**WHOTS 2021 FLUX SYSTEM DETAILS (Aug 2021, Sergio P. and Byron B.)**

**Instruments:**

One Vaisala weather sensor model WXT520 serial number G2950010, calibration 2021

One Vaisala weather sensor model WXT520 serial number L4720496, calibration 2021

One K&Z PSP (PSP1) model CM22 serial number 50122, calibration 9.00 – 2017 (calibration can be re-verified post-cruise)

One K&Z PSP (PSP2) model CMP22 serial number 170518, calibration 9.51 – 2017 (calibration can be re-verified post-cruise)

One Eppley PIR (PIR1) serial number 38519, calibration 2.96 (old cal. 2.92), Dome coef. 7.62 – July 2021

One Eppley PIR (PIR2) serial number 38521, calibration 2.57 (old cal. 2.48), Dome coef. 6.69 – July 2021

One Vaisala Pressure sensor model PTB330 serial number L2820128

One Surface temperature sensor (sea snake)

**Installation: (see photos on following pages)**

The two WXT weather stations were mounted on the bow jackstaff at the same height on two horizontal arms, projecting approximately 2 ft. forward of the mast and separated by approximately 4 ft on the port-starboard axis.

The seasnake was mounted to the starboard 02 deck railing near the bow.

All other sensors (PTB pressure, heading/GPS and IR/solar radiometers were mounted on the starboard side of the pilothouse roof. The location for the radiometers was judged to be the best compromise in terms of clear sky visibility, but some obstruction of the field of view is expected by the main mast.



Figure 1: Radiometer mount, logger/pressure sensor box and ethernet switch box mounted to starboard railing on the pilot house roof.

A picture containing outdoor, deck

Description automatically generated

Figure 2: Heading system box and power distribution box, mounted on starboard side railing on the pilot house roof.

A picture containing white

Description automatically generated

Figure 3: Seasnake SST system on starboard railing just aft of the bow deck.

A picture containing sky, outdoor, water, boat

Description automatically generated

Figure 4: WXT met stations mounted to the bow jackstaff.

Measurement heights (provisional pending remeasurement at end of cruise)

1) WXT weather stations: 13.7m asl

2) PTB pressure sensor: 12.9m asl

3) Seasnake SST: ~5-10cm (depth)

**Datalogger Program (for seasnake, radiometers and pressure):**

'First System 2xPSP,2xPIR,Sea Snake, Relative Pressure by Spezoa

'CR1000

'Mean2

'Logs Sea snake with 4 wires, PSP, PIR and Pressure

'Declare Variables and Units

'Two pyranometer from EPPLEY,

'Two pyrgeometer from EPPLEY,

'One Sea Snake

'One Atmospheric Pressure

'channels used as:

'1H=Eppley PIR1 Case Temp 1

'1L=Eppley PIR1 Dome Temp 3

'2H=Eppley PIR1 thermopile 5

'2L=Eppley PIR1 thermopile 6

'----------

'3H=Eppley PSP1 thermopile

'3L=Eppley PSP1 thermopile

'----------

'4H=Eppley PIR2 Case Temp 1

'4L=Eppley PIR2 Dome Temp 3

'5H=Eppley PIR2 Thermopile 5

'5L=Eppley PIR2 Thermopile 6

'-----------

'6H= Eppley PSP2 Thermopile

'6L= Eppley PSP2 Thermopile

'-----------------------------------------------------

'sea snake Half Bridge, 4 Wire measurements Seatemp\_r4W:

'7H & 7L ,8H & 8L ,E3

'(wire1,2) ==/\/\/\/\/\== (wire3,4)

'CH7- wire1(yellow)to 7H / 10k resistor between 7H and 7L/7L to E3

'wire3(green)to GND

'CH8- wire2(red)to 8H / wire4(blue)to 8L

'----------

'Pressure sensor PTB220 voltage

' via COM1 of logger

'-----------

'Declare Variables and Units

Public Batt\_Volt,PTemp

Public Case\_Res1(2)

Public PIR1\_V, PSP1\_V

Public Case\_Res2(2)

Public PIR2\_V, PSP2\_V

Public PIR1\_wm2, PIR2\_wm2

Public PSP1\_wm2, PSP2\_wm2

Public Case1\_R,Dome1\_R

Public Case2\_R,Dome2\_R

Public Case1\_T,Case2\_T

Public Dome1\_T,Dome2\_T

Public Snake\_R,Snake\_C

'000000

Public String1 As String \* 100

Public String2 As String \* 100

Public String3 As String \* 100

'Public String4 As String \* 100

'Public String5 As String \* 100

'Public String6 As String \* 40

Public TimeValue As String \* 20

Public hpa As String \* 10

Public hpat As String \* 10

Alias Case\_Res1(1) = CaseRes1

Alias Case\_Res1(2) = DomeRes1

Alias Case\_Res2(1)= CaseRes2

Alias Case\_Res2(2)= DomeRes2

'Declare Other Variables

'Declare Constants

'PSP and PIR constants from document 10/23/97 requested by J Hare to Eppley

' using YSI 44031

Const c1=0.0010295

Const c2=0.0002391

Const c3=0.0000001568

'Constants for YSI serie 46040 c4,c5,c6 changed March/4/2015

Const c4=0.001404694 'was 0.001399937

Const c5=0.000237006 'was 0.000237854

Const c6=0.000000101 'was 0.000000097

'Contant wire resistance for seasnake

'Const r\_cond=5.130 NOT USED OCT 2019

'PIR1 s/n 38519F3 calibration on Jul/2019 Eppley

Const PIR1\_Cnt = 0.00296

'----------------------

'PIR2 s/n 38521 calibration on Jul/2019 Eppley

Const PIR2\_Cnt = 0.00257

'--------------------------

'PSP1 s/n CM22 calibration on 2017 K&Z

Const PSP1\_Cnt = 0.00900

'---------------------------

'PSP2 s/n CMP22 calibration on 2017 K&Z

Const PSP2\_Cnt = 0.00951

'--------------------------------

Const high=true

Const low = false

'Coefficients for YSI 46040 PIR1 0 to 45C Oct 2019

' to calculate thermistor temp

'0-40 Const c7=0.001017394

'0-40 Const c8=0.000241046

'0-40 Const c9=0.000000149

Const c7=0.001404694

Const c8=0.000237006

Const c9=0.000000101

SequentialMode

'Define Data Tables

DataTable(Met1,True,-1)

DataInterval(0,60,Sec,-1)

'Average

Sample(1,Batt\_Volt,FP2)

Sample (1,PTemp,FP2)

'000000

Average (1,Case1\_R,IEEE4,0)

Average (1,Case1\_T,IEEE4,0)

Average (1,Dome1\_R,IEEE4,0)

Average (1,Dome1\_T,IEEE4,0)

Average (1,Case2\_R,IEEE4,0)

Average (1,Case2\_T,IEEE4,0)

Average (1,Dome2\_R,IEEE4,0)

Average (1,Dome2\_T,IEEE4,0)

'000000

Average (1,PIR1\_V,IEEE4,0)

Average (1,PIR1\_wm2,IEEE4,0)

Average (1,PSP1\_V,IEEE4,0)

Average (1,PSP1\_wm2,IEEE4,0)

'000000

Average (1,PIR2\_V,IEEE4,0)

Average (1,PIR2\_wm2,IEEE4,0)

Average (1,PSP2\_V,IEEE4,0)

Average (1,PSP2\_wm2,IEEE4,0)

'000000

Median (1,Snake\_R,60,IEEE4,False)

Median (1,Snake\_C,60,IEEE4,False)

Average (1,hpat,IEEE4,0)

'Standard Deviation

'StdDev (1,Case1\_R,FP2,False)

'StdDev (1,Case1\_T,FP2,False)

'StdDev (1,Dome1\_R,FP2,False)

'StdDev (1,Dome1\_T,FP2,False)

'StdDev (1,Case2\_R,FP2,False)

'StdDev (1,Case2\_T,FP2,False)

'StdDev (1,Dome2\_R,FP2,False)

'StdDev (1,Dome2\_T,FP2,False)

'StdDev (1,PIR1\_V,FP2,False)

'StdDev (1,PIR1\_wm2,FP2,False)

'StdDev (1,PSP1\_V,FP2,False)

'StdDev (1,PSP1\_wm2,FP2,False)

'StdDev (1,PIR2\_V,FP2,False)

'StdDev (1,PIR2\_wm2,FP2,False)

'StdDev (1,PSP2\_V,FP2,False)

'StdDev (1,PSP2\_wm2,FP2,False)

'StdDev (1,Snake\_R,FP2,False)

'StdDev (1,Snake\_C,FP2,False)

EndTable

'Main Program

BeginProg

SerialOpen (ComRS232,9600,0,0,100)

'Measure hpa via Com1

SerialOpen (Com1,9600,10,100,100)

Scan(1,Sec,5,0)

Battery(Batt\_Volt)

PanelTemp(PTemp,250)

'Timestamp

TimeValue = Met1.Timestamp(1,1)

'Generic Half Bridge Case1, Dome1 measurements from Eppley PIR1:

'1H case resistance with 9990.6 resistor between 1H and E1

'1L dome resistance with 9996 resistor between 1L and E1

BrHalf(Case\_Res1(),2,mV2500,1,Vx1,2,200,False,0,250,1,0)

Case1\_R=10000 \*(CaseRes1/(1-CaseRes1))

Dome1\_R=10004 \*(DomeRes1/(1-DomeRes1))

Case1\_T = 1/(c1+c2\*LN(Case1\_R)+c3\*PWR(LN(Case1\_R),3))+(-273.16)

Dome1\_T = 1/(c1+c2\*LN(Dome1\_R)+c3\*PWR(LN(Dome1\_R),3))+(-273.16)

'Generic Differential Voltage measurements Eppley PIR PIR\_V:

'Diff 2H,2L

VoltDiff(PIR1\_V,1,mV2\_5,2,False,0,\_60Hz,1.0,0)

PIR1\_wm2=(1/PIR1\_Cnt)\*PIR1\_V

'Generic Differential Voltage measurements Eppley PSP1 3H, 3L

'VoltDiff(PSP1\_V,1,mV7\_5,3,False,0,\_60Hz,1.0,0)

VoltDiff(PSP1\_V,1,mV25,3,False,0,\_60Hz,1.0,0)

PSP1\_wm2=(1/PSP1\_Cnt)\*PSP1\_V \*-1

'Generic Half Bridge Case2, Dome2 measurements from Eppley PIR2:

'4H case resistance with 9,987.5 ohms resistor between 1H and E3

'4L dome resistance with 9,992.0 ohms resistor between 1L and E3

BrHalf(Case\_Res2(),2,mV2500,7,Vx3,2,200,False,0,250,1,0)

Case2\_R=9994.6\*(CaseRes2/(1-CaseRes2))

Dome2\_R=9996.6\*(DomeRes2/(1-DomeRes2))

Case2\_T = 1/(c1+c2\*LN(Case2\_R)+c3\*PWR(LN(Case2\_R),3))+(-273.16)

Dome2\_T = 1/(c1+c2\*LN(Dome2\_R)+c3\*PWR(LN(Dome2\_R),3))+(-273.16)

'Generic Differential Voltage measurements Eppley PIR PIR\_V:

'Diff 5H,5L

VoltDiff(PIR2\_V,1,mV2\_5,5,False,0,\_60Hz,1.0,0)

PIR2\_wm2=(1/PIR2\_Cnt)\*PIR2\_V

'Generic Differential Voltage measurements Eppley PSP2 6H, 6L

'VoltDiff(PSP2\_V,1,mV7\_5,6,False,0,\_60Hz,1.0,0)

VoltDiff(PSP2\_V,1,mV25,6,False,0,\_60Hz,1.0,0)

PSP2\_wm2=(1/PSP2\_Cnt)\*PSP2\_V \*-1

'EndIf

'-----------------------------------------------------

'sea snake Half Bridge, 4 Wire measurements Seatemp\_r4W:

'7H & 7L ,8H & 8L ,E3

'(wire1,2) ==/\/\/\/\/\== (wire3,4)

'CH7- wire1(yellow)to 7H / 10k resistor between 7H and 7L/7L to E3

'wire3(green)to GND

'CH8- wire2(red)to 8H / wire4(blue)to 8L

BrHalf4W(Snake\_R,1,mV2500,mV2500,7,Vx2,1,2400,False,False,3000,\_60Hz,-10027,0)

Snake\_C = 1/(c4+c5\*LN(Snake\_R)+c6\*PWR(LN(Snake\_R),3))+(-273.16)

'---------------------------------------------------

'Vaisala Presure measuremnet via Com1

'hpa = pressure\_v\*120+495.25

'boulder height h=1655meters

'hpa= pressure+0.1176\*h

SerialIn (hpa,Com1,10,CHR(13)+CHR(10),11)

SplitStr(hpat,hpa,CHR(13)+CHR(10),1,0)

'Call Data Tables and Store Data

CallTable(Met1)

If TimeIntoInterval(0,60,sec) Then

String1= Batt\_Volt+CHR(44)+PTemp+CHR(44)+Met1.Case1\_R\_Avg+CHR(44)+Met1.Case1\_T\_Avg+CHR(44)+Met1.Dome1\_R\_Avg+CHR(44)+Met1.Dome1\_T\_Avg+CHR(44)+Met1.Case2\_R\_Avg+CHR(44)+Met1.Case2\_T\_Avg+CHR(44)

String2= Met1.Dome2\_R\_Avg+CHR(44)+Met1.Dome2\_T\_Avg+CHR(44)+Met1.PIR1\_V\_Avg+CHR(44)+Met1.PIR1\_wm2\_Avg+CHR(44)+Met1.PSP1\_V\_Avg+CHR(44)+Met1.PSP1\_wm2\_Avg+CHR(44)+Met1.PIR2\_V\_Avg+CHR(44)

String3= Met1.PIR2\_wm2\_Avg+CHR(44)+Met1.PSP2\_V\_Avg+CHR(44)+Met1.PSP2\_wm2\_Avg+CHR(44)+Met1.Snake\_R\_Med+CHR(44)+Met1.Snake\_C\_Med+CHR(44)+hpat+CHR(13)+CHR(10)

'Met1.Case1\_R\_Std+CHR(44)+Met1.Case1\_T\_Std+CHR(44)

'String4= Met1.Dome1\_R\_Std+CHR(44)+Met1.Dome1\_T\_Std+CHR(44)+Met1.Case2\_R\_Std+CHR(44)+Met1.Case2\_T\_Std+CHR(44)+Met1.Dome2\_R\_Std+CHR(44)+Met1.Dome2\_T\_Std+CHR(44)+Met1.PIR1\_V\_Std+CHR(44)+Met1.PIR1\_wm2\_Std+CHR(44)

'String5= Met1.PSP1\_V\_Std+CHR(44)+Met1.PSP1\_wm2\_Std+CHR(44)+Met1.PIR2\_V\_Std+CHR(44)+Met1.PIR2\_wm2\_Std+CHR(44)+Met1.PSP2\_V\_Std+CHR(44)+Met1.PSP2\_wm2\_Std+CHR(44)+Met1.Snake\_R\_Std+CHR(44)+Met1.Snake\_C\_Std+CHR(13)+CHR(10)

SerialOut (ComRS232,String1+String2+String3,"",0,0)

SerialFlush (Com1)

EndIf

NextScan

EndProg

**Datalogger Values Table**

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Table: Met1 **These are the output field to data file**

Interval: 60 SEC

Fields:

Batt\_Volt

PTemp

Case1\_R\_Avg

Case1\_T\_Avg

Dome1\_R\_Avg

Dome1\_T\_Avg

Case2\_R\_Avg

Case2\_T\_Avg

Dome2\_R\_Avg

Dome2\_T\_Avg

PIR1\_V\_Avg

PIR1\_wm2\_Avg

PSP1\_V\_Avg

PSP1\_wm2\_Avg

PIR2\_V\_Avg

PIR2\_wm2\_Avg

PSP2\_V\_Avg

PSP2\_wm2\_Avg

Snake\_R\_Med

Snake\_C\_Med

hpat\_Avg

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Table: DataTableInfo

Fields:

DataTableName(1)

SkippedRecord

DataRecordSize(1,1) Units: records

DataRecordSize(1,2) Units: records

SecsPerRecord

DataFillDays(1,1) Units: days

DataFillDays(1,2) Units: days

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Table: Public **These are output fields while running Loggernet**

Fields:

Batt\_Volt

PTemp

CaseRes1

DomeRes1

PIR1\_V

PSP1\_V

CaseRes2

DomeRes2

PIR2\_V

PSP2\_V

PIR1\_wm2

PIR2\_wm2

PSP1\_wm2

PSP2\_wm2

Case1\_R

Dome1\_R

Case2\_R

Dome2\_R

Case1\_T

Case2\_T

Dome1\_T

Dome2\_T

Snake\_R

Snake\_C

String1

String2

String3

TimeValue

hpa

hpat

**Moxas Configuration**

**Master 8 port**

[Network Settings]

IP Address=192.168.127.1

Netmask=255.255.255.0

Gateway=192.168.127.254

IP Configuration=0

DNS Server 1=

DNS Server 2=

[Serial]

Port1=9600,3,0,0,0,Mean\_2

Port2=19200,3,0,0,0,

Port3=19200,3,0,1,0,WXT520\_1

Port4=115200,3,1,1,0,

Port5=19200,3,0,1,0,WXT520\_2

Port6=115200,3,1,1,0,

Port7=19200,3,0,0,0,GPS

Port8=19200,3,0,1,0,Heading

[Operating Mode Option 1]

Port1=7,192.168.127.11,4001

Port2=7,192.168.127.12,4002

Port3=7,192.168.127.13,4003

Port4=7,192.168.127.14,4004

Port5=7,192.168.127.15,4005

Port6=7,192.168.127.16,4006

Port7=7,192.168.127.17,4007

Port8=7,192.168.127.18,4008

**Mean 2**

[Network Settings]

IP Address=192.168.127.11

Netmask=255.255.255.0

Gateway=

IP Configuration=0

DNS Server 1=

DNS Server 2=

[Serial]

Port1=9600,3,0,0,0,Mean\_2

[Operating Mode Option 1]

Port1=7,4001

**WXT520\_Slave\_1**

[Network Settings]

IP Address=192.168.127.13

Netmask=255.255.255.0

Gateway=

IP Configuration=0

DNS Server 1=

DNS Server 2=

[Serial]

Port1=19200,3,0,0,0,WXT520

[Operating Mode]

Port1=0

Port1=7,4003

**WXT520\_slave\_2**

[Network Settings]

IP Address=192.168.127.15

Netmask=255.255.255.0

Gateway=

IP Configuration=0

DNS Server 1=

DNS Server 2=

[Serial]

Port1=19200,3,0,0,0,WXT520

[Operating Mode]

Port1=0

Port1=7,4005

**GPS**

[Network Settings]

IP Address=192.168.127.17

Netmask=255.255.255.0

Gateway=

IP Configuration=0

DNS Server 1=

DNS Server 2=

[Serial]

Port1=19200,3,0,0,0,GPS\_Slave

[Operating Mode]

Port1=0

Port1=7,4007

**Heading**

[Network Settings]

IP Address=192.168.127.18

Netmask=255.255.255.0

Gateway=

IP Configuration=0

DNS Server 1=

DNS Server 2=

[Serial]

Port1=19200,3,0,0,0,Heading\_Slave

[Operating Mode]

Port1=0

Port1=7,4008