of each hour.
* Daily Table:
	+ Daily Average Soil Heat Flux: Average of all readings for the previous day ending at midnight AST.
* Hourly Raw Table:
	+ Hourly Sample Sensor mV: Recorded at the top of each hour. "Raw" data in mV.
	+ Hourly Average Sensor mV: Average of the 60 one-minute readings for the previous hour. "Raw" data in mV.

# Battery Voltage

Sensor: CH200

Output Units: V.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample CR1000 Battery Voltage: Measured at the top of the hour.
	+ Hourly Average CR1000 Battery Voltage: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum CR1000 Battery Voltage: The highest reading from the previous hour.
	+ Hourly Minimum CR1000 Battery Voltage: The lowest reading from the previous hour.

# Battery Current

Sensor: CH200

Output Units: A.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample CR1000 Battery Current: Measured at the top of the hour.
	+ Hourly Average CR1000 Battery Current: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum CR1000 Battery Current: The highest reading from the previous hour.
	+ Hourly Minimum CR1000 Battery Current: The lowest reading from the previous hour.

# Load Current

Sensor: CH200

Output Units: A.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample Load Current: Measured at the top of the hour.
	+ Hourly Average Load Current: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum Load Current: The highest reading from the previous hour.
	+ Hourly Minimum CR1000 Battery Current: The lowest reading from the previous hour.

# Solar Panel Voltage

Sensor: CH200

Output Units: V.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample Solar Panel Voltage: Hourly reading at the top of the hour.
	+ Hourly Average Solar Panel Voltage: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum Solar Panel Voltage: The highest reading from the previous hour.
	+ Hourly Minimum Solar Panel Voltage: The lowest reading from the previous hour.

# Solar Panel Current

Sensor: CH200

Output Units: A.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample Solar Panel Current: Hourly reading at the top of the hour.
	+ Hourly Average Solar Panel Current: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum Solar Panel Current: The highest reading from the previous hour.
	+ Hourly Minimum Solar Panel Current: The lowest reading from the previous hour.

# Datalogger (CR1000) Panel Temperature

Sensor: CR1000 Internal thermistor

Output Units: °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Average CR1000 Panel Temperature: Average of the 60 one-minute readings for the previous hour.

# Voltage Regulator (CH200) Temperature

Sensor: CH200

Output Units: °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Average CR1000 Panel Temperature: Average of the 60 one-minute readings for the previous hour.

# Resulting Final Storage Data Tables:

See Datalogger Output Files Excel Document

**Notes**

Definitions:

Scan interval = sampling duration = scan rate

Time of maximum or minimum values is not recorded

Sample reading = instantaneous reading

Beginning of the hour = top of the hour