

Schedule

08/31/17 (Lecture #1)

09/05/17 (Lecture #2)

09/07/17 (Lecture #3)

09/12/17 (4:00 – 18:30 h) (Lecture #4-5)

09/14/17 (Lecture #6)

09/21/17 (Lecture #7)

09/26/17 (4:00 – 18:30 h) (Lecture #8-9)

09/28/17 (Lecture #10)

10/03/17 (12:00 – 8:00 h) (Lab #1)

10/10/17 (12:00 – 8:00 h) (Lab #2)

10/20/17 (8:00 -17:00 h) (Lab #3)

10/24/17 (Q&A #1)

10/26/17 (Lecture #11)

11/07/17 (Q&A #2)

11/14/17 (Q&A #3)

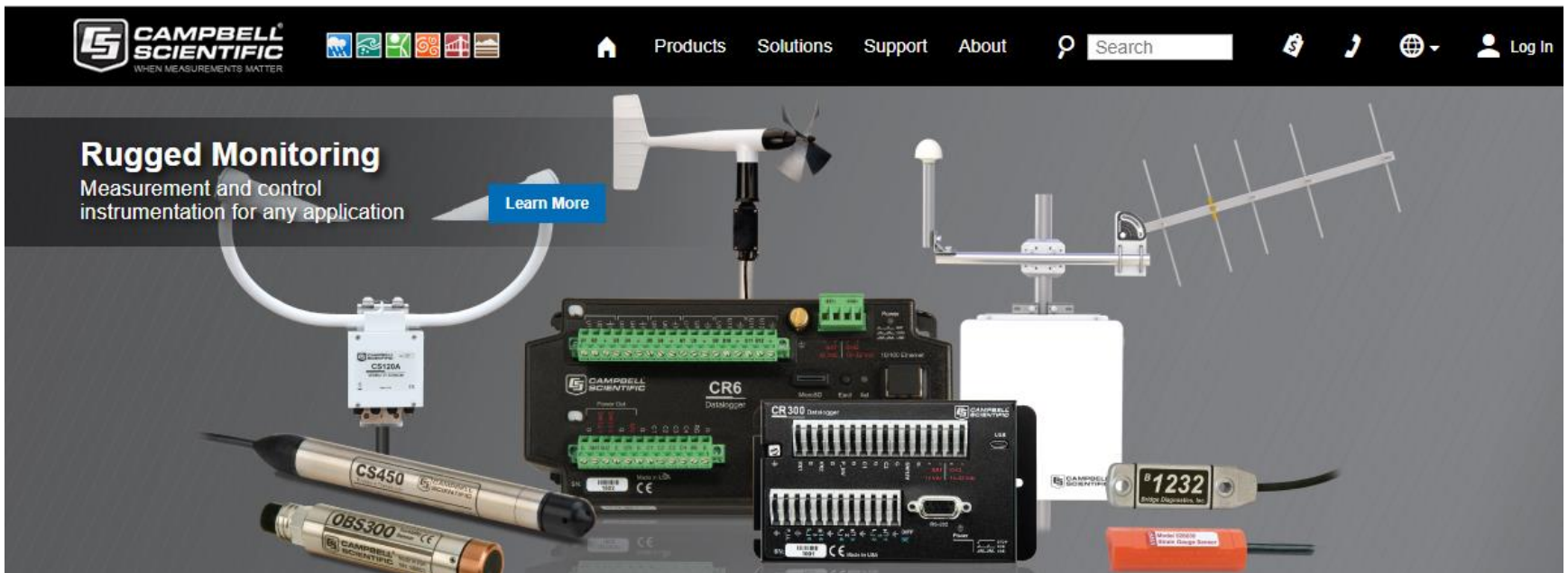
11/21/17 (Q&A #4)

12/07/17 (Lecture #12): Term paper due on Dec. 14, 2017

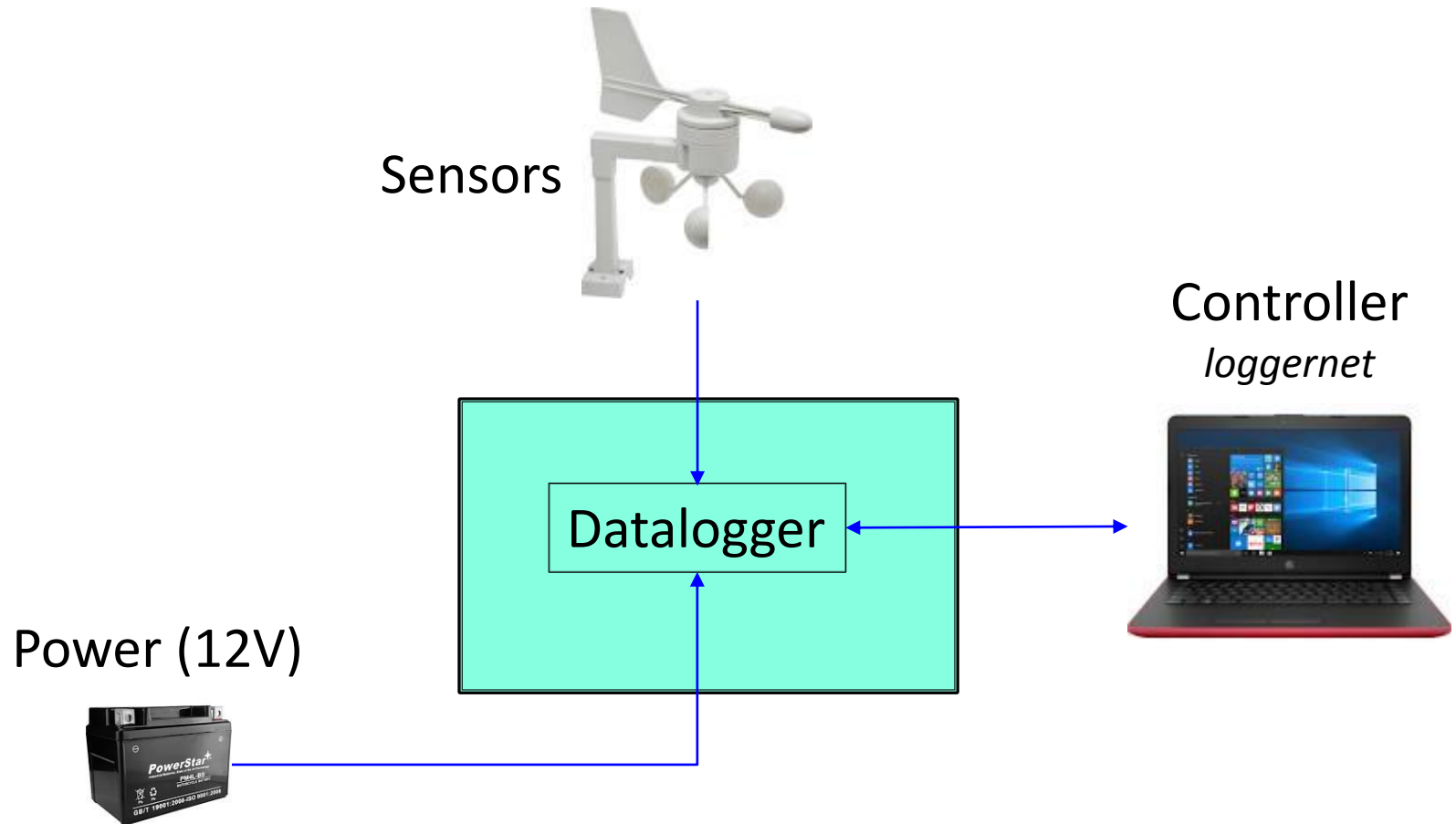
- 12 lectures
- 3 long labs (8 hours each)
- 2-3 homework
- 1 group project
- 4 Q&A (Geography Room 206)

Lab Exercise

- Introduction of Loggernet (<https://www.campbellsci.com/>)
- Address: 815 W 1800 N, Logan, UT 84321-1784
- Technical support: **435-227-9100**
- Making thermocouples



Basic Structure of a Microclimatic Station



KEF Micromet station

Jiquan Chen, 7/31/2017

Sensors & Datalogger

14" x 16" Enclosure (1)

CR23 datalogger (1)

HMP45C RH & T (1) – 2.0 m

Radiation shield (1)

HFT3 soil heat flux plates (3) – 2 cm

CS616 soil moisture (1)

257 soil moisture block (1) 10-15 cm

T-type TC(3), 5, 15, 25 cm

Program file "KEF_MET080217"

Loggernet

Laptop

Communication cable



Supporting Frame

Triangular antenna, 6" (1)

Guyed wires, 7.5' (3)

Silver anchors (3)

3/8" R bar (4)

Deep cycle marine battery (1)

Battery case (1)

Lightning rod (1)

Grounding rod (1)

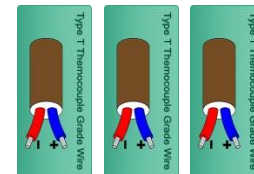
2'x2' plywood base (1)

Power cable

Grounding cable

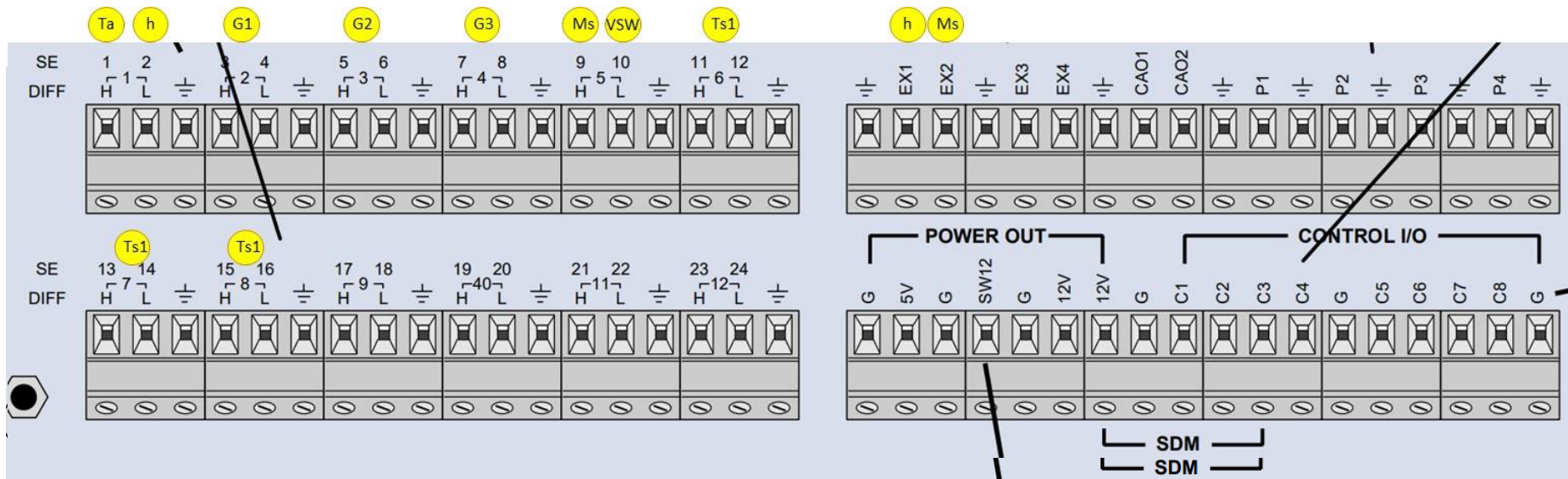
Protection tubing

Small medal anchors



Understanding the datalogger

- CR21, CR7, CR10, 21X, CR23, CR1000, CR3000, CR5000, etc.
- SE vs DIFF channels
- P1 - P4
- C1 - C4
- Ex1 – EX4
- Power supplies (5 V vs 12 V)
- AG vs G



Understanding the sensors

Signal output

- 1) **Voltage** (PAR, Pyranometer, HFT, Q7.1, etc.): range and resolution
- 2) **Pulse count** (TE525 rain gauge, cup-anemometer, etc.)
- 3) **Voltage with specified current** (e.g., Wheatstone Bridge) (107 Probe, Thermistor; HMP45C, moisture block, etc.)
- 4) **Timing** (Snow depth, sonic anemometer, TDR or CS616, etc.)

Understanding the programming (LoggerNet)

- Edlog: examples of thermocouple, thermistor, etc.
- CRBASICS: programming (EC systems)

```
'Raw data table
```

```
DataTable (delay_3d, TRUE, OFFSET)
```

```
TableHide
```

```
Sample (5, sonic_irga_raw(1), IEEE4)
```

```
EndTable
```

```
' 5-minute covariance of sonic data for steady state tests
```

```
DataTable (comp_cov_3d_5min, TRUE, 1)
```

```
TableHide
```

```
DataInterval (0, OUTPUT_INTERVAL_SST, Min, 1)
```

```
'Compute Ux mean and covariance of Ux with Ux, Uy, and Uz from sonic data.
```

```
Average (1, Ux, IEEE4, sonic_disable_f) 'Using sonic(2)
```

```
Covariance (3, Ux, IEEE4, sonic_disable_f, 3) 'Using sonic(2), sonic(3), and sonic(4)
```

```
'Compute Uy mean and covariance of Uy with, Uy, Uz from sonic data.
```

```
Average (1, Uy, IEEE4, sonic_disable_f) 'Using sonic(3)
```

```
Covariance (2, Uy, IEEE4, sonic_disable_f, 2) 'Using sonic(3) and sonic(4)
```

```
'Compute Uz mean and covariance of Uz with Uz from sonic data.
```

```
Average (1,Uz, IEEE4, sonic_disable_f) 'Using sonic(4)
```

```
Covariance (1,Uz, IEEE4, sonic_disable_f, 1) 'Using sonic(4)
```

```
'Compute covariance of Ts with Ts, Ux, Uy, and Uz from sonic data.
```

```
Covariance (4, Ts, IEEE4, sonic_disable_f, 4) 'Using sonic(1), sonic(2), sonic(3), sonic(4)
```

```
WindVector (1, Uy, Ux, IEEE4, sonic_disable_f, 0, 1, 2)
```

```
EndTable
```

Understanding the programming (LoggerNet)

- Edlog: examples of thermocouple, thermistor, etc.
- CRBASICS: programming (EC systems)

:{CR23X-TD}

;**Micromet station at the KEB -- understory, 8/2/2017**

;**Soil heat fluxes (w/m²) using diff voltage, SN: H973485**

16:P2

1:1

2:25

3:3

4:6

5:43.43

6:0.0

Tips

- Use the technical support at Campbell Scientific, Inc.
- Read the manuals
- Understand the sensor specifications
- Practice, practice, practice...

Lab Exercise

- Main menu (Main, Program, Data, Tool, Utilities, Favorite)
- Main → Setup; Main → Connect
- Program → Edlog