Documentation Of The Taylor Valley Blue Boxes for season 2006/07

(aka Blue Box Bible 0607 v.1)

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Version: 1
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CHANGES

Blue Box 06/07 Version:

V.1 N/A

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1. Sensors

1.1 Available Sensors

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)	11/17/05 23:45	11/11/05 14:10	11/26/05 10:02	11/26/05 15:12
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		10/24/04 21:00	11/24/04 13:50	11/16/05 16:45	11/20/05
Ablation Transducer (pressure transducer)	Druck Pressure Transducer PDCR 1830 or 1230; Keller Pressure Transducer Series 169/173 only at Lake Hoare.	Continuous lake ice ablation measurement	Druck Incorporated (203) 746-0400 Keller ?	cm	11/19//05	2000/01 ?	19/11/04	17/11/04
Lake Level (Stage) Transducer		Continuous lake level measurements	Druck Incorporated (203) 746-0400		21/11/04	17/11/04	19/11/04	N/A

● in instruction manual for LI 190SB quantum Sensor (Campbell Scientific, revision: 6/9) in Table 1 "Multiplier Required for Flux Density and Total Fluxes" (pg. 2), units are wrong (mmole s^{-1} m^{-2} or mmole m^{-2}). Units should be mmole s-1 m^{-2}/ mV & mmole m-2/mV.
● Units for Surface PAR output value are in mV. After applying multiplier (during data logging or after we download data) we end up with mmole s^{-1} m^{-2} or mmole m^{-2} for Total Fluxes.

● The Keller Pressure Transducers still remained at Lake Hoare, and program for Lake Hoare is different than the other programs. Druck Pressure Transducers are presented at all other lakes (Fryxell, ELB & WLB).

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*** **(Lake Fry, ELB and 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) ***Keller Pressure Transducer 173*** **(only at Lake Hoare)**

Sensor details:
N/A

Instruction Manual from Campbell Scientific
www.campbellsci.ca/Catalogue/KELLER169_173_Man.pdf

(5) **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

(6) **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

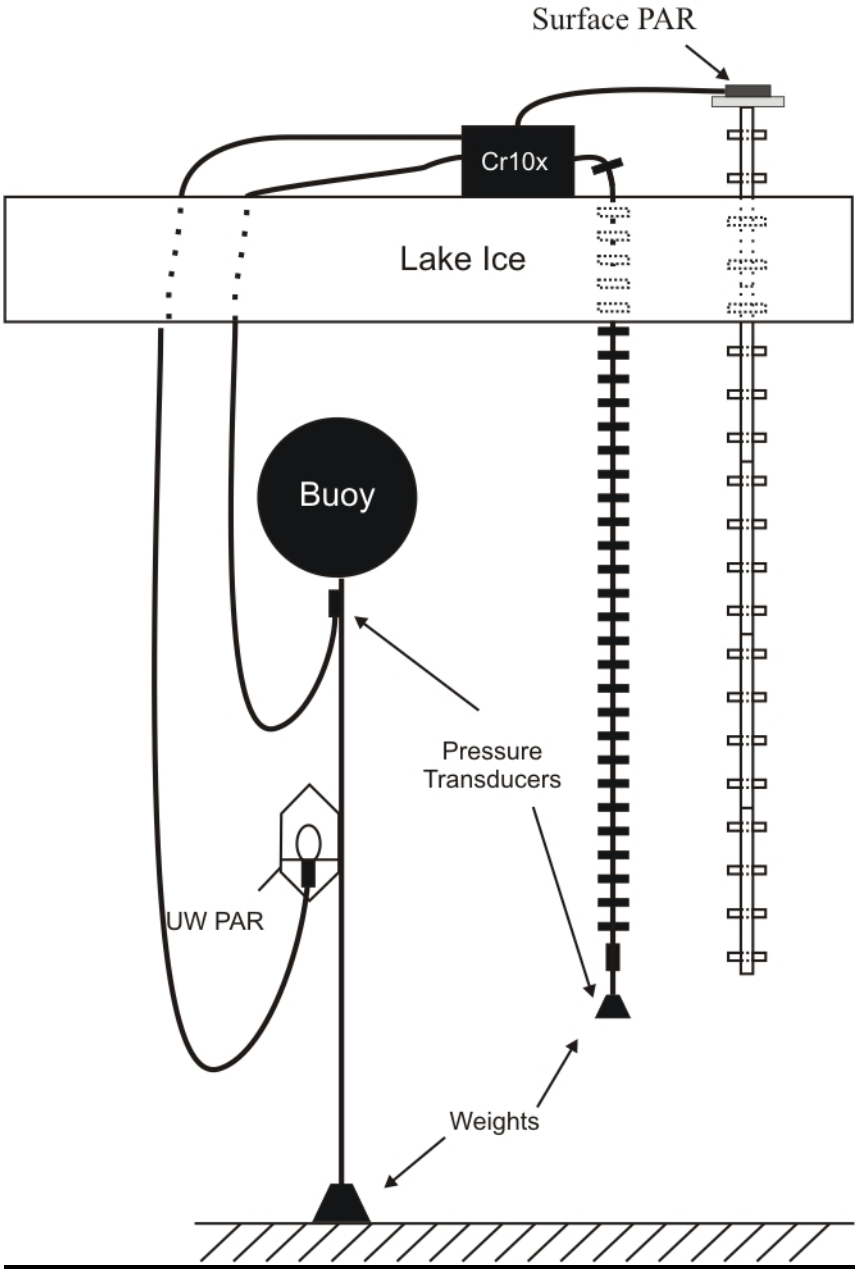

Fig.1: Lake cross-section showing buoy, data logger, position of deployed sensors and ablation stake.

UW par deployment depths measured from the surface of the ice:

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

2. Blue Box Filed Setup

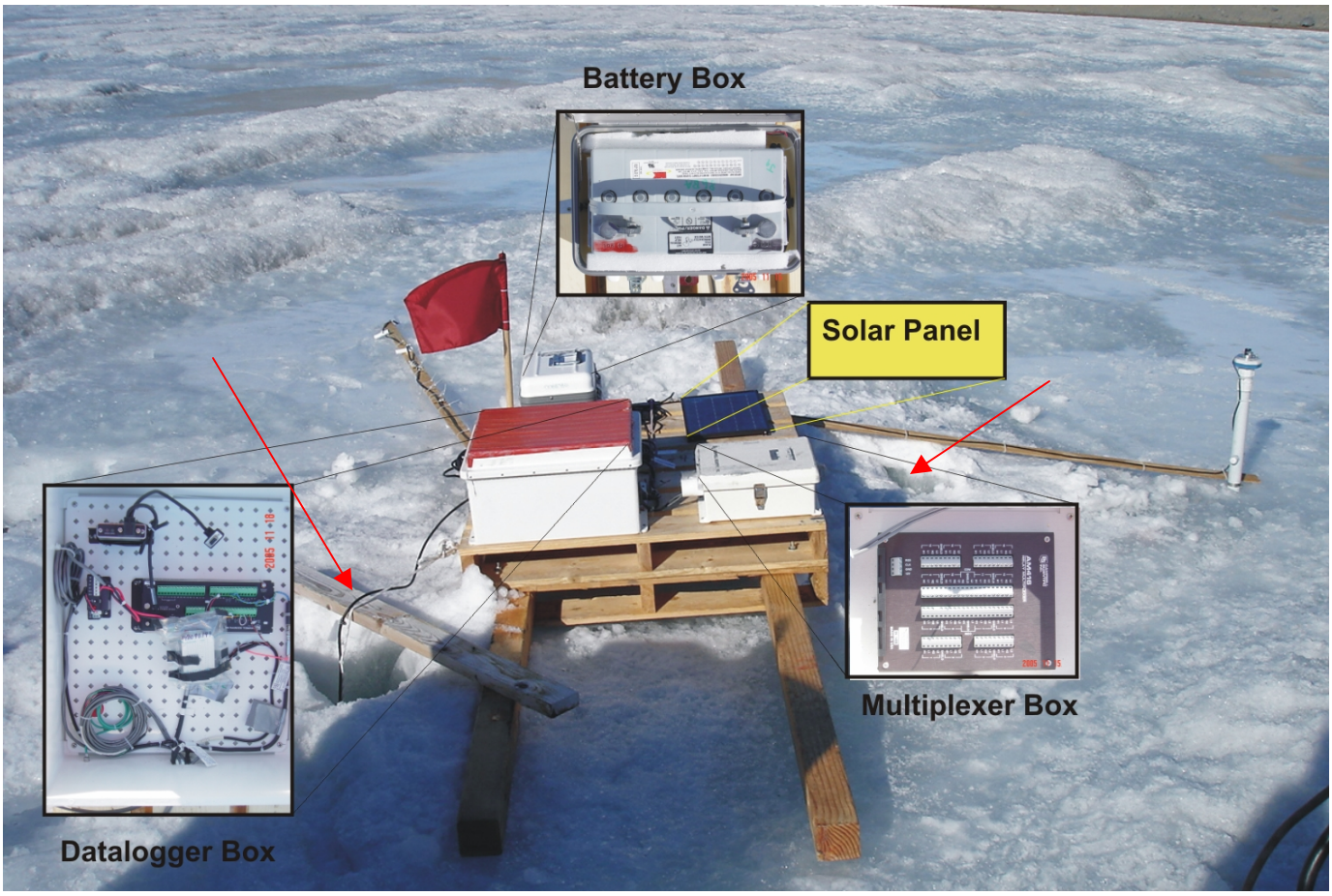

Fig. 2: Field setup and components of a Blue Box system. Outriggers are facing main wind direction and with two anchors (marked by red arrows) to prevent box from flipping.

3. Notes on changes made in November 2006

3.1 Hardware Changes

For all Lakes:

- to prevent blue boxes from flipping over:
  - ► outriggers facing the main wind direction were added to blue box pallets.
  - ► blue box pallets were further stabilized by two anchors.
- uw par were attached to buoy at the fixed distance from pressure transducer.
- short wooden poll with red flag were added to each blue box pallet.
- all 4" pvc pipes installed last year/season were taken out.

Sensor replacement/installation:

- uw par were replaced at Lake Fryxell and Lake Hoare according to two-year schedule established by John Priscue.

NOTE:

- Underwater sonars were late (delivered a few days before the end of our fieldwork deployment). They will be deployed in 2007-08 season. Miroljub took one to UIC to make and test a program, other three were left in McMurdo.
- Miroljub gave old laminated uw par labels from Fryxell & Hoare to John Priscue at Lake Bonney. Whoever change uw par should keep doing this because JP traditionally keeps track of all uw par sensors from the beginning of the LTER project.
- Laminated labels for new uw sensors were left in a data logger box attached to uw par cable.

● We installed 4" pipes for securing a stage transducer cable from being cut during ice drilling. However, it shows that these pipes could produce more problems than being helpful. At lake Hoare, one pipe slip through the ice (although it was secured by 2x4 – see figure 4 below). In a case that buoy needs to be taken out and sensors replaced, it's

requires more resources and stage transducer must be freed from buoy (cut attachment, secure from freezing and pulled twice through the buoy).

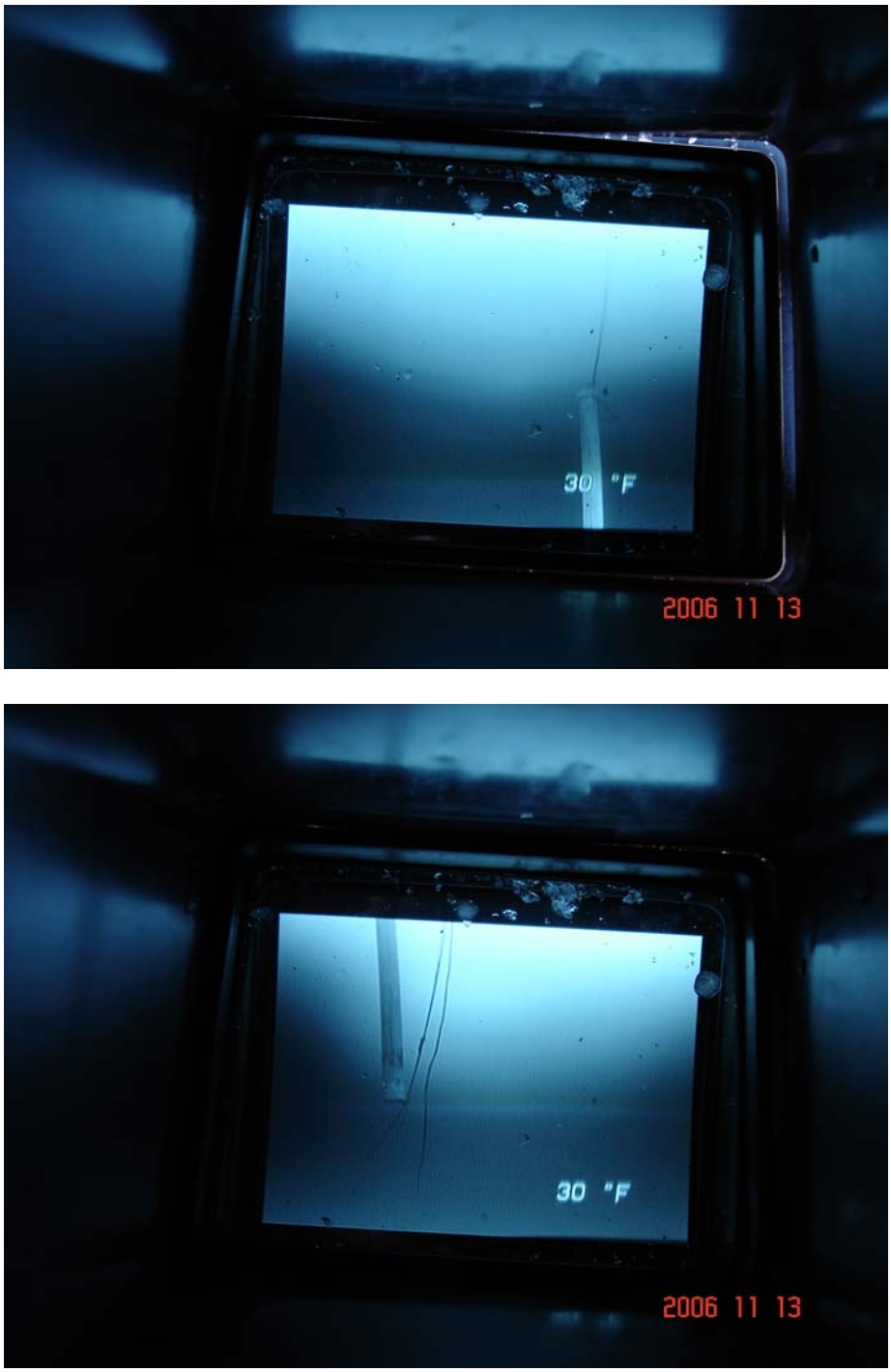

Fig. 4: Images of top & bottom part of 4 " pvc pipe at the Lake Hoare that slipped through the ice. Miroljub made a special hook to ketch it and pull it out.

3.1.1 Lake Fryxell

- Melted out uw par and deployed new one and attached to buoy (Fig. 5).

- Old uw par Cable ablation = 2 m 35 cm

- Deployment Date: 11/25/2006

- New sensor information:
  - **New UW par – Lake Fryxell**
    MULT –146.20 (in air)
    -236.84 (in water)
    tcoff: 0.0036
    Units: µmol $s^{-1}m^{-2}$
    Serial#: SPQA 1861
    Cal. Date: 07 Apr. 06 LiCor

    Back: of laminated card:
    µmol $s^{-1}m^{-2}$ (instantaneous)
    µmol m^{-2} (integrated)
    µmol $s^{-1}m^{2}$ (average)

- **Old uw par information from Lake Fryxell**
  Front of laminated card:
  MULT –147.28 (in air)
  -238.59 (in water)
  tcoff: 0.0036
  Units: µmol $s^{-1}m^{-2}$ per µA
  Serial#: SPQA 2869
  Cal. Date: 14 Apr. 04 LiCor

  Back of laminated card:
  Multiplier must be entered into meter
  refer to manual
  Units:
  µmol $s^{-1}m^{-2}$ (instantaneous)
  µmol m^{-2} (integrated)
  µmol $s^{-1}m^{2}$ (average)
  Recalibration recommended every to year

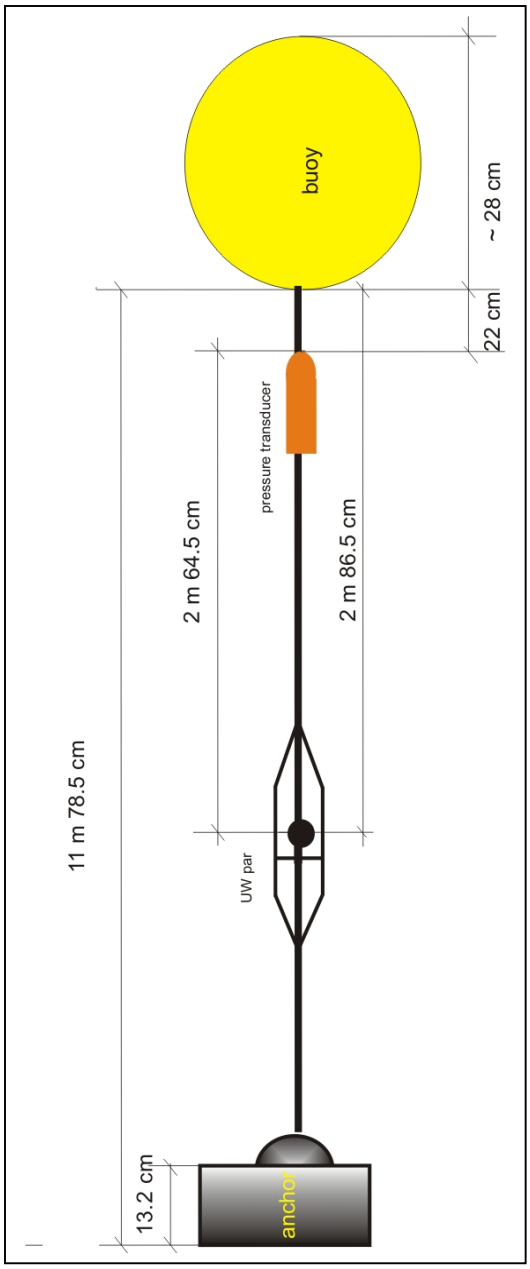

Fig. 5: Buoy at Lake Fryxell.
(not to scale)

3.1.2 Lake Hoare

- Melted out uw par, deployed new one and attached to buoy (Fig. 6).

- Old uw par Cable Ablation = 113.4 cm

- Deployment Date: Th 11/15/06

- New sensor information:

  New uw par inside the MPL Box
  MULT –159.24 (in air)
  -257.97 (in water)
  tcoff: 0.0036
  Units: µmol $s^{-1}m^{-2}$
  Serial#: SPQA1692
  Cal. Date: 07 Apr. 06 LiCor

  Back of laminated card:
  µmol $s^{-1}m^{-2}$ (instantaneous)
  µmol m^{-2} (integrated)
  µmol $s^{-1}m^{2}$ (average)

- **Old uw par information from Lake Hoare:**

  Front of laminated card:
  MULT –141.04 (in air)
  -228.48 (in water)
  tcoff: 0.0036
  Units: µmol $s^{-1}m^{-2}$ per µA
  Serial#: SPQA 1171
  Cal. Date: 14 Apr. 04 LiCor

  Back of laminated card:
  Multiplier must be entered into meter
  refer to manual
  Units:
  µmol $s^{-1}m^{-2}$ (instantaneous)
  µmol m^{-2} (integrated)
  µmol $s^{-1}m^{2}$ (average)
  Recalibration recommended every to year

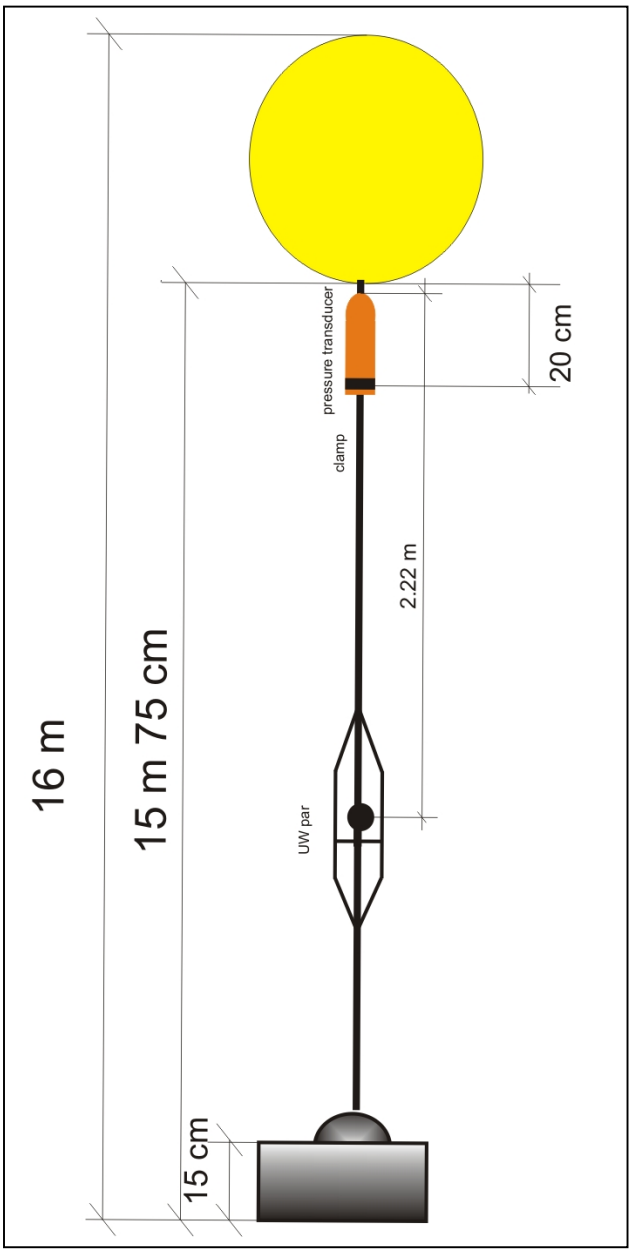

Fig. 6: Buoy at Lake Hoare. (not to scale)

3.1.3 East Lake of Lake Bonney

- Melted out uw par and attached to the buoy (Fig. 7).
- Old UW par Cable Ablation = 134 cm.

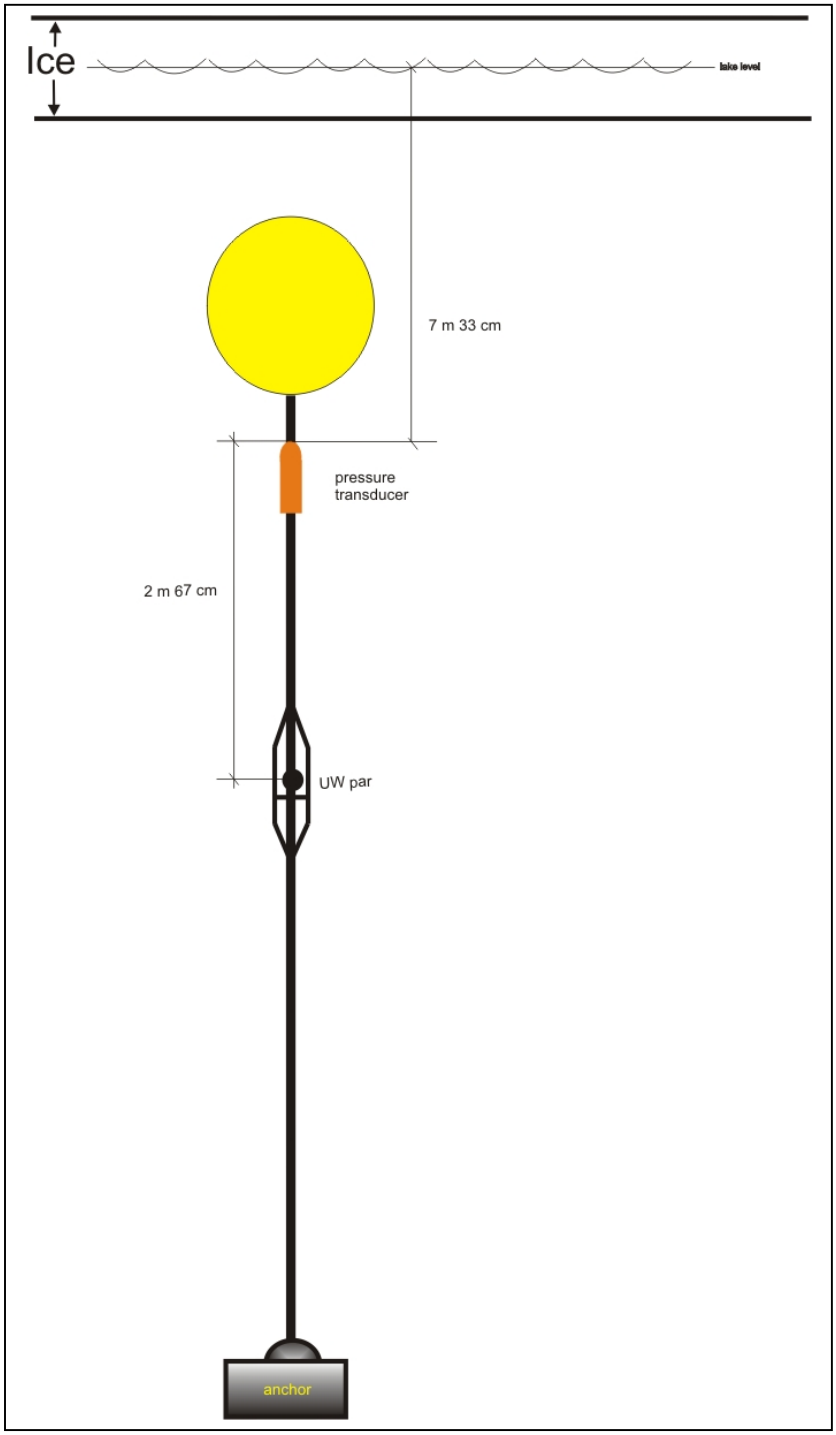

Fig. 7: Buoy at East Lobe of Lake Bonney.
(not to scale)

3.1.4 West Lobe of Lake BonneyLB

- Melted out uw par and attached to the buoy (Fig.8).
- UW par Cable Ablation = 16 cm

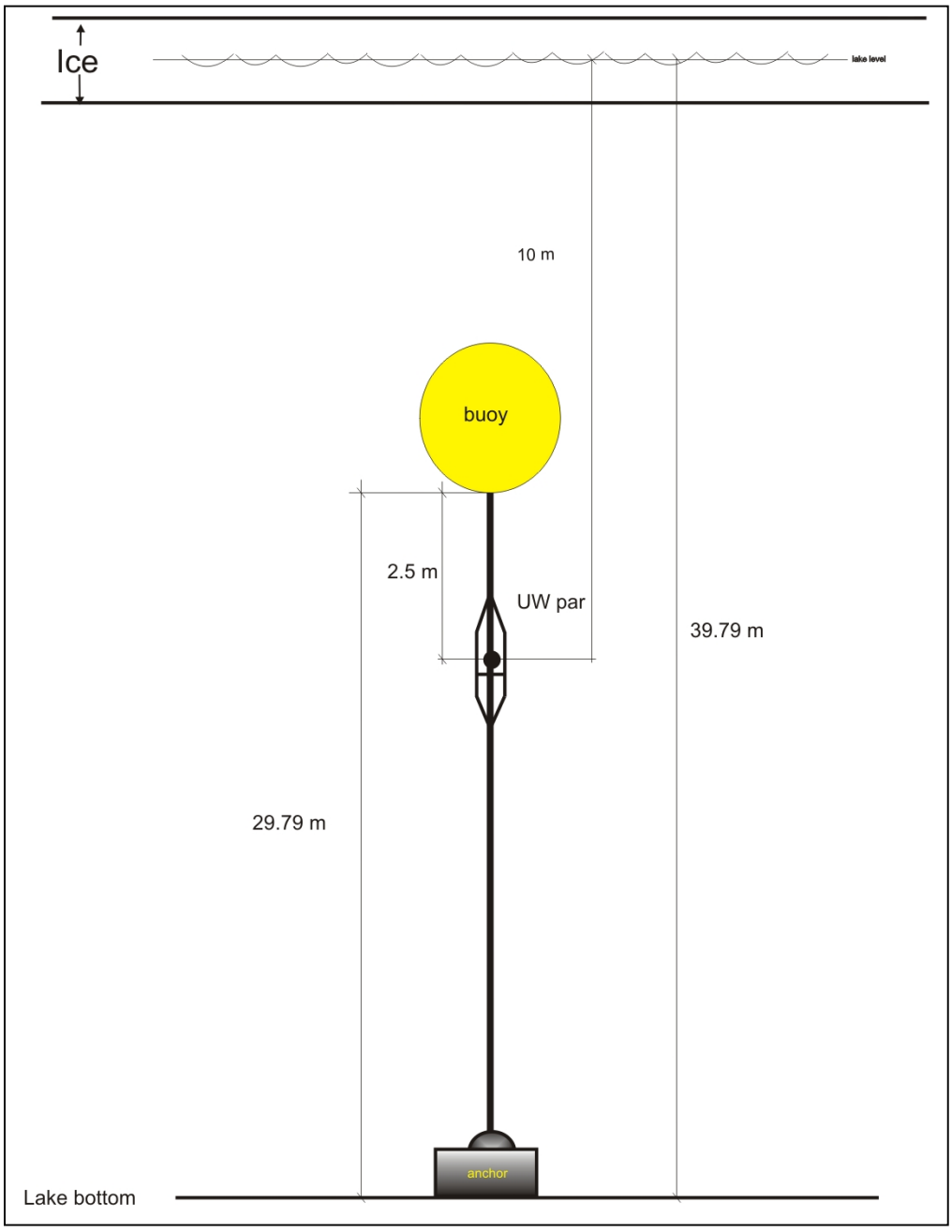

Fig. 8: Buoy at East Lobe of Lake Bonney.
(not to scale)

3.2 Software Changes

● N/A

3.2.1 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 when we installed sensor).
● 200 for Surface PAR.

There are two reasons why we chose this approach:
1. This is the safest and easiest way to go. We deploy the real multiplier later during the data post processing. This way, we can always backtrack and figure out what the multiplier should be by only having the sensor serial numbers deployed.

2. Those are round values that are close to what the real multipliers are.

Below Programs an Wiring are the same as last season/year/blue box bible.

4. Programs and CR10x Data logger Wiring

NOTE:
For all lakes:
There were no changes in program or wiring from last year.

4.1 Lake Fryxell

.....**3.1.1 Wiring**

Wiring at Lake Fryxell Blue Box after rebuilding Blue Boxes in Nov 2005

CR10X 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

AM416 Relay Multiplexer:
Two gray wires inside the multiplexer box are not connected:

4.1.2 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)
 1: 1        Final Storage Area 1
 2: 1        Array ID

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

9:  Resolution (P78)
 1: 1        High Resolution

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

;CALCULATE AVERAGE FOR STAGE_CM
11:  Average (P71)
 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)
 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

4.1.3 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
.....Input storage (*6) locations
.....Final storage array definition

4.1.4 Final storage array definition (*.FSL file)

Final Storage Label File for: FRL PROGRAM UPDATED FOR PAR (QUANTUM) SENSOR NOV 2005.csi
Date: 11/20/2005
Time: 16:07:00

1 Output_Table 20.00 Min
1 1 L
2 Year_RTM L
3 Day_RTM L
4 Hour_Minute_RTM L
5 ablat_cm_AVG H
6 stage_cm_AVG H
7 uwlight_AVG L
8 par_AVG L
9 battvolts_AVG L

Estimated Total Final Storage Locations used per day 792

4.2 Lake Hoare

.....4.2.1 Wiring

Wiring at Lake Hoare Blue Box (after rebuilding Blue Boxes in Nov 2005)

(Multiplexer=MUX)

CR10X wiring

Stage transducer jumper wire (3 wires with black heat shrunk resistor)
Yellow 1H
Black 1L (the black stage transducer wire also goes in here, see below)
Purple E1 (together with purple from other jumper)

Stage transducer (instrument with dessicant filled vent tube, this one will have more pink dessicant than the other)
Black 1L (the Black stage transducer jumper wire also goes here, see above)
Red 2H
Green 2L
White AG (any one)
Blue G (any one)

Ablation transducer jumper wire (3 wires with black heat shrunk resistor)
Yellow 3H
Black 3L (the black ablation transducer wire also goes in here, see below)
Purple E1 (together with purple from other jumper)

Ablation transducer (instrument with dessicant filled vent tube, this one will have less pink dessicant than the other)
Black 3L (the Black ablation transducer jumper wire also goes here, see above)
Red 4H
Green 4L
White AG (any one)
Blue G (any one) this one was disconected

Mux signal cable
Red 5H
White 5L
Black E2
Green AG (any one)
Clear G (any one)

Note: Green should be connected to AG according to BBB 04/05. However, at CR10 was connected at G (right to AG port). Because everything works properly, it was left at G when Medved rebuild blue boxes in 2006.

Mux power/reset cable
Red 12V (any one)
White C3

Green C2
Black G (any one)
Clear G (any one)

Surface PAR
Red 6H
Black 6L
Clear G
Jumper Wire from Black 6L to AG

Multiplexer Wiring

Underwater light (PAR) sensor (twisted blue and green wires)
Blue Set 1, H1
Green Set 1, L1

Mux Common wires

Mux signal cable
Red Com, H1
White Com, L1
Black Com, L2
Green Com, H2
Clear Com, Shield

Mux power/reset cable
Red 12V
White CLK
Green RES
Black GND
Clear Com, Shield

4.2.2 Program

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

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

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

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

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

5:  Do (P86)
 1: 42       Set Port 2 High

6:  Do (P86)
 1: 73       Pulse Port 3

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

8:  Do (P86)
 1: 52       Set Port 2 Low

9:  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)

10:  Set Active Storage Area (P80)^25311
```

1: 1 Final Storage Area 1
2: 2 Array ID

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

12: Average (P71)
1: 1 Reps
2: 4 Loc [stage_psi]

13: Standard Deviation (P82)
1: 1 Reps
2: 4 Sample Loc [stage_psi]

14: Resolution (P78)
1: 1 High Resolution

15: Average (P71)
1: 1 Reps
2: 5 Loc [stage_cm]

16: Resolution (P78)
1: 0 Low Resolution

17: Average (P71)
1: 2 Reps
2: 26 Loc [uwlight]

18: Average (P71)
1: 1 Reps
2: 14 Loc [ablat_psi]

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

20: Resolution (P78)
1: 1 High Resolution

21: Average (P71)
1: 1 Reps
2: 15 Loc [ablat_cm]

22: Resolution (P78)
1: 0 Low Resolution

23: Average (P71)
1: 1 Reps
2: 7 Loc [volts]

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

*Table 2 Program
01: 0.0000 Execution Interval (seconds)
;
;
;
;
; SUBROUTINES RUN THE TWO PRESSURE TRANSDUCERS (DIFFERENT MODELS THAN AT OTHER LAKES)
;
*Table 3 Subroutines

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

2: Full Bridge (P6)
1: 1 Reps
2: 3 25 mV Slow Range
3: 1 DIFF Channel
4: 1 Excite all reps w/Exchan 1
5: 770 mV Excitation
6: 1 Loc [_____]
7: .01 Mult
8: 0 Offset

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

4: Z=X/Y (P38)
1: 2 X Loc [_____]
2: 1 Y Loc [_____]
3: 3 Z Loc [_____]

5: Z=X*F (P37)
1: 3 X Loc [_____]
2: .52 F
3: 4 Z Loc [stage_psi]

6: Z=X*F (P37)
1: 3 X Loc [_____]
2: 36.5 F
3: 5 Z Loc [stage_cm]

7: End (P95)

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

9: 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

10: 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

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

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

13: Z=X*F (P37)

1: 13 X Loc [_____]
2: 36.5 F
3: 15 Z Loc [ablat_cm]

14: End (P95)

End Program

4.2.3 Input storage (*6) locations

-Input Locations-
1 _____ 1 1 1
2 _____ 1 1 1
3 _____ 1 2 1
4 stage_psi 1 2 1
5 stage_cm 1 1 1
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 _____ 1 0 0
29 _____ 1 0 0
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-
0,2,25311
1,Year_RTM,2775
1,Day_RTM
1,Hour_Minute_RTM
2,stage_psi_AVG~4,14666
3,stage_psi_STD~4,24383
4,stage_cm_AVG~5,5591
5,uwlight_AVG~26,19363
5,surflight_AVG~27
6,ablat_psi_AVG~14,7360
7,ablat_psi_STD~14,25199
8,ablat_cm_AVG~15,6446
9,volts_AVG~7,7857

.....4.2.4 Final storage array definition

Final Storage Label File for: LAKE HOARE PROGRAM FOR UPDATED BLUE BOX.csi
Date: 11/9/2005
Time: 15:31:57

2 Output_Table 20.00 Min
1 2 L
2 Year_RTM L
3 Day_RTM L
4 Hour_Minute_RTM L
5 stage_psi_AVG L
6 stage_psi_STD L
7 stage_cm_AVG H
8 uwlight_AVG L
9 surflight_AVG L
10 ablat_psi_AVG L
11 ablat_psi_STD L
12 ablat_cm_AVG H
13 volts_AVG L

Estimated Total Final Storage Locations used per day 1080

4.3 Lake Bonney East Lobe

.....4.3.1 Wiring

Wiring at Lake Bonney East Blue Box after rebuilding Blue Box in Nov 2005

CR10 wiring

Stage transducer (instrument with dessicant-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 dessicant-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

Jump Wire from 3L to AG

Surface PAR

Black	4L
Red	4H

Jumpe rWire from 4L to AG

Multiplexer Box

Note:
Three mV adapters are attached at multiplexer (R=1210OHM)

1st at 3	2nd at 2	3rd at 1
Blue H1	Blue H1	Blue H1
Green L1	Green L1	Green L1

Mux Cable # 1

Green	RES
White	CLK
Black	GND
Red	12V
Clear	Shield COM

Mux Cable # 2:

Green	COM H2
White	COM L1
Black	COM L2
Red	COM H1
Clear	Shield COM

.....4.3.2 Program

```
;{CR10X}
;This is a program for East Lake Bonney with new surface light sensor installed (PAR)
and compiled for CR10X datalogger

*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

; SETUP 20 MINUTES INTERVAL TIME
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 AND ARRAY ID
7:  Set Active Storage Area (P80)
 1: 1        Final Storage Area 1
 2: 3        Array ID

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

9:  Resolution (P78)
 1: 1        High Resolution

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

;MEASURE AVERAGE  STAGE TRANSDUCER
11:  Average (P71)
 1: 1        Reps
 2: 5        Loc [ stage_cm  ]

12:  Resolution (P78)
 1: 0        Low Resolution

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

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

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

*Table 3 Subroutines

End Program

4.3.3 Input storage (*6) locations

-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 _____ 0 0 0
7 _____ 0 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-
0,3,1744
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

.....4.3.4 Final storage array definition (*.FSL)

Final Storage Label File for: NEW BYE PROGRAM WITH SURFACE PAR INSTALLED ON NOV 2005.csi
Date: 11/25/2005
Time: 18:43:28

3 Output_Table 20.00 Min
1 3 L
2 Year_RTM L
3 Day_RTM L
4 Hour_Minute_RTM L
5 ablat_cm_AVG H
6 stage_cm_AVG H
7 uwlight_AVG L
8 par_AVG L
9 battvolts_AVG L

Estimated Total Final Storage Locations used per day 792

4.4 Lake Bonney West Lobe

.....4.4.1 Wiring

Wiring at Lake Bonney West Blue Box after rebuilding Blue Boxes in Nov 20051

CR10X wiring

Ablation transducer (instrument with dessicant 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

Note: uw par has jumper wire at this CR10X. Probably this PAR sensor were purchased from LiCor directly; LiCor PAR sensor purchased from Campbell have them build into the lines.

Surface PAR

Black	4L
Red	4H

Jump wire from Black 4L to AG

Multiplexer Box

Present, but not connected to CR10X.

Note: Mux cable wiring description wasn't presented in BBB 04/05. Meda just transfer wiring from old Blue Box to the new Blue Box. Wiring description below was the same he found it at the field. This wiring needs to be double-checked.

Mux Cable # 1:

Connection at CR10X:		Connection at AM 416	
White	C3	Clear	shield COM (b/w 10-11)
Green	C2	Green	res
Black	G	White	clk
Clear	G (b/w Com 11-12)	Black	gnd
Red	12V	Red	12V

Mux Cable # 2

Connection at CR10X:		Connection at AM 416	
White	L5	Clear	shield
Green	disconnected	Green	COM H2
Black	disconnected	White	COM L1 (b/w 7-8)
Clear	G	Black	COM L2 (b/w 10-11)
Red	H5	Red	disconnected

.....4.4.2 Program

```
;{CR10X}
;BONNEY WEST PROGRAM
; this is the same program from 2004 compiled for CR10x

;{CR10X}  Change existing program on 11/26/05
;
*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 WOLTAGE
4:  Batt Voltage (P10)
 1: 4        Loc [ battvolts ]
```

```
; TIME INTERVAL SETUP FOR 20 KMINUTES
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)
 1: 1        Final Storage Area 1
 2: 4        Array ID

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

8:  Resolution (P78)
 1: 1        High Resolution

; CALCULATE AVERAGE FOR ABLATION SENSOR
9:  Average (P71)
 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)
 1: 3        Reps
 2: 2        Loc [ uwlight   ]

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

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

*Table 3 Subroutines

End Program
```

4.4.3 Input storage (*6) locations

-Input Locations-
1 ablat_cm 1 1 1
2 uwlight 1 1 1
3 par 1 1 1
4 battvolts 1 1 1
5 _____ 0 0 0
6 _____ 0 0 0
7 _____ 0 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-
0,4,14092
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

4.4.4 Final storage array definition

Final Storage Label File for: NEW BYW PROGRAM INSTALLED NOV 2005 NO MUX.csi
Date: 11/25/2005
Time: 20:52:39

4 Output_Table 20.00 Min
1 4 L
2 Year_RTM L
3 Day_RTM L
4 Hour_Minute_RTM L
5 ablat_cm_AVG H
6 uwlight_AVG L
7 par_AVG L
8 battvolts_AVG L

Estimated Total Final Storage Locations used per day 648