**Metek**

The Metek is a sonic anemometer. The wind field and acoustic temperature are measured in 3 dimensions using 6 transducers that which emit ultrasonic acoustic pulses and measure the time taken to receive the signal at an opposing receiver. The transducers each act alternately as transmitters and receivers and the system is geometrically arranged such that each emitted pulse is received by three transducers and a total of 9 paths are created. Temperature and winds are simultaneously derived because the former is a scaler quantity and the latter is a vector quantity enabling equations to be derived for each with a single unknown.

**Turning the system on/off:**

 Connect/disconnect power source.

 There are separate power lines for system electronics and the heater.

**Communications & Settings:**

Default: RS485/422

 Baud = 57600

 Data bits = 8

 Parity = None

 Stop bits = 1

 Flow control = Xon / Xoff

Each sonic is also enabled for output over ethernet. The IP addresses are in the MOSAiC comms and serial numbers spreadsheet. The port is 5001. Note that the instrument cannot receive commands over TCP/IP and therefore configurations must be done with the serial interface.

To connect and configure a sonic using the serial interface:

1) Connect cables, power device

2) Connect to your computer COM port. You need an RS232-485 converter. See image.

Green -> R-

Brown -> T-

Black Shield -> GND or on logger. Might not be critical.

White -> T+

Yellow -> R+

Jumper L4 to L5, R1 to R2, R4 to R5

 RS485/422 "Metek"

 | | | | |

 G B W Y SHIELD/BLACK to Logger G

 | | | |

 R- T- GND T+ R+

 L1 \* | R1

 L2 \* | R3

 L3 \* \* R3

 L4 | | R4

 L5 | | R5

 DB9

 RS232 Computer

Like this

Metek





Computer

3) Connect an ethernet cable to the Metek and to the network switch (this is only needed to test output through the network).

4) Open Hyperterminal/Foxterm and connect using a new COM port connection and the serial settings form the top of this section.

5) If you power on the metek now you should see a welcome message. If already powered you may or may not see ouput. Type "?" (no quotes) followed by Enter and metek should print configuration. Now you need to configure.

6) Enter this command and carriage return: KEY=29015

This gives you service level access enabling all parameters to be changed. A lower level is KEY=1 (some access).

7) See also “meteksetings\_july23.rtf” in the ~/Instruments/Metek/settings/ directory. You need to set the following:

Command (followed by Enter) Note

DM2 = , Set the delimiter for the network channel to a comma

FR1 = 0 Framing for instantaneous output.

IPA = 192.168.202.# Metek IP. Set to whatever the metek is being assigned for an IP

DHC = 0 Turn off DHCP so we can have a static IP

HTM = 3 Heating mode is automatic and dependent on both temp and data qual

SFR = 20000 Sets output for 20Hz

SBR = 57600 Baud rate, should already be 57600

OI2 = 96 Ditto for network channel

OI1 = 96 Instantaneous serial ouput set to 97; string parameter for desired output

NLC = 0 No log in required for network

NLD = 0 No log in required for serial

*If the Metek is on the tower*

FR2 = 0 No framing on for network output

GWY = 192.168.1.1 Gateway IP. Set to whatever your computer is.

*If the Metek is on ASFS*

FR2 = 1 Framing on for network output ( <STX> <ETX>)

GWY = 192.168.202.254 Gateway IP. Set to whatever your computer is.

You should now see streaming 20Hz messages over the serial line. This is what the PC is reading at the tower.

8) Close connection and start a new connection as follows:

 TCP/IP Winsock

 Host address = (whatever is the Metek's IP)

 Port = 5001

You should now see streaming 20Hz messages over the network line, which is the line that all our systems are logging data from.

**Variables:**

There is a little variability in what is saved between ASFS and NOAAS, but important ones:

 Heating state (0 = off, 1 = on & operational, 2 = on & faulty)

 Sensor path state (n of 9 paths were using in the measurement)

x: wind velocity in the x plane

 y: wind velocity in the y plane

 z: wind velocity in the z plane

 T: sonic temperature

 InclX: inclinometer roll

 InclY: inclinometer pitch

Refer to manual (OLD\_MANUAL\_20180814\_uSonic-3\_Class-A\_MP\_Manual\_Ki page 59-64) for more details on variables and diagnostics. We are using OI2 = 96, which from pages 61-62 is a=0+b=0+c=0+d=0e=0+f=32+g=64+h=0. A status message of diagnostics is printed before this, which is decoded at page 59. The entire message is therefore diag(14 char),x,y,z,T,v,d,vs,ds,roll,pitch,azimuth. Azimuth is not actually calculated by Metek and is ignored by ASFS and I think also NOAAS. v,d,vs,ds are calculations of x,y,z and are redundant so ASFS ignores them. vs and ds are particularly unnecessary and I think NOAAS ignores those.

**Post Processing:**

* Intensive.

**Daily Data Checks:**

* Check that data is coming in and that it is complete.
* Are there missing values?
* Check the diagnostic values.
* Check the inclinometer. If the Metek is off-level it is not very important for the wind measurements since this can be corrected in post-processing. However, the inclinometer is a good measure of the stability of the ASFS.

**ASFS Visit Checks:**

* (1) Inspect instrument cables. In particular, the manufacturer indicated that the connectors are prone to corrosion and we saw some of this in Boulder. There is cold weather tape protecting the connectors – inspect and replace tape as necessary.
* (2) Clear snow/ice from the system if it is there. Do this carefully because the sensor heads are delicate and movement of the sensor arms affects the calibration. Take a photo of the condition of the instrument before cleaning; we are applying a reduced amount of heating and are not certain what to expect.

**Things to consider:**

* The sonic temperature is not precisely the same as the thermodynamic temperature because the sonic temperature is (a) not as well calibrated as other temperature sensors and (b) does not account for the affect that variability in humidity has on air density.
* Some settings (e.g., network settings like IP address) require the instrument to be power cycled to take effect.
* If the ASFS is tilted (incl X > 0 and/or incl Y > 0) z would need to be incorporated to rotate the coordinate system to calculate an accurate horizontal wind speed and direction.
* We are using the convention x,y,z instead of u,v,w in our raw data because this is the convention used by Metek. It specifically refers to the wind components in a right-handed coordinate system in the frame of reference of the anemometer.