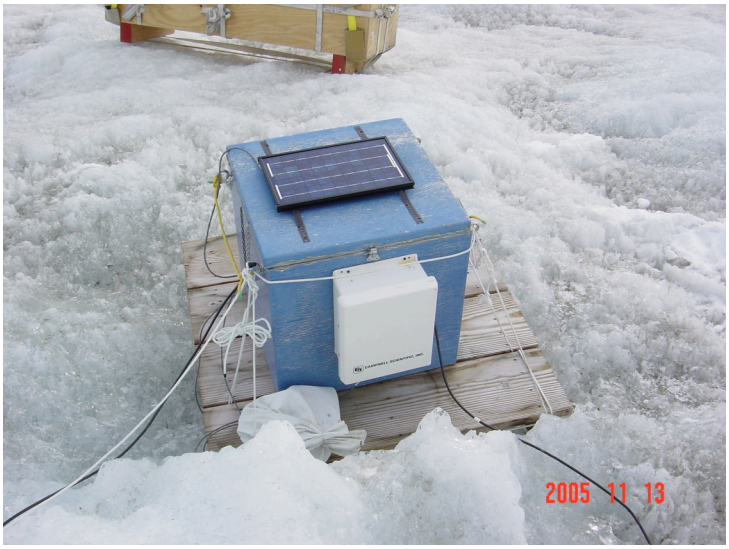
Documentation of The Taylor Valley Blue Boxes for season 2009/10



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Version: 1
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TABLE OF CONTENT:

1. Sensors

1.1 Available Sensors

Blue Box Sensor List								
SENSORS	SENSOR TYPE	Aplications	Company	Units	Deployment Date			
					Fryxell	Hoare	ELB	WLB
Surface PAR	LI190 SB Quantum	Measures incedent Photosynthetically Active Radiation	LI-COR Biosciences 4421 Superior St. Lincoln, NE 68504 Phone: 800-447-3576 Fax: 402-467-2819	micromoles of quanta per second per square meter (mmol s-1 m-2)	11/08/08	11/01/08	12/13/08	12/14/08
Underwater PAR	LI-193 Spherical Quantum Sensor	Measures PAR coming from all directions.	LI-COR Biosciences 4421 Superior St. Lincoln, NE 68504 Phone: 800-447-3576 Fax: 402-467-2819		11/16/09	11/01/08	11/6/09	11/20/09
Ablation Transducer (pressure transducer)	Druck Pressure Transducer PDCR 1830 or 1230;	Continuous lake ice ablation measurement	Druck Incorporated (203) 746-0400 Keller ?	cm	11/19//05	?	11/19/04	11/9/09
Lake Lavel (Stage) Transducer		Continuous lake level measurements	Druck Incorporated (203) 746-0400		11/21/04	11/11/09	11/19/04	N/A

1.2 Sensors, Data Logger and Programming Information and Manuals at the Internet

(1) ***LI190 SB Quantum***

Sensor details:
http://www.licor.com/env/Products/Sensors/190/li190_description.jsp

Instruction Manual from Campbell Scientific:
http://www.campbellsci.com/documents/manuals/li190sb.pdf

(2) ***LI-193 Spherical Quantum Sensor***

Sensor details:
http://www.licor.com/env/Products/Sensors/193UW/li193_description.jsp
http://www.licor.com/env/PDF_Files/193SA.pdf

(3) ***Druck's Pressure Transducer*** **(LF, LH, ELB, WLB)**

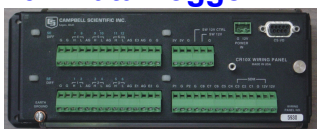
Sensor details:
http://www.gesensing.com/products/resources/datasheets/PDSA065june02.pdf

Instruction Manual from Campbell Scientific
http://www.campbellsci.com/documents/manuals/cs420-l.pdf

Note: Ablation Transducer (frequently called Pressure Transducer) and Lake Level Transducer (also known as Stage Transducer) are both the same type of transducers. The only difference between two is that they are differently

programmed – one for measuring the Ice ablation and the other for measuring the lake level.

(4) **CR10X Data Logger**



Measurements and Control Module Operator's Manual
http://www.campbellsci.com/documents/manuals/cr10x-ov.pdf

CR10X Specifications
http://www.campbellsci.com/documents/lit/s_cr10x.pdf

CR10X Brochure
http://www.campbellsci.com/documents/lit/b_cr10x.pdf

(5) **LoggerNet Instructions**

Logger Net Datalogger Support Software
http://www.campbellsci.com/loggernet3x

LoggerNet Users Manual 3.3
http://www.campbellsci.com/documents/manuals/loggernet.pdf

LoggerNet Users Manual 2.1b
http://www.campbellsci.com.au/documents/manuals/loggernet2-1.pdf

1.3 Diagram

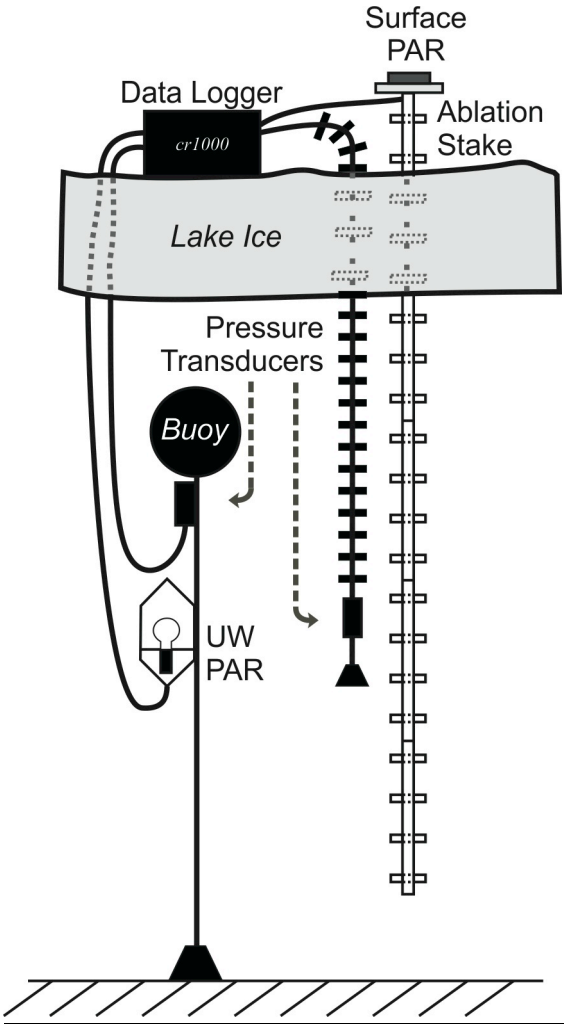


Fig.1: Lake cross-section showing buoy, data logger, position of deployed sensors and ablation stake.

UW PAR deployment depths are <u>measured from piezometric water level</u>:

Lake Fryxel: 8 m
Lake Hoare: 10 m
ELB: 10.55 m
WLB: 10m

Note: UW PAR is fixed to the buoy. However, due to continuous lake level change, depth corrections are necessary for UW PAR data

2. BlueBox Field Setup

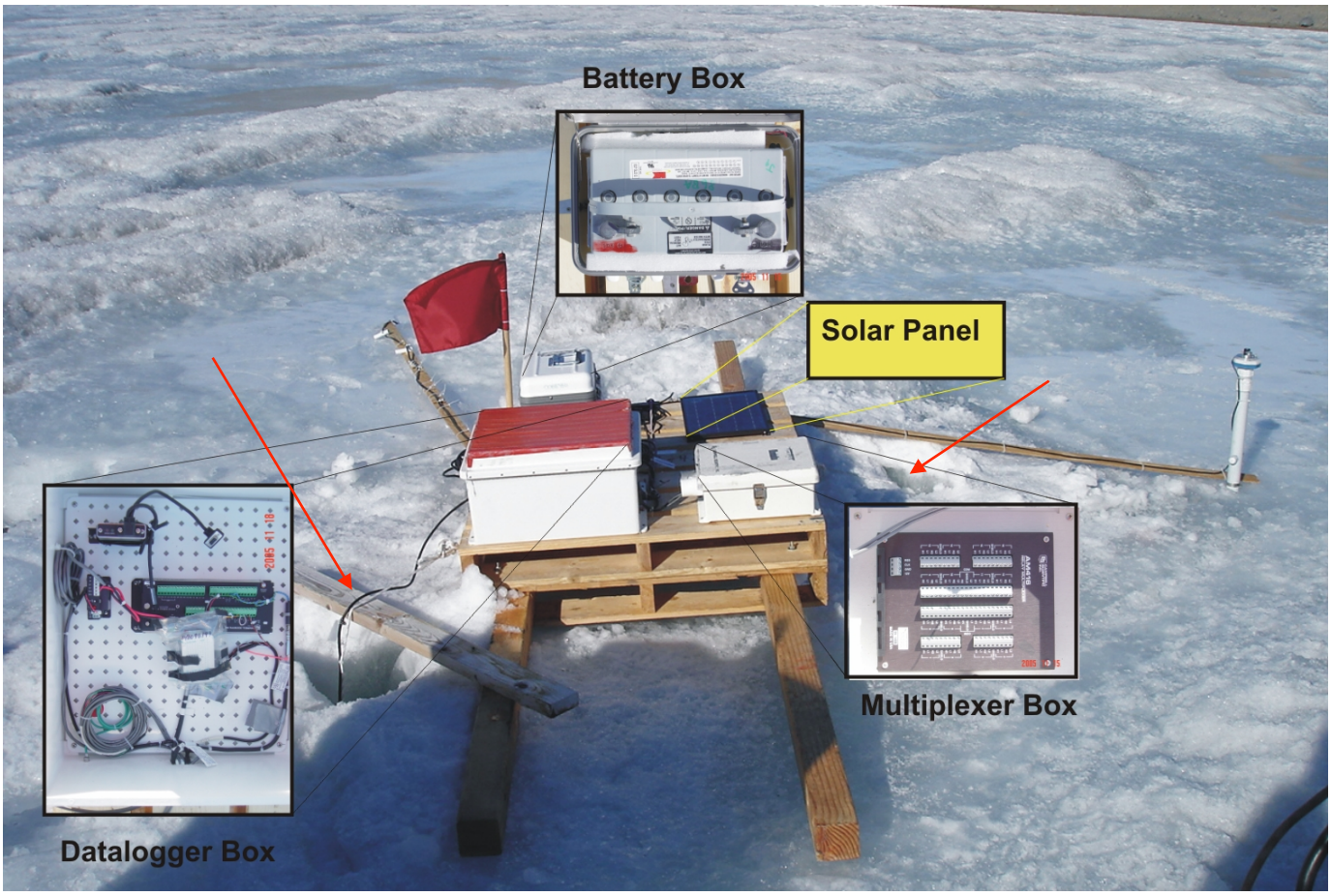


Fig. 2: Field setup and components of a Blue Box system. Outriggers are facing main wind direction and with two anchors (marked by red arrows) to prevent box from flipping.

3. Sensors/setup changes

3.1.1 Lake Fryxell

- Replaced UW PAR
  - Mult: -203.00 (in water)
  - Tcoff: 0.0036
  - Serial# SPQA 1171
  - Deployed date: 11/16/09
- UW Altimeter was removed

3.1.2 Lake Hoare

- Replaced Stage Pressure Transducer (Druck 1830-8388)
  - Mult: 103.1695
  - Serial# 2742650
  - Date deployed: 11/28/09
- UW Altimeter was removed

3.1.3 East Lobe Bonney

- Replaced UW PAR
  - Mult: -219.22 (in water)
  - Tcoff: 0.0036
  - Serial# SPQA 3560
  - Deployed date: 11/6/09

3.1.4 West Lobe Bonney

- Replaced UW PAR
  - Mult: -218.62 (in water)
  - Tcoff: 0.0036
  - Serial# SPQA 1863
  - Deployed date: 11/20/09
- UW Altimeter was removed
- Replaced Ablation Pressure Transducer (Druck 1830)
  - Serial# 2742652
  - Mult: 101.4542

3.2.1 Software Changes

LF, LH, and WLB were uploaded with a new program that excludes PSA-916 sonar that was installed two years ago. LH program reflects changes for a new pressure transducer sensor

3.2.2 Note on Multipliers

In the program running at Blue Boxes, we always have multiplier value of:

- 100 for UW PAR (or “–100” - depending on how we wired the sensor).
- 200 for Surface PAR

4. Programs and CR10x Data logger Wiring

4.1.1 Lake Fryxell wiring (CR10x)

Stage transducer (instrument with desiccant-filled vent tube)

Red	E1
Orange	H5
Black	L5
Yellow	H6
Blue	L6
White	AG (any one)
Clear	G (any one)

Ablation transducer (instrument with desiccant-filled vent tube)

Red	E1
Orange	H1
Black	L1
Yellow	H2
Blue	L2
White	AG (any one)
Clear	G (any one)

Underwater PAR

Green	3L
Blue	3H

Surface PAR

Black	4L
Red	4H
Clear	G

Jumper Wire from Black 4L to AG

4.1.2 Lake Fryxell program

```
;{CR10}
;
*Table 1 Program
  01: 60       Execution Interval (seconds)


; MEASURE ABLATION SENSOR
1:  Full Bridge w/mv Excit (P9)
 1: 1        Reps
 2: 5        2500 mV Slow Ex Range
 3: 3        25 mV Slow Br Range
 4: 1        DIFF Channel
```

```
 5: 1        Excite all reps w/Exchan 1
 6: 2500     mV Excitation
 7: 1        Loc [ ablat_cm  ]
 8: 102.22   Mult
 9: 0.0      Offset
;
;MEASURE UNDERWATER LIGHT
2:  Volt (Diff) (P2)
 1: 1        Reps
 2: 2        7.5 mV Slow Range
 3: 3        DIFF Channel
 4: 2        Loc [ uwlight   ]
 5: -100     Mult
 6: 0.0      Offset

; MEASURE  SURFACE LIGHT SENSOR (QUANTUM)
3:  Volt (Diff) (P2)
 1: 1        Reps
 2: 3        25 mV Slow Range
 3: 4        DIFF Channel
 4: 3        Loc [ par       ]
 5: 200      Mult
 6: 0.0      Offset

; MEASURE BATTERY VOLTAGE
4:  Batt Voltage (P10)
 1: 4        Loc [ battvolts ]

; MEASURE STAGE TRANSDUCER SENSOR
5:  Full Bridge w/mv Excit (P9)
 1: 1        Reps
 2: 5        2500 mV Slow Ex Range
 3: 3        25 mV Slow Br Range
 4: 5        DIFF Channel
 5: 1        Excite all reps w/Exchan 1
 6: 2500     mV Excitation
 7: 5        Loc [ stage_cm  ]
 8: 102.12   Mult
 9: 0.0      Offset

;TIME INTERVAL SETUP FOR 20 MINUTES
6:  If time is (P92)
 1: 0        Minutes (Seconds --) into a
 2: 20       Interval (same units as above)
 3: 10       Set Output Flag High
```

```
; SETUP STORAGE AREA & ARRY ID TO 1
7:  Set Active Storage Area (P80)^22950
 1: 1        Final Storage Area 1
 2: 1        Array ID

; SETUP TIME
8:  Real Time (P77)^19867
 1: 1220     Year,Day,Hour/Minute (midnight = 2400)

9:  Resolution (P78)
 1: 1        High Resolution

;CALCULATE AVERAGE FOR ABLAT_CM
10:  Average (P71)^1315
 1: 1        Reps
 2: 1        Loc [ ablat_cm  ]

;CALCULATE AVERAGE FOR STAGE_CM
11:  Average (P71)^20053
 1: 1        Reps
 2: 5        Loc [ stage_cm  ]


12:  Resolution (P78)
 1: 0        Low Resolution

;CALCULATE AVERAGE FOR, UWLIGHTS, PAR, AND BATTERY VOLTS
13:  Average (P71)^23697
 1: 3        Reps
 2: 2        Loc [ uwlight   ]

; COMUNICATE WITH STORAGE AREA
14:  Serial Out (P96)
 1: 71       Storage Module

*Table 2 Program
  02: 0.0000    Execution Interval (seconds)

*Table 3 Subroutines

End Program

-Input Locations-
1 ablat_cm  5 1 1
2 uwlight   1 1 1
3 par       1 1 1
```

4 battvolts 1 1 1
5 stage_cm 1 1 1
6 _____ 1 0 0
7 _____ 1 0 0
8 _____ 0 0 0
9 _____ 0 0 0
10 _____ 0 0 0
11 _____ 0 0 0
12 _____ 0 0 0
13 _____ 0 0 0
14 _____ 0 0 0
15 _____ 0 0 0
16 _____ 0 0 0
17 _____ 0 0 0
18 _____ 0 0 0
19 _____ 0 0 0
20 _____ 0 0 0
21 _____ 0 0 0
22 _____ 0 0 0
23 _____ 0 0 0
24 _____ 0 0 0
25 _____ 0 0 0
26 _____ 0 0 0
27 _____ 0 0 0
28 _____ 0 0 0
-Program Security-
0000
0000
0000
-Mode 4-
-Final Storage Area 2-
0
-DLD File Labels-
0
-Final Storage Labels-
0,1,22950
1,Year_RTM,19867
1,Day_RTM
1,Hour_Minute_RTM
2,ablat_cm_AVG~1,1315
3,uwlight_AVG~2,23697
3,par_AVG~3
3,battvolts_AVG~4
4,stage_cm_AVG~5,20053

4.2.1 Lake Hoare wiring

Stage transducer (instrument with desiccant-filled vent tube)

Red	E1
Orange	H5
Black	L5
Yellow	H6
Blue	L6
White	AG (any one)
Clear	G (any one)

Ablation transducer (instrument with desiccant-filled vent tube)

Red	E1
Orange	H1
Black	L1
Yellow	H2
Blue	L2
White	AG (any one)
Clear	G (any one)

Underwater PAR

Green	3L
Blue	3H

Surface PAR

Black	4L
Red	4H
Clear	G

Jumper Wire from Black 4L to AG

4.2.2 Lake Hoare program

```
;{CR10X}
*Table 1 Program
  01: 60.0000   Execution Interval (seconds)

;Measure Stage Transducer Sensor

1:  Full Bridge w/mv Excit (P9)
 1: 1        Reps
 2: 5        2500 mV Slow Ex Range
 3: 3        25 mV Slow Br Range
 4: 5        DIFF Channel
 5: 2        Excite all reps w/Exchan 2
 6: 2500     mV Excitation
 7: 29       Loc [ stg       ]
```

8: 103.169 Multiplier
9: 0.0 Offset

2: Batt Voltage (P10)
1: 7 Loc [volts]

3: Do (P86)
1: 2 Call Subroutine 2

4: Volt (Diff) (P2)
1: 1 Reps
2: 3 25 mV Slow Range
3: 1 DIFF Channel
4: 27 Loc [surflight]
5: 200 Mult
6: 0.0 Offset

5: Volt (Diff) (P2)
1: 1 Reps
2: 1 2.5 mV Slow Range
3: 2 DIFF Channel
4: 26 Loc [uwlight]
5: -100 Mult
6: 0 Offset

6: If time is (P92)
1: 0 Minutes (Seconds --) into a
2: 20 Interval (same units as above)
3: 10 Set Output Flag High (Flag 0)

7: Set Active Storage Area (P80)^11931
1: 1 Final Storage Area 1
2: 2 Array ID

8: Real Time (P77)^2775
1: 1220 Year,Day,Hour/Minute (midnight = 2400)

9: Resolution (P78)
1: 1 High Resolution

10: Average (P71)^5591
1: 1 Reps
2: 5 Loc [stage_cm]

11: Resolution (P78)

```
 1: 0        Low Resolution

12:  Average (P71)^19363
 1: 2        Reps
 2: 26       Loc [ uwlight   ]

13:  Average (P71)^7360
 1: 1        Reps
 2: 14       Loc [ ablat_psi ]

14:  Standard Deviation (P82)^25199
 1: 1        Reps
 2: 14       Sample Loc [ ablat_psi ]

15:  Resolution (P78)
 1: 1        High Resolution

16:  Average (P71)^6446
 1: 1        Reps
 2: 15       Loc [ ablat_cm  ]

17:  Resolution (P78)
 1: 0        Low Resolution

18:  Average (P71)^7857
 1: 1        Reps
 2: 7        Loc [ volts     ]

19:  Serial Out (P96)
 1: 71       Storage Module

*Table 2 Program
  01: 0.0000    Execution Interval (seconds)
;
;
;
;
; SUBROUTINES RUN THE PRESSURE TRANSDUCERS
;
*Table 3 Subroutines

1:  Beginning of Subroutine (P85)
 1: 2        Subroutine 2

2:  Full Bridge (P6)
 1: 1        Reps
```

```
 2: 3        25 mV Slow Range
 3: 3        DIFF Channel
 4: 1        Excite all reps w/Exchan 1
 5: 770       mV Excitation
 6: 11       Loc [ _________ ]
 7: .01      Mult
 8: 0        Offset

3:  Full Bridge (P6)
 1: 1        Reps
 2: 3        25 mV Slow Range
 3: 4        DIFF Channel
 4: 1        Excite all reps w/Exchan 1
 5: 770       mV Excitation
 6: 12       Loc [ _________ ]
 7: .5       Mult
 8: 0        Offset

4:  Z=X/Y (P38)
 1: 12       X Loc [ _________ ]
 2: 11       Y Loc [ _________ ]
 3: 13       Z Loc [ _________ ]

5:  Z=X*F (P37)
 1: 13       X Loc [ _________ ]
 2: .52      F
 3: 14       Z Loc [ ablat_psi ]

6:  Z=X*F (P37)
 1: 13       X Loc [ _________ ]
 2: 36.5      F
 3: 15       Z Loc [ ablat_cm  ]

7:  End (P95)

End Program


-Input Locations-
1 _________ 1 0 0
2 _________ 1 0 0
3 _________ 1 0 0
4 stage_psi 1 0 0
5 stage_cm  1 1 0
6 _________ 0 0 0
7 volts     1 1 1
```

8 _____ 0 0 0
9 _____ 0 0 0
10 _____ 0 0 0
11 _____ 1 1 1
12 _____ 1 1 1
13 _____ 1 2 1
14 ablat_psi 1 2 1
15 ablat_cm 1 1 1
16 _____ 0 0 0
17 _____ 0 0 0
18 _____ 0 0 0
19 _____ 0 0 0
20 _____ 0 0 0
21 _____ 0 0 0
22 _____ 0 0 0
23 _____ 0 0 0
24 _____ 0 0 0
25 _____ 0 0 0
26 uwlight 5 1 1
27 surflight 1 0 1
28 abl 1 0 0
29 stg 1 0 1
30 _____ 1 0 0
31 _____ 1 0 0
32 _____ 1 0 0
33 _____ 1 0 0
34 _____ 1 0 0
35 _____ 1 0 0
36 _____ 0 0 0
-Program Security-
0
0
0
-Mode 4-
-Final Storage Area 2-
0
-CR10X ID-
0
-CR10X Power Up-
0
-CR10X Compile Setting-
0
-CR10X RS-232 Setting-
-1
-DLD File Labels-
0

-Final Storage Labels-
0,2,11931
1,Year_RTM,2775
1,Day_RTM
1,Hour_Minute_RTM
2,stage_cm_AVG~5,5591
3,uwlight_AVG~26,19363
3,surflight_AVG~27
4,ablat_psi_AVG~14,7360
5,ablat_psi_STD~14,25199
6,ablat_cm_AVG~15,6446
7,volts_AVG~7,7857

4.3.1 East Lobe Bonney wiring

;**Stage transducer** (instrument with desiccant-filled vent tube)
;Red E1
;Orange H5
;Black L5
;Yellow H6
;Blue L6
;White AG (any one)
;Clear G (any one)
;
;**Ablation transducer** (instrument with desiccant-filled vent tube)
;Red E1
;Orange H1
;Black L1
;Yellow H2
;Blue L2
;White AG (any one)
;Clear G (any one)
;
;**Underwater PAR**
;Green 3L
;Blue 3H

;**Surface PAR**
;Black 4L
;Red 4H
;Clear G
;Jumper Wire from Black 4L to AG

;**PSA-916 Wiring**

;*********Internal Swiches in PSA-916*****
;1-ON
;2-OFF
;3-ON
;4-ON
;5-ON
;6-ON
;7-OFF
;8-OFF

;Green Not used - (analog output ground)
;Orange Not used - (analog output)

```
;Red    12V      - (external power 6-12V) - it goes to SW 12 V
;Black  G        - (Ground)
;White  C4       - (RS-232 External Key Input)
;Blue   C5       - (RS-232 Output/Error Output)

; Control Ports

     ;   CP1 -
     ;   CP2 -
     ;   CP3 - jump wire to SW 12V CTRL (Fryxel, ELB & WLB)
     ;   CP4 - white (input)
     ;   CP5 - blue (output)

;SW 12V
     ;sw 12V CTRL - jump wire to CP3

     ;sw 12V - Red

     ; Black - Ground
```

4.3.2 East Lobe Bonney program

```
*Table 1 Program
  01: 60.0000   Execution Interval (seconds)

; MEASURE ABLATION SENSOR
1:  Full Bridge w/mv Excit (P9)
 1: 1        Reps
 2: 5        2500 mV Slow Ex Range
 3: 3        25 mV Slow Br Range
 4: 1        DIFF Channel
 5: 1        Excite all reps w/Exchan 1
 6: 2500     mV Excitation
 7: 1        Loc [ ablat_cm  ]
 8: 102.21   Mult
 9: 0.0      Offset

; MEASURE UNDERVATER LIGHT  (UW PAR)
2:  Volt (Diff) (P2)
 1: 1        Reps
 2: 2        7.5 mV Slow Range
 3: 3        DIFF Channel
 4: 2        Loc [ uwlight   ]
 5: -100     Mult
 6: 0.0      Offset
```

```
;MEASURE SURFACE LIGHT (PAR)
3:  Volt (Diff) (P2)
 1: 1        Reps
 2: 3        25 mV Slow Range
 3: 4        DIFF Channel
 4: 3        Loc [ par       ]
 5: 200      Mult
 6: 0.0      Offset

;MEASURE BATTERY VOLTAGE
4:  Batt Voltage (P10)
 1: 4        Loc [ battvolts ]

; MEASURE STAGE TRANSDUCER VOLTAGE
5:  Full Bridge w/mv Excit (P9)
 1: 1        Reps
 2: 5        2500 mV Slow Ex Range
 3: 3        25 mV Slow Br Range
 4: 5        DIFF Channel
 5: 1        Excite all reps w/Exchan 1
 6: 2500     mV Excitation
 7: 5        Loc [ stage_cm  ]
 8: 101.53   Mult
 9: 0.0      Offset


'********************************************************************
'**************PSA-916 MEASURMENT*********************************
'********************************************************************


; If is midnight, exicute program

6:  If time is (P92)
 1: 0        Minutes (Seconds --) into a
 2: 1440     Interval (same units as above)
 3: 30       Then Do


     '*****************************************
     '************* Turn Port 3 High to ***********
     '************* turn ON Switched 12 V***********
     '*****************************************

7:  Do (P86)
 1: 43       Set Port 3 High
```

8: Excitation with Delay (P22)
 1: 2   Ex Channel
 2: 0000   Delay W/Ex (0.01 sec units)
 3: 100   Delay After Ex (0.01 sec units)
 4: 0000   mV Excitation

```
;*******************************************
;****Turn Port 4 High to set trigger high*****
;**********  (pause sounder)  ***************
;*******************************************
```

9: Do (P86)
 1: 44   Set Port 4 High

```
;*********************************
; Reset read ascii values to 00000
;*********************************
```

;---

; Decimal 48= 0 ASCII

10: Z=F x 10^n (P30)
 1: 48   F
 2: 00   n, Exponent of 10
 3: 6   Z Loc [Uascii_0]

;---

; Decimal 48= 0 ASCII

11: Z=F x 10^n (P30)
 1: 48   F
 2: 00   n, Exponent of 10
 3: 7   Z Loc [Uascii_1]

;---

```
; Decimal 48= 0 ASCII

12:  Z=F x 10^n (P30)
 1: 48       F
 2: 00       n, Exponent of 10
 3: 8        Z Loc [ Uascii_2  ]

;---------------------------------------------------------------

; Decimal 48= 0 ASCII

13:  Z=F x 10^n (P30)
 1: 48       F
 2: 00       n, Exponent of 10
 3: 9        Z Loc [ Uascii_3  ]

;---------------------------------------------------------------

; Decimal 48= 0 ASCII

14:  Z=F x 10^n (P30)
 1: 48       F
 2: 00       n, Exponent of 10
 3: 10       Z Loc [ Uascii_4  ]

;---------------------------------------------------------------

; Decimal 48= 0 ASCII

15:  Z=F x 10^n (P30)
 1: 48       F
 2: 00       n, Exponent of 10
 3: 11       Z Loc [ Uascii_5  ]

;---------------------------------------------------------------

; Decimal 48= 0 ASCII

16:  Z=F x 10^n (P30)
 1: 48       F
 2: 00       n, Exponent of 10
 3: 12       Z Loc [ Uascii_6  ]


    ;*************************************************************
    ; Set port 4 low to trigger measurement with Benthos PSA-916
```

```
;************************************************************
```

; * set port 4 low to click under ice sounder

```
  17:  Do (P86)
   1: 54       Set Port 4 Low
```

```
;************************************************************
;**********Read Benthos PSA-916 RS232 output******************
;************************************************************
```

; Instruction P15 uses CP4 as DTR, CP5 as RX.

; Receives ascii string as binary RS232, 1200 baud (set inside sounder

; with dip switches, see the above). Term char 13 = <cr>. Output is"Rxx.xx(E)<cr><lf>"

; i.e. 8(9) characters (the E and 9 if no echo rec'd).

; P63 identifies 82 (Ascii R) as leading

; tag, and P15 identifies <cr> as end tag. Five values xx.xx (Ascii . = 46)

; read into 5 input locations from Uascii_1

; DTR - Data Transmit?
; RTS - Receive to Send
; CTS - Clear To Send
; RX - Receive ?
; TX - Transmit ?
; <cr> - carrage return
; <lf> - line feed

```
  18:  Port Serial I/O (P15)
   1: 1        Reps
   2: 21       8-Bit, RS-232 Binary, 1200 Baud
   3: 1        Delay (0.01 sec units) before TX
   4: 4        First (RTS/DTR) of Control Ports Used
   5: 13       Start Loc for TX [ junk      ]
   6: 0        Number of Locs to TX
   7: 13       Termination Character for RX
   8: 9        Max Characters to RX
   9: 200      Time Out for CTS (TX) and/or RX (0.01 sec units)
```

```
    10: 7       Start Loc for RX [ Uascii_1  ]
    11: 1.0     Mult for RX
    12: 0.0     Offset for RX


;* * * filter to synchronize the output stream Data output starts with an R.
; 82 = R in ASCII table for alphabethic characters

    19:  Extended Parameters (P63)
     1: 82      Option
     2: 0       Option
     3: 0       Option
     4: 0       Option
     5: 0       Option
     6: 0       Option
     7: 0       Option
     8: 0       Option


     ;*****************************************
     ; Set port 4 high to end measure mode PSA-916
     ;*****************************************


    20:  Do (P86)
     1: 44      Set Port 4 High


     ;*****************************************
     ;****Conversion from ASCII to Decimal*******
     ;*****************************************

; Conversion from ascii (Uascii_1 .. _5) to decimal.

; Using subroutine 1 for conversion digit by digit

; First put all readings in same format: xx.xx
; If format is x.xx insert a leading zero after
; bumping digits along one place.


;------------------------ set if format 0X.XXX-------------------------
;If second location is "." than move digit one place to the right


    21:  If (X<=>F) (P89)
```

```
     1: 8        X Loc [ Uascii_2  ]
     2: 1        =
     3: 46       F
     4: 30       Then Do


;---------move value from location 4 to location 5------------

         22:  Z=X (P31)
          1: 10       X Loc [ Uascii_4  ]
          2: 11       Z Loc [ Uascii_5  ]

;---------move value from location 3 to location 4------------

         23:  Z=X (P31)
          1: 9        X Loc [ Uascii_3  ]
          2: 10       Z Loc [ Uascii_4  ]


;----------move value from location 2 to location 3------------

         24:  Z=X (P31)
          1: 8        X Loc [ Uascii_2  ]
          2: 9        Z Loc [ Uascii_3  ]

;----------move value from location 1 to location 2------------

         25:  Z=X (P31)
          1: 7        X Loc [ Uascii_1  ]
          2: 8        Z Loc [ Uascii_2  ]


;-----Insert "0" at the first location (decimal 48=0 ascii)-----


         26:  Z=F x 10^n (P30)
          1: 48       F
          2: 00       n, Exponent of 10
          3: 7        Z Loc [ Uascii_1  ]




    27:  End (P95)
```

```
      ;*************************************
      ;
      ;***Now do digit by digit conversion***
      ;*************************************
      ;

;------------------first digit-------------------------------
; Take value from location Uascii_1 and put it in location num
;(num location is further use in a subroutine).
; Make location multiple to be 10. Reduce this value for 0.1 for
; eqach incoming digit conversion (see end of soubroutine).
; Value in location Convert returned from the end of soubroutine
; and store in location Under.
; After first digit is saved, next digits
; added in next decimal place via decrease in location 'multipl'
; by factor of 10 (see end of soubroutine).

     28:  Z=X (P31)
      1: 7        X Loc [ Uascii_1  ]
      2: 14       Z Loc [ num       ]

     29:  Z=F x 10^n (P30)
      1: 1        F
      2: 1        n, Exponent of 10
      3: 15       Z Loc [ mult      ]

     30:  Do (P86)
      1: 1        Call Subroutine 1

     31:  Z=X (P31)
      1: 16       X Loc [ Convert   ]
      2: 17       Z Loc [ Under     ]

;------------------Now second digit--------------------------------


     32:  Z=X (P31)
      1: 8        X Loc [ Uascii_2  ]
      2: 14       Z Loc [ num       ]

     33:  Do (P86)
      1: 1        Call Subroutine 1

     34:  Z=X+Y (P33)
      1: 17       X Loc [ Under     ]
```

```
 2: 16       Y Loc [ Convert   ]
 3: 17       Z Loc [ Under     ]

;------------------Now third digit--------------------------------
;skipping decimal point at third location (Uascii_3)


35:  Z=X (P31)
 1: 10       X Loc [ Uascii_4  ]
 2: 14       Z Loc [ num       ]

36:  Do (P86)
 1: 1        Call Subroutine 1

37:  Z=X+Y (P33)
 1: 17       X Loc [ Under     ]
 2: 16       Y Loc [ Convert   ]
 3: 17       Z Loc [ Under     ]

;------------------Now fourth digit-------------------------------

38:  Z=X (P31)
 1: 11       X Loc [ Uascii_5  ]
 2: 14       Z Loc [ num       ]

39:  Do (P86)
 1: 1        Call Subroutine 1

40:  Z=X+Y (P33)
 1: 17       X Loc [ Under     ]
 2: 16       Y Loc [ Convert   ]
 3: 17       Z Loc [ Under     ]

;-----------------------------------------------------------------
; Uascii_6 skipped. This Location is only for "E" or 9 as an error message
; - no signal recived.


 '*****************************************
 ;************* Turn Port 3 Low to ************
 ;************* turn OFF Swiched 12 V**********
 '*****************************************


41:  Do (P86)
 1: 53       Set Port 3 Low
```

```
; Closing If statement/command/P92

42:  End (P95)



     ;***********************************************
     ;
     ; ************** OUTPUT ************************
     ;***********************************************
     ;


43:  Do (P86)
 1: 10       Set Output Flag High (Flag 0)



; SETUP 20 MINUTES INTERVAL TIME
44:  If time is (P92)
 1: 0        Minutes (Seconds --) into a
 2: 20       Interval (same units as above)
 3: 10       Set Output Flag High

; SETUP STORAGE AREA AND ARRAY ID
45:  Set Active Storage Area (P80)^29610
 1: 1        Final Storage Area 1
 2: 3        Array ID

46:  Real Time (P77)^25760
 1: 1220     Year,Day,Hour/Minute (midnight = 2400)

47:  Resolution (P78)
 1: 1        High Resolution

;MEASURE AVERAGE ABLATION SENSOR
48:  Average (P71)^25466
 1: 1        Reps
 2: 1        Loc [ ablat_cm  ]

;MEASURE AVERAGE  STAGE TRANSDUCER
49:  Average (P71)^32453
 1: 1        Reps
 2: 5        Loc [ stage_cm  ]
```

```
50:  Resolution (P78)
 1: 0        Low Resolution

;MEASURE AVERAGE FRO UNDERVATER LIGHT, SURFACE LIGHT AND
BATTERY VOLTAGE (REPS 3)
51:  Average (P71)^23865
 1: 3        Reps
 2: 2        Loc [ uwlight   ]

;COMMUNICATE WITH STORAGE MODULE (7)
52:  Serial Out (P96)
 1: 71       Storage Module

;*********now for PSA916*****************************


;TIME INTERVAL ONCE A DAY (AT NOON)
53:  If time is (P92)
 1: 720      Minutes (Seconds --) into a
 2: 1440     Interval (same units as above)
 3: 10       Set Output Flag High

; SETUP STORAGE AREA & ARRY ID TO 1
54:  Set Active Storage Area (P80)^1813
 1: 1        Final Storage Area 1
 2: 32       Array ID

; SETUP TIME
55:  Real Time (P77)^28407
 1: 1220     Year,Day,Hour/Minute (midnight = 2400)


56:  Resolution (P78)
 1: 0        Low Resolution


; GET A DISTANCE TO THE ICE FROM PSA-916
57:  Sample (P70)^7309
 1: 1        Reps
 2: 17       Loc [ Under     ]


; Activate Serial Output: Comunicate with storage area - send
; data to SM4M for storage.

58:  Serial Out (P96)
```

```
 1: 71       Storage Module

*Table 2 Program
  01: 0.0000    Execution Interval (seconds)

;*********************************************************
*Table 3 Subroutines
;*********************************************************

; ------ Subroutine for  ascii to decimal conversion -----

; Benthos sounder return depth in ascii format. Convert digit-by-digit

; to decimal here, then save as one number [Convert] for output.


1:  Beginning of Subroutine (P85)
 1: 1        Subroutine 1

;--------------***Decimal 48=0 ASCII ****----------------------
; Take value from location num and if this value is equal 48
; than put it in location Convert .


    2:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 48       F
     4: 30       Then Do


        3:  Z=F x 10^n (P30)
         1: 0        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    4:  End (P95)

;--------------***Decimal 49=1 ASCII ****----------------------

    5:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 49       F
     4: 30       Then Do
```

```
        6:  Z=F x 10^n (P30)
         1: 1        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    7:  End (P95)

;--------------***Decimal 50=2 ASCII ****----------------------

    8:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 50       F
     4: 30       Then Do


        9:  Z=F x 10^n (P30)
         1: 2        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    10:  End (P95)

;--------------***Decimal 51=3 ASCII ****----------------------

    11:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 51       F
     4: 30       Then Do


        12:  Z=F x 10^n (P30)
         1: 3        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    13:  End (P95)

;--------------***Decimal 52=4 ASCII ****----------------------
```

```
    14:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 52       F
     4: 30       Then Do


        15:  Z=F x 10^n (P30)
         1: 4        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    16:  End (P95)

;--------------***Decimal 53=5 ASCII ****----------------------

    17:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 53       F
     4: 30       Then Do


        18:  Z=F x 10^n (P30)
         1: 5        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    19:  End (P95)

;--------------***Decimal 54=6 ASCII ****----------------------

    20:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 54       F
     4: 30       Then Do


        21:  Z=F x 10^n (P30)
         1: 6        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]
```

```
    22:  End (P95)

;--------------***Decimal 55=7 ASCII ****----------------------


    23:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 55       F
     4: 30       Then Do


        24:  Z=F x 10^n (P30)
         1: 7        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    25:  End (P95)

;--------------***Decimal 56=8 ASCII ****----------------------


    26:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 56       F
     4: 30       Then Do


        27:  Z=F x 10^n (P30)
         1: 8        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    28:  End (P95)

;--------------***Decimal 57=9 ASCII ****----------------------

    29:  If (X<=>F) (P89)
     1: 14       X Loc [ num       ]
     2: 1        =
     3: 57       F
     4: 30       Then Do
```

```
        30:  Z=F x 10^n (P30)
         1: 9        F
         2: 00       n, Exponent of 10
         3: 16       Z Loc [ Convert   ]


    31:  End (P95)

;*****************************************************
;
;***save decimal as one number [Cononvert] for output***
;*****************************************************

; take value from Convert, multiple and put back in location Convert
; (rewrite location Convert)
; This value in location Convert returne back in Table 1
; and add it in location Under.

    32:  Z=X*Y (P36)
     1: 16       X Loc [ Convert   ]
     2: 15       Y Loc [ mult      ]
     3: 16       Z Loc [ Convert   ]


    33:  Z=X*F (P37)
     1: 15       X Loc [ mult      ]
     2: .1       F
     3: 15       Z Loc [ mult      ]



34:  End (P95)
End Program


-Input Locations-
1 ablat_cm  1 1 1
2 uwlight   1 1 1
3 par       1 1 1
4 battvolts 1 1 1
5 stage_cm  1 1 1
6 Uascii_0  1 0 1
7 Uascii_1  1 2 3
8 Uascii_2  1 3 2
9 Uascii_3  1 1 2
```

10 Uascii_4 1 2 2
11 Uascii_5 1 1 2
12 Uascii_6 1 0 1
13 junk 1 1 0
14 num 1 10 4
15 mult 1 2 2
16 Convert 1 5 11
17 Under 1 4 4
18 _____ 0 0 0
19 _____ 0 0 0
20 _____ 0 0 0
21 _____ 0 0 0
22 _____ 0 0 0
23 _____ 0 0 0
24 _____ 0 0 0
25 _____ 0 0 0
26 _____ 0 0 0
27 _____ 0 0 0
28 _____ 0 0 0
-Program Security-
0000
0000
0000
-Mode 4-
-Final Storage Area 2-
0
-CR10X ID-
0
-CR10X Power Up-
3
-CR10X Compile Setting-
3
-CR10X RS-232 Setting-
-1
-DLD File Labels-
0
-Final Storage Labels-
0,3,29610
1,Year_RTM,25760
1,Day_RTM
1,Hour_Minute_RTM
2,ablat_cm_AVG~1,25466
3,stage_cm_AVG~5,32453
4,uwlight_AVG~2,23865
4,par_AVG~3
4,battvolts_AVG~4

5,32,1813
6,Year_RTM,28407
6,Day_RTM
6,Hour_Minute_RTM
7,Under~17,7309

4.4.1 West Lobe Bonney wiring (CR10x)

Ablation transducer (instrument with desiccant-filled vent tube)

Red	E1
Orange	H1
Black	L1
Yellow	H2
Blue	L2
White	AG (any one)
Clear	G (any one)

Underwater PAR

Green	3L
Blue	3H

Surface PAR

Black	4L
Red	4H
Clear	G

Jumper Wire from Black 4L to AG

4.4.2 West Lobe Bonney program

```
;{CR10X}


*Table 1 Program
  01: 60.0000   Execution Interval (seconds)

; MEASURE ABLATION SENSOR
1:  Full Bridge w/mv Excit (P9)
 1: 1        Reps
 2: 5        2500 mV Slow Ex Range
 3: 3        25 mV Slow Br Range
 4: 1        DIFF Channel
 5: 1        Excite all reps w/Exchan 1
 6: 2500     mV Excitation
 7: 1        Loc [ ablat_cm  ]
 8: 101.86   Mult
 9: 0.0      Offset

;MEASURE UNDERWATER LIGHT
2:  Volt (Diff) (P2)
 1: 1        Reps
 2: 2        7.5 mV Slow Range
 3: 3        DIFF Channel
```

```
 4: 2        Loc [ uwlight   ]
 5: -100     Mult
 6: 0.0      Offset

;MEASURE SURFACE LIGHT SENSOR (QUANTUM) - SURFACE PAR
3:  Volt (Diff) (P2)
 1: 1        Reps
 2: 3        25 mV Slow Range
 3: 4        DIFF Channel
 4: 3        Loc [ par       ]
 5: 200      Mult
 6: 0.0      Offset

; MEASURE BATTERY VOLTAGE
4:  Batt Voltage (P10)
 1: 4        Loc [ battvolts ]

; TIME INTERVAL SETUP FOR 20 MINUTES
5:  If time is (P92)
 1: 0        Minutes (Seconds --) into a
 2: 20       Interval (same units as above)
 3: 10       Set Output Flag High

;SETUP STORAGE AREA AND ARREY ID TO 4
6:  Set Active Storage Area (P80)^15304
 1: 1        Final Storage Area 1
 2: 4        Array ID

7:  Real Time (P77)^3758
 1: 1220     Year,Day,Hour/Minute (midnight = 2400)

8:  Resolution (P78)
 1: 1        High Resolution

; CALCULATE AVERAGE FOR ABLATION SENSOR
9:  Average (P71)^9773
 1: 1        Reps
 2: 1        Loc [ ablat_cm  ]

10:  Resolution (P78)
 1: 0        Low Resolution

;CALCULATE AVERAGE FOR UNDERWATER LIGHT, PAR, AND BATTERY
VOLTS (REPS 3)
11:  Average (P71)^11901
 1: 3        Reps
```

```
 2: 2        Loc [ uwlight   ]

; COMUNICATE WITH STORAGE MODULE (7)
12:  Serial Out (P96)
 1: 71       Storage Module



End Program

-Input Locations-
1 ablat_cm  1 1 1
2 uwlight   1 1 1
3 par       1 1 1
4 battvolts 1 1 1
5 __________ 1 0 0
6 __________ 1 0 0
7 __________ 1 0 0
8 __________ 0 0 0
9 __________ 0 0 0
10 __________ 0 0 0
11 __________ 0 0 0
12 __________ 0 0 0
13 __________ 0 0 0
14 __________ 0 0 0
15 __________ 0 0 0
16 __________ 0 0 0
17 __________ 0 0 0
18 __________ 0 0 0
19 __________ 0 0 0
20 __________ 0 0 0
21 __________ 0 0 0
22 __________ 0 0 0
23 __________ 0 0 0
24 __________ 0 0 0
25 __________ 0 0 0
26 __________ 0 0 0
27 __________ 0 0 0
28 __________ 0 0 0
-Program Security-
0000
0000
0000
-Mode 4-
-Final Storage Area 2-
0
```

-CR10X ID-
0
-CR10X Power Up-
3
-CR10X Compile Setting-
3
-CR10X RS-232 Setting-
-1
-DLD File Labels-
0
-Final Storage Labels-
0,4,15304
1,Year_RTM,3758
1,Day_RTM
1,Hour_Minute_RTM
2,ablat_cm_AVG~1,9773
3,uwlight_AVG~2,11901
3,par_AVG~3
3,battvolts_AVG~4