

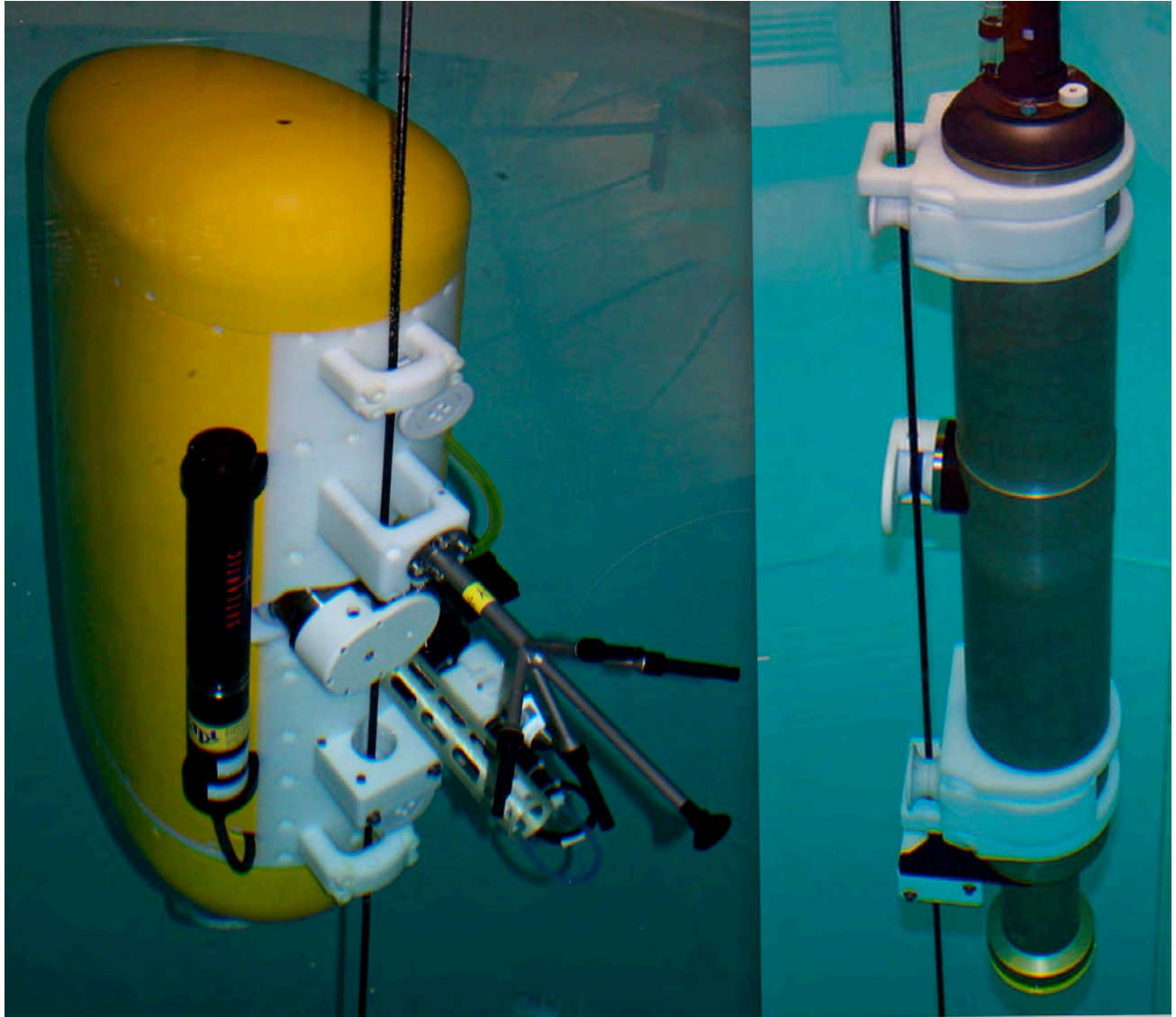
Profilers Samplers Flotation



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Profiler Integrated Sensors & Communications Interface

User Manual



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Figure B-3: Packet Header Structure.....	B-6

Introduction

MMP Integrated Sensors and Communications

The MMP requires a Conductivity, Temperature, Depth (CTD) sensor to control profiler movement and profiling duration. Many other optional integrated sensors are available. McLane also integrates new sensors upon customer request.



Installed sensors affect battery drain and ballast calculations. Contact McLane (www.mclanelabs.com) for further information.




Each integrated sensor and the inductive communications options are explained in the following chapters:

Chapter Contents	
Chapter	Sensor
1	Sea-Bird CTD Sensors – General Info
1.1	Sea-Bird 52MP CTD with MMP
1.2	Sea-Bird 41CP CTD with ITP
2	Aanderaa Optode Sensors – General Info
3	Nortek Aquadopp ACM Sensors – General Info
3.1	Aquadopp Model II ACM
3.2	AquaPro Model HR ACM
4	Falmouth Scientific ACM+ Sensor
5	Nobska MAVS ACM Sensor
6	Wet Labs Optical Sensors – General Info
6.1	Wet Labs BBFL2
6.2	Wet Labs FLBB(RT)/D or FLBB CD
6.3	Wet Labs C-Star
6.4	Wet Labs SeaOwl
7	Ostar OceanServer MotionPack Sensor
8	Satlantic SUNA Sensor

Sensors Chapter Contents	
9	Biospherical PAR Sensors
9.1	Biospherical PAR QSP-2200
9.2	Biospherical PAR QCP-2300
10	Seapoint Turbidity/Fluorometer Sensors
11	Inductive Communications
11.1	Sea-Bird IMM
11.2	RBR MLM

User Key

This user manual contains the following keys to call attention to information:

	Note	Information of special note such as proper battery installation.
	Important	Information to take caution such as handling of bulk head connectors.
	Caution	Information to prevent serious conditions such as loss of data.

Chapter 1

Sea-Bird CTD Sensors – General Information

The Profiler requires a Conductivity, Temperature, Depth sensor (CTD) to control profile duration and depth. The 52MP CTD is the default CTD enabled on the Profiler. Other CTD sensors are also available. This section provides information common to the 52MP CTD and the 41CP CTD. The 41CP CTD is installed only on the Ice Tethered Profiler (ITP). For more information about Sea-Bird CTD sensors, refer to the Sea-Bird Electronics website (www.seabird.com) or contact Sea-Bird.



Correct sensor orientation is critical. Completely review sensor-specific mechanical instructions in each section of this Chapter and consult Sea-Bird before disassembling sensor components.

Protecting Sea-Bird CTD Water Outlet Cells

The Sea-Bird sensor cells have protective caps that cover the water intake port and the T-shaped water outlet. Keep these protective caps in place until deployment to prevent contamination by airborne particulates. The water intake port has a TC Duct that keeps the water measured by the temperature sensor the same as the water that passes through the cell. Contamination can coat the cell walls and change sensor calibration.



Flushing before and after deployment keeps the cell clean and facilitates wetting the conductivity cell electrodes. Use a dilute solution of Triton X-100 (approximately 1 part Triton to 50 parts deionized water).

Testing Sea-Bird CTD Sensors

When Bench Testing with the Sea-Bird CTD sensors use a closed loop of tubing to connect the intake and exhaust ports.

Using Bench Test Options

The main Bench Tests and 52MP/41CP CTD Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu, type 5 at the prompt to display the Bench Tests Menu.

```
Config: MPP_CT                               CF2 V5.00 of Jan 11 2013
                                           _____
                                           McLane Research Laboratories, USA
                                           Pattern Profiler
                                           S/N: ML12345-001
                                           _____
                                           Main Menu
                                           _____
                                           Tue Feb 19 07:16:21 2013
<1> Set Time                                <5> Bench Test ←
<2> Diagnostics                            <6> Deploy Profiler
<3> Flash Card Ops                         <7> Offload Deployment Data
<4> Sleep                                  <8> Contacting McLane
<C> Configure
```

Figure 1-1: Profiler Main Menu

```
Configuration: MMP_IM_CT_CM_PA_SC           CF2 V5_00 of Dec 7 2012
                                           _____
                                           Bench Tests
                                           _____
                                           Fri Dec 7 13:30:20 2012
Sensor Utilities:
<1> Seabird 52MP CTD communication ←
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass
System evaluation:
<7> Motor operation
<8> Release Brake
<9> Independent Watchdog
<0> Estimate deployment endurance
Sensor & Option tests:
Exit:
<X> Main Menu
Selection [] ?
```

Figure 1-2: Profiler Bench Tests Menu



The sensor-specific Bench Tests menus are the same for the Sea-Bird 52MP and 41CP CTD sensors. The examples shown in this section feature the 52MP CTD.

2. From the Bench Tests menu, type *1* at the prompt to display the Seabird 52MP/41CP CTD Bench Test Menu (Figure 1-3).
3. Type *1* to connect directly with the 52MP/41CP CTD.

```
Selection [] ? 1
                _____
                Seabird 52MP CTD Bench Test Menu
                _____
                Thu Dec  6 16:11:44 2012
                <1> Direct communications (9600 Baud) ← Direct Communications
                <2> Restore McLane parameters
                <3> Restore factory parameters
                <4> Report parameter settings
                <5> Perform a profile test loop

                <M> return to previous Menu

Selection  [] ? 1

04/16/12 12:13:45 SBE/52MP Press ^C to terminate COMM session.
04/16/12 12:13:45 SYSTEM Press ^B to change or confirm Baud rate
```

Figure 1-3: 52MP CTD Bench Test Menu



The Profiler communicates with the Sea-Bird CTD at 9600 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 1-4). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-ðÄ-fûx-` ,ò6x-Ê‡-ò-ûfx6òx-Ü6ò-ðÄ-Ê-
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 1-4: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu displays the Baud Rate menu (Figure 1-5). Use this menu option to temporarily connect at the sensor’s current baud rate. Once connected to the sensor, change to the profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Select new Baud rate
-----
                Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600

<G> Go to COMM session
      Selection  [] ? g
```

Figure 1-5: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the CTD, typing commands at the command prompt provides additional sensor information.

```
Selection [] ? 1
01/11/13 13:47:03 SBE/52MP Press ^C to terminate COMM session.
01/11/13 13:47:04 SYSTEM Press ^B to change or confirm Baud rate.

01/11/13 13:47:04 SBE/52MP 9.6 kBaud communication channel opened.
01/11/13 13:47:04 SBE/52MP Powered on.
*****
SBE 52 MP 2.4 ←————— 52MP CTD
S>DS
SBE 52 MP 2.4 SERIAL NO. 0107
DO installed = no
stop profile when pressure is less than = -100.0 decibars
automatic bin averaging when p < -100.0 disabled
number of samples = 304
number of bins = 0
top bin interval = 10
top bin size = 10
top bin max = 100
middle bin interval = 50
middle bin size = 50
. . . ←————— Display shortened for brevity
S>slp
S> [^C]
*****
01/11/13 13:48:08 SBE/52MP Powered off.
01/11/13 13:48:08 SBE/52MP 9.6 kBaud communication channel closed.
```

Figure 1-6: Option <1> 52MP CTD Direct Communications

```
Selection [] ? 1
04/22/14 16:10:20 SBE/41CP 9.6 kBaud communication channel opened.
04/22/14 16:10:20 SBE/41CP Powered on.
*****
SBE 41CP-IDO McLane V 3.0 ←————— 41CP CTD
S>ds
SBE 41CP-IDO McLane V 3.0 SERIAL NO. 5556
firmware compilation date: 4 February 2010
stop profile when pressure is less than = -100.0 decibars
automatic bin averaging at end of profile disabled
number of samples = 81
number of bins = 0
top bin interval = 10
top bin size = 10
top bin max = 100
middle bin interval = 50
middle bin size = 50
. . . ←————— Display shortened for brevity
S> [^C]
*****
04/22/14 16:10:27 SBE/41CP Powered off.
04/22/14 16:10:27 SBE/41CP 9.6 kBaud communication channel closed.
```

Figure 1-7: Option <1> 41CP CTD Direct Communications

Restore McLane and Factory Settings

Option <2> and <3> from the SBE 52MP/ 41CP Bench Test menu restore the McLane or Seabird factory settings. Figure 1-8 shows a reset of the McLane-defined parameters. Using option <2> requires typing the password *McLane*.

```
Selection [M] ? 2 Password: mclane

14:58:37 SBE/52MP communication channels opened.
14:58:37 SBE/52MP powered ON.
14:58:37 SBE/52MP sending command []. ..
14:58:37 SBE/52MP sending command []. ..
14:58:38 SBE/52MP sending command [pcutoff= -100.0]. ..
14:58:38 SBE/52MP sending command [initprofile]. ..
14:58:39 SBE/52MP sending command [ds].
.....

14:58:40 SBE/52MP was able to restore McLane parameters.

14:58:40 SBE/52MP powered OFF.
14:58:40 SBE/52MP power-down delay .....
14:58:45 SBE/52MP communication channels closed.
```

Figure 1-8: Option <2> Restore McLane Settings

Option <3> ‘Restore factory parameters’ (not shown) restores the configuration parameters delivered with the 52MP CTD. Using option <3> requires the password *factory*.



The firmware requires the Sea-bird CTD parameters configured by McLane. Changing settings, or resetting to the factory settings prevents the CTD from working correctly with the Profiler.

Display Current Settings

Option <4> displays the current SBE 52MP/41CP CTD settings.

```
Selection [M] ? 4

14:58:54 SBE/52MP press ^C to terminate COMM session.
14:58:55 SBE/52MP communication channels opened.
14:58:55 SBE/52MP powered ON.
*****

14:58:55 SBE/52MP executing scripted commands. Please wait...

14:58:55 SBE/52MP sending command [ds].

S>

14:58:56 SBE/52MP completed scripted commands.

14:58:56 SBE/52MP press ^C to terminate COMM session.

SBE 52 MP 1.1a SERIAL NO. 0007
stop profile when pressure is less than = -100.0 decibars
automatic bin averaging when p < -100.0 disabled
number of samples = 0
number of bins = 0
top bin interval = 10
top bin size = 10
top bin max = 100
middle bin interval = 50
middle bin size = 50
middle bin max = 1000
bottom bin interval = 100
bottom bin size = 100
do not include two transition bins
oxygen frequency multiplier = 0.25
S>

S> [^C]
*****

14:59:08 SBE/52MP powered OFF.
14:59:08 SBE/52MP power-down delay .....
14:59:13 SBE/52MP communication channels closed.
```

Figure 1-9: Option <4> Report Parameter Settings

Perform Profile Test Loop

Option <5> runs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile.

```
Selection  [] ? 5

11/28/12 12:37:00 SBE/52MP Automated verification of sensor settings.
11/28/12 12:37:01 SBE/52MP 9.6 kBaud communication channel opened.
11/28/12 12:37:01 SBE/52MP Powered on.
11/28/12 12:37:01 SBE/52MP Sending command [qs].
11/28/12 12:37:02 SBE/52MP Sending command []. . .
11/28/12 12:37:03 SBE/52MP Sending command [ds]. . . . .
11/28/12 12:37:04 SBE/52MP Identified as V2.4, S/N 106.
11/28/12 12:37:04 SBE/52MP Sending command [outputctdo=n]. .
11/28/12 12:37:04 SBE/52MP Sending command [outputctdoraw=n]. .
11/28/12 12:37:05 SBE/52MP Sending command [pcutoff= -100.0]. .
11/28/12 12:37:05 SBE/52MP Sending command [initprofile]. .
11/28/12 12:37:06 SBE/52MP Sending command [ds]. . . . .
11/28/12 12:37:07 SBE/52MP Powered off.
11/28/12 12:37:07 SBE/52MP Power-down delay . . . . .
11/28/12 12:37:12 SBE/52MP 9.6 kBaud communication channel closed.
11/28/12 12:37:13 SYSTEM Deleting C0000000.DAT.

1 file(s) erased

Press ^C to exit the loop
```

Figure 1-10: Option <5> Perform Profile Test Loop

Additional Sensor-Specific Test Options

From the main Bench Tests menu additional sensor testing options can be selected for pressure and temperature averages.

```
-----  
Configuration: MMP_IM_CT_CM_PA_SC          CF2 V5_00 of Dec  7 2012  
  
-----  
                          Bench Tests  
-----  
  
                          Fri Dec  7 13:30:20 2012  
  
Sensor Utilities:  
  
<1> Seabird 52MP CTD communication  
<2> Seabird 52MP CTD pressure  
<3> Seabird 52MP CTD average pressure  
<4> Seabird 52MP CTD temperature record  
  
<5> Nortek AquaDopp DVS communication  
<6> Nortek AquaDopp DVS tilt & compass  
  
System Evaluation:  
<7> Motor operation  
<8> Release Brake  
<9> Independent Watchdog  
<0> Battery endurance  
  
System Sensor & Option Tests:  
  
<I> Seabird Inductive Modem  
<M> OceanServer5000 MotionPack  
<P> Biospherical PAR  
<W> Wetlabs ECO BBFL2  
  
Exit:  
  
<X> Main Menu  
  
Selection [] ? 1
```

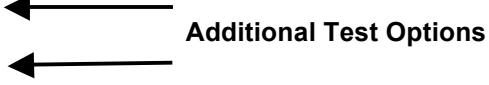


Figure 1-11: Main Bench Tests Menu

Display 52MP/41CP CTD Pressure

Option <2> from the main Bench Tests menu displays the current CTD pressure.

```
Selection [] ? 2

04/21/14 14:59:45 SBE/52MP pressure = -0.110 dbar.

Press any key to continue.
```

Figure 1-12: Option <5> Display SBE 52MP CTD Pressure

Display 52MP/41CP CTD Average Pressure

Option <3> from the main Bench Tests menu displays a user-selected number of pressure measurements. The measurements are then averaged.

```
Selection [] ? 3

Enter number of measurements to average (2-5000) [100] ? 3

04/21/14 15:00:03 SBE/52MP Pressure 1 of 3 = -0.120 dbar.

04/21/14 15:00:06 SBE/52MP Pressure 2 of 3 = -0.130 dbar.

04/21/14 15:00:09 SBE/52MP Pressure 3 of 3 = -0.130 dbar.

04/21/14 15:00:09 SBE/52MP Pressure = -0.127 dbar, averaged over 3
samples.

Press any key to continue.
```

Figure 1-13: Option <3> Display and Average Pressure Settings

Display 52MP/41CP CTD Temperature

Option <4> from the main Bench Tests menu sets a number of temperature readings to record and the measurement interval. The firmware wakes from Suspend mode at the set interval and takes a temperature reading. The measurements are then averaged after the specified number of readings are taken. When the user wakes the firmware, the temperature readings and average can be displayed.

```
Selection [ ] ? 4
Enter number of measurements (1-1000) [ 3 ] ?
Enter measurement interval [sec] (20- 600) [ 300 ] ? 20
04/21/14 15:01:25  SYSTEM Temperature record will finish at 04/21/14
15:02:40.
04/21/14 15:01:25  SBE/52MP Powered on.
04/21/14 15:01:30  SBE/52MP Identified as V3.0, S/N 5556 with ID0.
04/21/14 15:01:31  +24.2926 ∞C
04/21/14 15:01:44  SYSTEM Suspended until 04/21/14 15:01:51 ... Awake
04/21/14 15:01:55  +24.3163 ∞C
04/21/14 15:02:08  SYSTEM Sleeping until 04/21/14 15:02:11 ...
04/21/14 15:02:15  +24.3360 ∞C
04/21/14 15:02:28  SYSTEM Sleeping until 04/21/14 15:02:31 ...
04/21/14 15:02:40  SBE/52MP Averaged 3 of 3 requested temperature samples.
04/21/14 15:02:40  SYSTEM Suspended ... .
Enter ^C now to wake up ... [^C]
Display temperature record [Y] ? [^C] ← Display record
```

Figure 1-14: Option <4> Record and Average Temperature



The Sea-Bird documentation is included with the sensor. Refer to this documentation for sensor-specific calibration details used for processing unpacked data.

Notes

Section 1.1

Sea-Bird 52MP CTD Sensor with MMP

The Sea-Bird 52MP CTD is a conductivity, temperature, depth sensor that can also include an optional Sea-Bird 43F Dissolved Oxygen sensor. For more information about the 52MP CTD sensor, refer to the Sea-Bird Electronics website (www.seabird.com) or contact Sea-Bird.

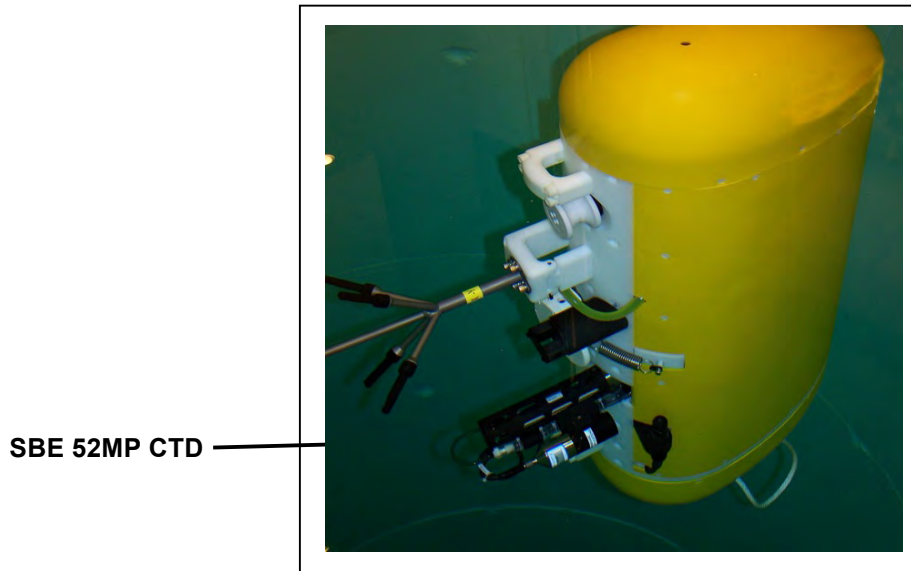


Figure 1.1-1: MMP with Sea-Bird 52MP CTD



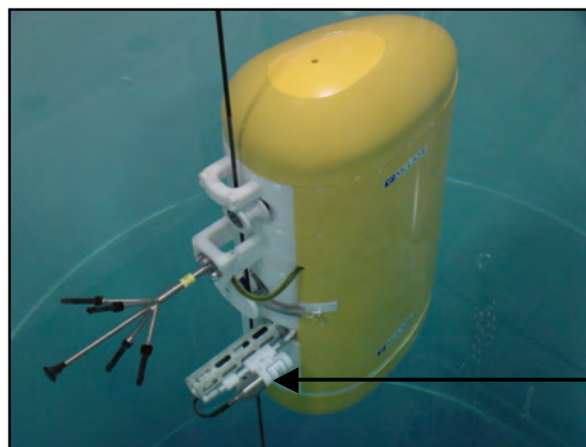
Mount and orient the 52MP CTD so the intake and exhaust are on the same horizontal plane.

Sea-Bird 43F IDO with 52MP CTD on MMP

The Sea-Bird 43F Dissolved Oxygen sensor is a polarographic membrane sensor that can be optionally integrated on the MMP with the Sea-Bird 52MP CTD.



It is critical to keep the 43F IDO from freezing temperatures during shipment, deployment, recovery and storage. Exposure to temperatures below freezing can cause damage to the sensor.



43F Dissolved
Oxygen

Figure 1.1-2: SBE 52MP CTD with 43F Dissolved Oxygen

Collecting Data with the Sea-Bird 52MP CTD

A sample unpacked CTD file is shown in Figure 1.1-3. The columns display Conductivity, Temperature and Depth. The hz column displays zeros if the Sea-Bird 43F dissolved oxygen sensor option is not installed.

Profile 7			
mmho/cm	Celsius	dbars	hz
0.9126	16.3126	0.740	2310
0.9114	16.3133	0.750	2327
0.9104	16.3141	0.750	2331
0.9099	16.3147	0.750	2332
0.9097	16.3157	0.750	2328
0.9100	16.3158	0.750	2327
0.9104	16.3147	0.750	2321
0.9107	16.3142	0.750	2318
0.9109	16.3143	0.750	2314
0.9110	16.3148	0.750	2309
0.9109	16.3144	0.750	2301
0.9107	16.3143	0.750	2296
0.9105	16.3149	0.750	2290
0.9103	16.3148	0.750	2286
0.9101	16.3153	0.750	2278
0.9100	16.3149	0.740	2274
0.9100	16.3150	0.740	2269
0.9100	16.3159	0.750	2262

Figure 1.1-3: Unpacked 52MP CTD File with 43F Oxygen Data

Configuring the Firmware to Use the 52MP CTD

The Profiler System Configuration menu specifies the active sensors. To enable a Sea-Bird 52MP CTD, complete the following steps:

1. From the Main Menu type *c* and enter the password *con*.
2. Select <1> for the CTD Port. The CTD Selection menu displays.

```
Config: MPP_CT_CM_TU                               CF2 V5.22 of Apr 28 2015
-----
                Pattern Profiler
                System Configuration
-----
                Tue May 26 15:13:05 2015

System Parameters:
  <0> Battery capacity                240 Ah

Sensor Suite:
Port J9:CTD
  <1> Seabird 52MP CTD ----- ENABLED ← CTD Port
Port J5:ACM
  <2> Falmouth Scientific 3d ACM+ --- ENABLED
      Port J6:IMM
  <I> Telemetry
      Port J4:SSP
  <B> BioSuite Triplet/PAR
  <J> Wetlabs ECO FLBBCD
  <N> Satlantic SUNA Nitrate
  <O> Aanderaa Optode
  <U> bbe FluoroProbe
  <W> Wetlabs ECO BBFL2
  <Y> Wetlabs ECO FLBB2K
  <@> Wetlabs FLNTRTD
      Port J10:SPR
  <L> Wetlabs ECO FLBB(RT)/D
  <P> Biospherical PAR
      Port J7:TRB
  <T> Seapoint IR Turbidity ----- ENABLED @ 5 samp/avg, Autogain
      Port J8:FLR
  <E> Seapoint CHL Fluorometer
  <F> Wetlabs CDOM Fluorometer
      Port J4i:SER
  <H> ProOceanus CH4
  <M> OceanServer5000 MotionPack
      Port J5i:SER
  <K> ProOceanus CO2

Exit:
  <X> Save changes      <^C> Cancel changes
```

Figure 1.1-4: System Configuration Menu

3. Select the installed CTD.

```
-----  
Config: MPP_IM_CT_CM_PA_MP          CF2 V5.16 of Aug 22 2014  
  
-----  
                Pattern Profiler  
                CTD Selection  
-----  
                Tue Sep  2 09:53:16 2014  
  
<1> Falmouth Scientific Em CTD  
<2> Seabird 41CP CTD  
<3> Seabird 52MP CTD ----- ENABLED  
<4> RBR CTD  
<5> Mensor 6180 DPT  
  
<X> configuration menu  
  
Selection [] ? 3
```

Figure 1.1-5: CTD Selection

Removing the 52MP CTD from the MMP

A releasable polyethylene support strut on the MMP body provides easier installation and removal of the Sea-Bird 52MP CTD. When removing the 52MP CTD from the MMP, use the photos and steps that follow as a guide.

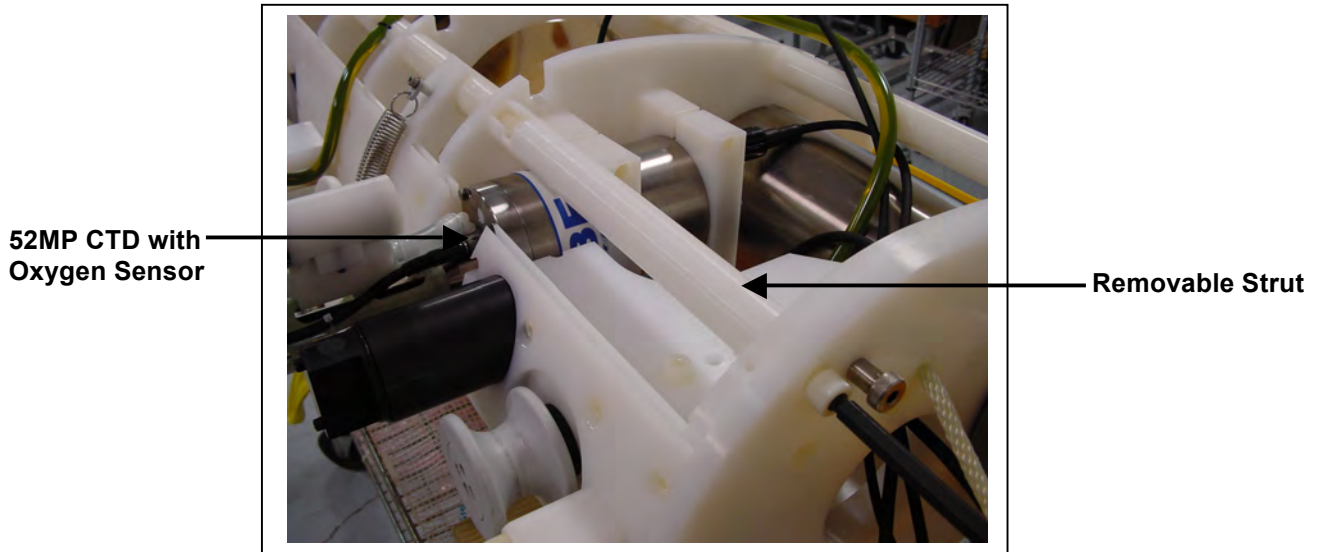


Figure 1.1-6: 52MP CTD and Removable Strut

1. Remove the MMP skin.
2. Turn the strut so that the notch faces up as shown in Figure 1.1-7.

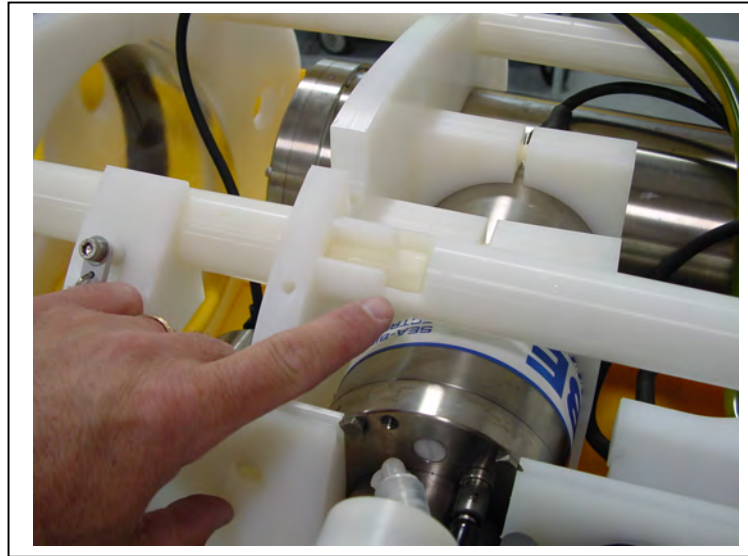


Figure 1.1-7: Strut with Notch Facing Up

3. Using a 3/8" Hex Driver, remove the socket cap screw from the bottom of the strut.

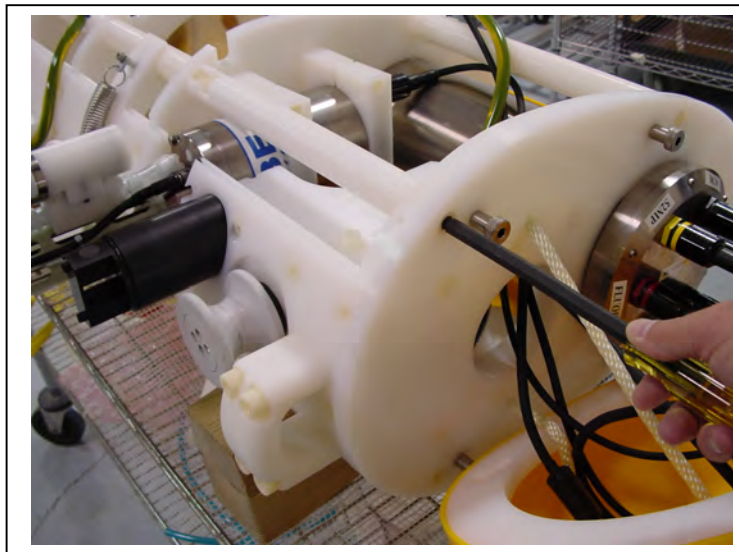


Figure 1.1-8: Remove Socket Cap Screw

4. Lift the strut up to remove the CTD.

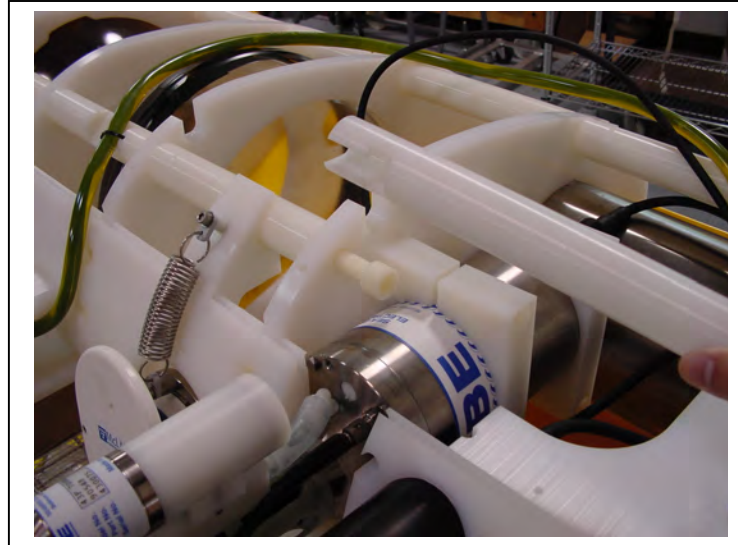


Figure 1.1-9: Removing the Strut

5. Using an Allen wrench, remove the mounting screws (ensure that the sensor is supported).

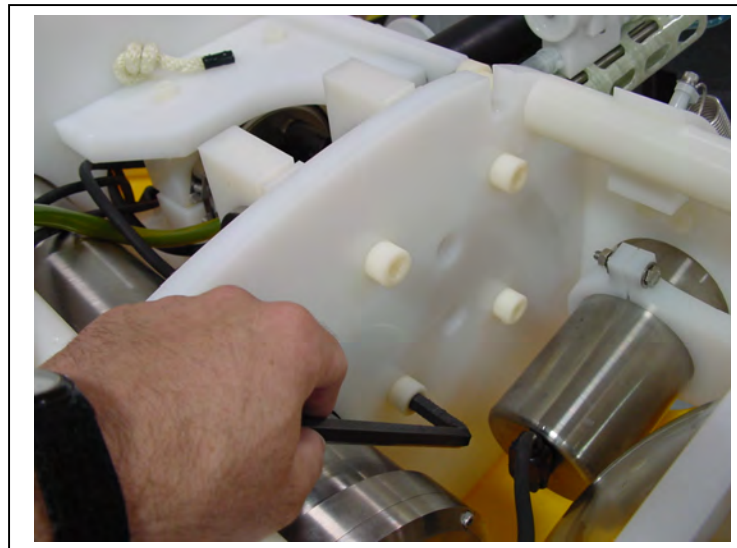


Figure 1.1-10: Loosening the Mounting Plate Screw

- Carefully lift the 52MP CTD from the sensor mount (shown in Figure 1.1-11).



Figure 1.1-11: Lifting the CTD from the Sensor Mount

- Unplug the bulkhead connector and remove the cable.



Figure 1.1-12: Unplugging the Bulkhead Connector

- Reverse steps 1-7 to install the 52MP CTD.

Notes

Section 1.2

Sea-Bird 41CP CTD with ITP

The Sea-Bird 41CP CTD is a conductivity, temperature, depth sensor integrated with the Ice Tethered Profiler (ITP). The 41CP CTD can include an optional Sea-Bird Integrated Dissolved Oxygen (IDO) sensor. For more information about the 41CP CTD sensor, refer to the Sea-Bird Electronics website (www.seabird.com) or contact Sea-Bird.

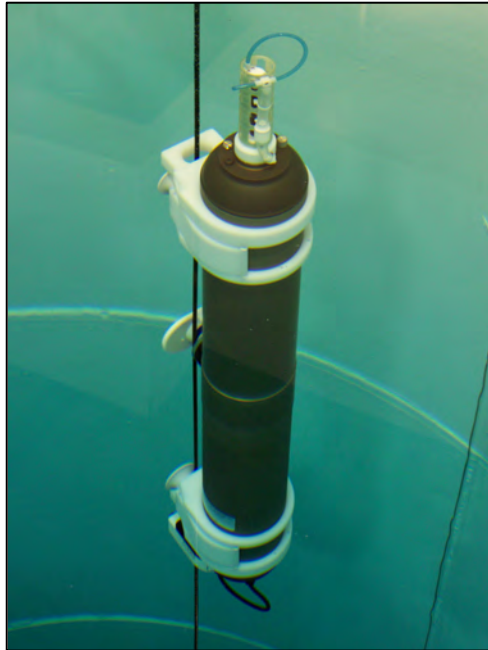


Figure 1.2-1: ITP with Sea-Bird 41CP CTD



The 41CP CTD is installed only on the Ice Tethered Profiler (ITP).

Sea-Bird IDO with 41CP CTD on Ice Tethered Profiler

The Sea-Bird 41CP Integrated Dissolved Oxygen sensor is a polarographic membrane sensor that can be optionally integrated on the ITP with the Sea-Bird 41CP CTD.



It is critical to keep the 41CP-IDO from freezing temperatures during shipment, deployment, recovery and storage. Exposure to temperatures below freezing can cause damage to the sensor.

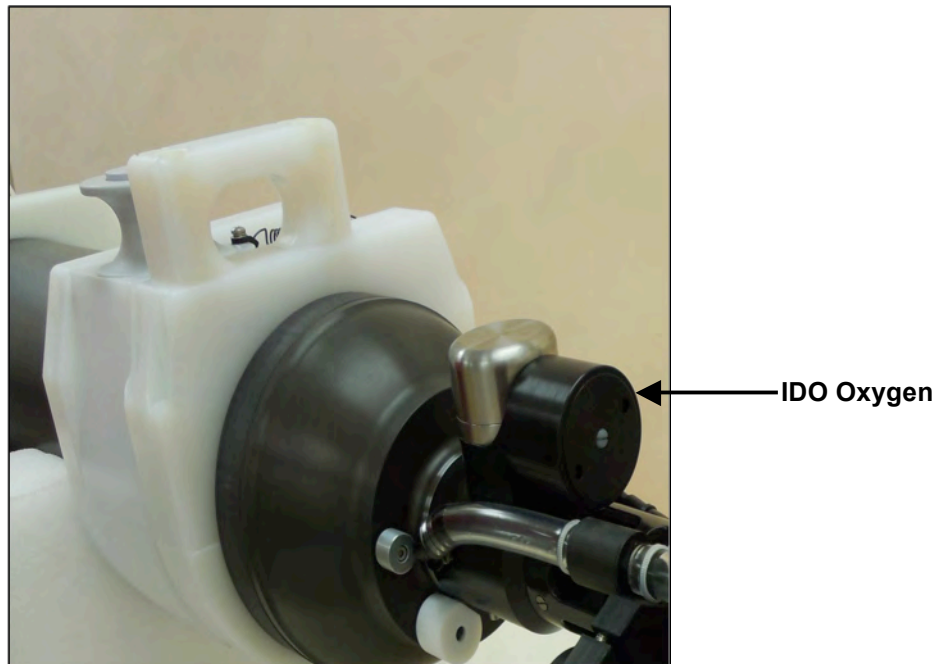


Figure 1.2-2: ITP 41CP CTD with Integrated Dissolved Oxygen

Collecting Data with the Integrated Dissolved Oxygen Sensor

If the IDO sensor is integrated with the 41CP CTD, the CTD file displays the measurement in hz (Figure 1.2-3). If integrated dissolved oxygen is not installed the hz column contains 0.

Profile 7			
mmho/cm	Celsius	dbars	hz
1.7994	17.9822	11.710	20294
1.7995	17.9855	11.700	20401
1.7990	17.9874	11.710	20490
1.7990	17.9884	11.710	20481
1.7991	17.9920	11.710	20482
1.7992	17.9933	11.710	20497
1.7994	17.9938	11.700	20493
1.7988	17.9937	11.700	20496
1.7992	17.9929	11.730	20494
1.7996	17.9926	11.710	20543
1.7992	17.9920	11.710	20568
1.7994	17.9919	11.710	20549
1.7992	17.9917	11.710	20530
1.7990	17.9915	11.710	20540
1.7997	17.9916	11.710	20575
1.7993	17.9917	11.710	20590
1.7990	17.9918	11.720	20565
1.7994	17.9918	11.710	20585
1.7995	17.9924	11.700	20576

Figure 1.2-3: Unpacked 41CP CTD File with Integrated Dissolved Oxygen Data

Configuring the Firmware to Use the 41CP Sea-Bird CTD

The Profiler System Configuration menu specifies the active sensors. To enable a Sea-Bird 41CP CTD, complete the following steps:

1. From the Main Menu type *c* and enter the password *con*.
2. Select <1> for the CTD sensor Port. The CTD Selection menu displays.

```
Config: MPP_CT_CM_TU                      CF2 V5.22 of Apr 28 2015
-----
                Pattern Profiler
                System Configuration
-----
                Tue May 26 15:13:05 2015

System Parameters:
  <0> Battery capacity                      240 Ah

Sensor Suite:
Port J9:CTD
  <1> Seabird 41CP CTD ----- ENABLED ← 41CP CTD
Port J5:ACM
  <2> Falmouth Scientific 3d ACM+ --- ENABLED

  Port J6:IMM
  <I> Telemetry

  Port J4:SSP
  <B> BioSuite Triplet/PAR
  <J> Wetlabs ECO FLBBCD
  <N> Satlantic SUNA Nitrate
  <O> Aanderaa Optode
  <U> bbe FluoroProbe
  <W> Wetlabs ECO BBFL2
  <Y> Wetlabs ECO FLBB2K
  <@> Wetlabs FLNTURTD

  Port J10:SPR
  <L> Wetlabs ECO FLBB(RT)/D
  <P> Biospherical PAR

  Port J7:TRB
  <T> Seapoint IR Turbidity ----- ENABLED @ 5 samp/avg, Autogain

  Port J8:FLR
  <E> Seapoint CHL Fluorometer
  <F> Wetlabs CDOM Fluorometer

  Port J4i:SER
  <H> ProOceanus CH4
  <M> OceanServer5000 MotionPack

  Port J5i:SER
  <K> ProOceanus CO2

Exit:
  <X> Save changes      <^C> Cancel changes
```

Figure 1.2-4: System Configuration Menu with Sensor Selections

3. Select the installed CTD.

```
-----  
Config: MPP_IM_CT_CM_PA_MP           CF2 V5.16 of Aug 22 2014  
  
-----  
                Pattern Profiler  
                CTD Selection  
-----  
  
                Tue Sep  2 09:53:29 2014  
  
<1> Falmouth Scientific Em CTD  
<2> Seabird 41CP CTD ----- ENABLED  
<3> Seabird 52MP CTD  
<4> RBR CTD  
<5> Mensor 6180 DPT  
  
<X> configuration menu
```

Figure 1.2-5: CTD Selection

Configuring the Firmware to Use the IDO Sensor

A setting on the System Configuration menu flags whether IDO is enabled.

1. From the Main Menu type *c* and enter the password *con*.
2. Select <1> for the CTD Sensor Port.
3. Select <2> for the 41CP CTD and then type *Y* to enable the IDO.
4. Select <X> to exit and save the entry.

```
-----  
Config: MPP_IM_CM_PA_MP                CF2 V5.16 of Aug 22 2014  
  
-----  
                Pattern Profiler  
                CTD Selection  
  
-----  
                Tue Sep  2 10:01:11 2014  
  
<1> Falmouth Scientific Em CTD  
<2> Seabird 41CP CTD  
<3> Seabird 52MP CTD  
<4> RBR CTD  
<5> Mensor 6180 DPT  
  
<X> configuration menu  
  
Selection [] ? 2  
  
Enable the "Seabird 41CP CTD" [Y] ? y  
  
Does this CTD have an Integrated Dissolved Oxygen sensor [N] ? y ← IDO Prompt
```

Figure 1.2-6: SBE 41CP CTD Integrated Dissolved Oxygen Prompt

Chapter 2 Aanderaa Optode Sensors

Aanderaa Optode sensors measure dissolved oxygen. MMP Release v5.00 firmware and higher support the Aanderaa Optode models 4835, 4330 and 4330F. MMP Release v3.16 and higher support the Aanderaa Optode model 3830. For more information about these sensors, refer to the Aanderaa website (www.aanderaa.com) or contact Aanderaa.



Some Aanderaa models return more data fields than others. The Profiler looks at only the first five data fields (Model, Serial Number, Oxygen, Saturation and Temperature).

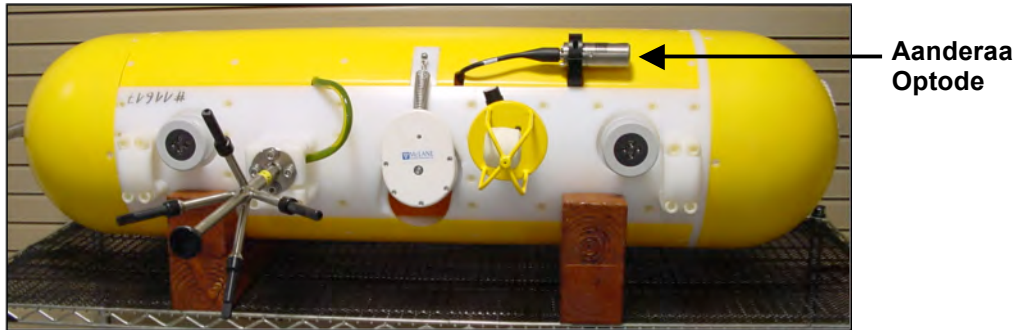


Figure 2-1: MMP with Aanderaa Optode – Side View

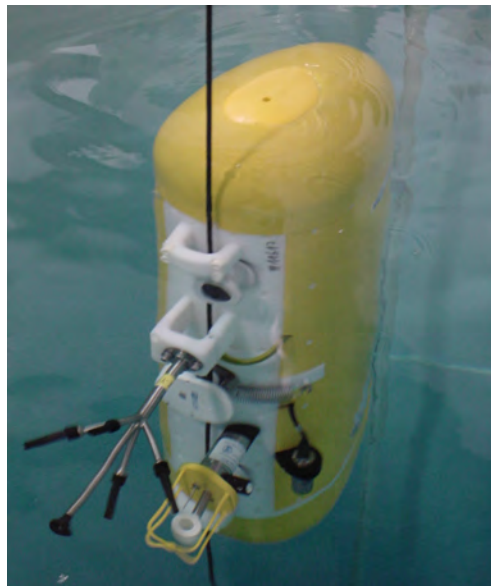


Figure 2-2: Profiling MMP with Aanderaa Optode

Collecting Data with the Aanderaa Optode

Optode data is logged in the Engineering File as shown in Figure 2-3. When the Optode is disabled or switched off (as during ramp up), the columns contain '0.00'. If there is no data collected within 5 seconds, the Optode automatically powers off to conserve battery energy.

Profile 16

Sensors were turned on at 11/14/2013 00:00:02
 Vehicle began profiling at 11/14/2013 00:02:03

Optode Data

Date	[mA]	[V]	[dbar]	Oxygen[uM]	Optode	Temp[C]	CHL	NTU	Temperature	
11/14/2013 00:02:03			0	11.9	0.000	0.00	0.00	1548	1980	546
11/14/2013 00:02:10			75	11.9	0.000	0.00	0.00	1553	2002	546
11/14/2013 00:02:16			30	11.9	0.000	0.00	0.00	1555	2016	546
11/14/2013 00:02:22			27	11.9	0.000	0.00	0.00	1558	2027	545
11/14/2013 00:02:28			26	11.9	0.000	0.00	0.00	1559	2033	546
11/14/2013 00:02:39			25	11.9	0.500	277.08	16.41	1558	2033	545
11/14/2013 00:02:46			26	11.9	0.490	276.65	16.41	1559	2038	545
11/14/2013 00:02:53			26	11.9	0.500	277.08	16.41	1560	2042	545
11/14/2013 00:03:02			26	11.9	0.570	276.85	16.41	1560	2043	545
11/14/2013 00:03:09			25	11.9	0.610	276.72	16.41	1560	2046	545
11/14/2013 00:03:18			26	11.9	0.530	276.39	16.42	1561	2048	545

Figure 2-3: Engineering Data with Aanderaa Optode Oxygen and Temperature Data



The Optode data collection interval is the same as the MMP firmware 'stop check interval' setting. Due to the time required for the Optode to collect data, the Stop Check Interval should not be set below 4 seconds if the Aanderaa Optode is enabled.

Configuring the Firmware to Use the Aanderaa Optode

The Profiler System Configuration menu specifies the active sensors. To enable an Aanderaa Optode, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select <O> for the Aanderaa Optode and then type *Y* to enable the sensor.

```
Config: MPP_CT_CM_TU                               CF2 V5.22 of Apr 28 2015
-----
                Pattern Profiler
                System Configuration
-----
                Tue May 26 15:13:05 2015

System Parameters:
  <0> Battery capacity                               240 Ah

Sensor Suite:
Port J9:CTD
  <1> Seabird 52MP CTD ----- ENABLED
Port J5:ACM
  <2> Falmouth Scientific 3d ACM+ --- ENABLED
      Port J6:IMM
  <I> Telemetry
      Port J4:SSP
  <B> BioSuite Triplet/PAR
  <J> Wetlabs ECO FLBB2K
  <N> Satlantic SUNA Nitrate
  <O> Aanderaa Optode----- ENABLED ← Aanderaa Optode
  <U> bbe FluoroProbe
  <W> Wetlabs ECO BBFL2
  <Y> Wetlabs ECO FLBB2K
  <@> Wetlabs FLNTURTD
      Port J10:SPR
  <L> Wetlabs ECO FLBB(RT)/D
  <P> Biospherical PAR
      Port J7:TRB
  <T> Seapoint IR Turbidity ----- ENABLED @ 5 samp/avg, Autogain
      Port J8:FLR
  <E> Seapoint CHL Fluorometer
  <F> Wetlabs CDOM Fluorometer
      Port J4i:SER
  <H> ProOceanus CH4
  <M> OceanServer5000 MotionPack
      Port J5i:SER
  <K> ProOceanus CO2

Exit:
  <X> Save changes      <^C> Cancel changes
```

Figure 2-4: System Configuration Menu

Using Bench Test Options

The main Bench Tests and Aanderaa Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only the options available to installed sensors.

1. From the main Profiler Menu, type 5 at the prompt to display the Bench Tests Menu.

```
-----  
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013  
  
          McLane Research Laboratories, USA  
          Pattern Profiler  
          S/N: ML12345-01D  
  
-----  
          Pattern Profiler  
          Main Menu  
  
-----  
          Wed Nov 13 10:00:55 2013  
<1> Set Time          <5> Bench Test  
<2> Diagnostics      <6> Deploy Profiler  
<3> Flash Card Ops   <7> Offload Deployment Data  
<4> Sleep            <8> Contacting McLane  
<C> Configure
```

Figure 2-5: Profiler Main Menu


```

Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013

-----
                Pattern Profiler
                Bench Tests
-----

                Wed Nov 13 10:06:19 2013

Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Falmouth Scientific 3d ACM+ communication
<6> Falmouth Scientific 3d ACM+ tilt & compass

System Evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<0> Estimate deployment endurance
<D> Detailed schedule
<S> Recover schedule

System Sensor & Option Tests:
<I> Seabird Inductive Modem
<L> Wetlabs ECO FLBB(RT)/D
<M> OceanServer5000 MotionPack
<O> Aanderaa Optode

Exit:

```

Figure 2-6: Profiler Bench Tests Menu

The sensor-specific Bench Tests menus are the same for the Aanderaa models integrated with the Profiler . The examples shown in this section feature the 4330F Optode.

2. From the Bench Tests menu, type O at the prompt to display the AAND/OPT Bench Test menu.
3. Type *I* to connect directly with the Aanderaa Optode.

```

Configuration: MMP_IM_CT_CM_OP_PA          CF2 V5_00 of Aug 29 2012

-----
                AAND/OPT Bench Test Menu
-----

                Wed Aug 29 16:41:36 2012

<1> Direct communications (9600 Baud)
<2> Perform a profile test loop
<M> return to previous Menu

Selection  [] ? 1
08/29/12 12:13:45 AAND/OPT Press ^C to terminate COMM session.
08/29/12 12:13:45 SYSTEM Press ^B to change or confirm Baud rate

```

← **Direct Communications**

Figure 2-7: Aanderaa Optode Bench Tests Menu



The Profiler communicates with the Aanderaa at 9600 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 2-8). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` , ò6x-Ê†-ò-ûfxf6òx Ü6ò-òÄ-Ê
04/23/14 12:50:37 AAND OPT ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 2-8: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu displays the Baud Rate menu (Figure 2-9). Use this menu option to temporarily connect at the sensor's current baud rate. Once connected to the sensor, change to the Profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Select new Baud rate
-----
                Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600
<G> Go to COMM session
      Selection [] ? g
```

Figure 2-9: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the Optode, typing commands at the command prompt provides additional sensor information. For all three Aanderaa Optode models, the Profiler firmware reads only the first five data fields (model number, serial number, oxygen concentration, oxygen saturation and oxygen temperature) and ignores any other trailing fields. During direct communications with the sensor, the additional trailing fields display. However, these fields are ignored by the Profiler.

Figure 2-10 shows direct connection with the 4330F Optode. Figure 2-11 shows direct connection with the 3830 Optode.

```

Selection [M] ? 1

08/29/12 16:41:43 AAND/OPT Press ^C to terminate COMM session.
08/29/12 16:41:44 AAND/OPT Communication channels opened.
08/29/12 16:41:44 AAND/OPT Powered on.
*****
4330F 1086 234.355 89.486 24.181 29.595 29.595 35.644 6.049
520.2 523.6 25.9
4330F 1086 234.381 89.496 24.181 29.594 29.594 35.627 6.033
520.1 524.6 25.9
4330F 1086 234.694 89.616 24.181 29.579 29.579 35.599 6.020
520.1 523.2 25.9
4330F 1086 234.685 89.613 24.181 29.580 29.580 35.594 6.014
520.1 522.3 25.9
4330F 1086 234.924 89.704 24.181 29.569 29.569 [^C]
*****
08/29/12 16:41:51 AAND/OPT Powered off.
08/29/12 16:41:51 AAND/OPT Communication channels closed.

```

Figure 2-10: Aanderaa 4330F Optode Direct Communications

```

TX channel open.
RX channel open.

Aanderaa communication channel open.
<CTRL>-<C> to terminate session.

      3830      688      272.82      101.94      22.98
      ↑        ↑        ↑          ↑          ↑
  Model   Serial#  Oxy Concentration  Oxy Saturation  Oxy Temp

```

Figure 2-11: Aanderaa 3830 Optode Direct Communications

1. Type `Get_All` to display Optode settings as shown in Figure 2-12. Verify the following settings: Interval = 30 and Output = 100.

```

Get_All
Protect          3830    688      0
PhaseCoef       3830    688 -8.323242E+00  1.183118E+00  0.000000E+00  0.000000E+00
TempCoef        3830    688  2.609516E+01 -3.167202E-02  2.981936E-06 -4.364193E-09
FoilNo  3830    688    4804
C0Coef  3830    688  3.172420E+03 -1.072609E+02  2.133159E+00 -1.792340E-02
C1Coef  3830    688 -1.739810E+02  5.102620E+00 -9.857580E-02  8.022400E-04
C2Coef  3830    688  3.956000E+00 -9.810400E-02  1.853460E-03 -1.425360E-05
C3Coef  3830    688 -4.263370E-02  8.788200E-04 -1.644089E-05  1.137090E-07
C4Coef  3830    688  1.768690E-04 -2.955020E-06  5.550390E-08 -3.084930E-10
Salinity        3830    688  0.000000E+00
CalAirPhase    3830    688  2.985921E+01
CalAirTemp     3830    688  1.987216E+01
CalAirPressure 3830    688  1.014400E+03
CalZeroPhase   3830    688  6.518473E+01
CalZeroTemp    3830    688  2.047768E+01
Interval       3830    688     30
AnCoef        3830    688  0.000000E+00  1.000000E+00
Output         3830    688     100
SoftwareVersion 3830          688      3
SoftwareBuild  3830    688      7

```

Interval →

Output →

Figure 2-12: Verifying Optode Settings

Refer to the Aanderaa documentation for other valid direct commands.

2. Type [CTRL]-[C] to return to the Bench Tests menu.

Perform Profile Test Loop

Option <2> runs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile.

```
Selection [M] ? 2

Enter StopCheck interval in seconds [15] (4-60) [15] ? 4

08/29/12 16:42:01 AAND/OPT M#4330, S#1086, 234.13 Oxygen, 24.18 Temperature.
08/29/12 16:42:06 AAND/OPT M#4330, S#1086, 234.31 Oxygen, 24.18 Temperature.
08/29/12 16:42:11 AAND/OPT M#4330, S#1086, 234.10 Oxygen, 24.18 Temperature.
08/29/12 16:42:16 AAND/OPT M#4330, S#1086, 234.33 Oxygen, 24.18 Temperature.
08/29/12 16:42:21 AAND/OPT M#4330, S#1086, 234.09 Oxygen, 24.18 Temperature.
[^C]
```

Figure 2-13: Option <2> Perform Profile Test Loop



Due to the time required for the Optode to collect data, the Stop Check Interval should not be set below 4 seconds if the Aanderaa Optode is enabled.

Notes

Chapter 3

Nortek Aquadopp ACM Sensors – General Info

The Nortek Aquadopp Acoustic Doppler Current Meter (ACM) sensor collects doppler acoustic current measurements. The MMP firmware supports two models of the Aquadopp sensor, the Aquadopp II and the AquaPro (HR). This section provides information common to both the HR and Aquadopp II ACM sensors. For more information about these sensors, refer to the Nortek website (www.nortekusa.com) or contact NortekUSA.

Aquadopp II

MMP Release v5.00 firmware and higher support the Aquadopp II sensor. The Aquadopp II is integrated as a standard self-logging sensor. The data is stored locally on the sensor in a file named Axxxxxxx.DAT during profiling, and transferred to the MMP controller at the end of the profile. If Aquadopp II data is available, file offload is through inductive communications. Data can then be unpacked to a text file using the McLane Unpacker software. See the ‘Unpacking Deployment Data’ chapter in the MMP User Manual for more about unpacking deployment data.

AquaPro HR

AquaPro (HR) integration is a prototype implementation on the MMP. The AquaPro (HR) is a customized interface and does not follow the standard conventions of MMP sensor interactions.



Contact McLane for details before planning a deployment with an AquaPro (HR) sensor. The AquaPro (HR) is a self-logging sensor (stores all data on the sensor) however, the AquaPro (HR) does not transfer data to the MMP controller at the end of the profile. The data stored on the AquaPro (HR) must be manually retrieved after deployment recovery.

Configuring the Firmware to Use the Aquadopp Sensors

The Profiler System Configuration menu specifies the active sensors. To enable an Aquadopp sensor complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select <2> for the Nortek Aquadopp and then type a selection to enable the Aquadopp model. Type *Y* to enable the sensor.

```
Config: MPP_CT_CM_TU                               CF2 V5.22 of Apr 28 2015
-----
                Pattern Profiler
                System Configuration
-----
                Tue May 26 15:13:05 2015

System Parameters:
  <0> Battery capacity                               240 Ah

Sensor Suite:
Port J9:CTD
  <1> Seabird 52MP CTD ----- ENABLED

Port J5:ACM
  <2> Nortek AquaDopp2 DVS ----- ENABLED AquaDopp2
      Port J6:IMM
  <I> Telemetry
      Port J4:SSP
  <B> BioSuite Triplet/PAR
  <J> Wetlabs ECO FLBB CD
  <N> Satlantic SUNA Nitrate
  <O> Aanderaa Optode
  <U> bbe FluoroProbe
  <W> Wetlabs ECO BBFL2
  <Y> Wetlabs ECO FLBB2K
  <@> Wetlabs FLNTURTD
      Port J10:SPR
  <L> Wetlabs ECO FLBB (RT) /D
  <P> Biospherical PAR
      Port J7:TRB
  <T> Seapoint IR Turbidity ----- ENABLED @ 5 samp/avg, Autogain
      Port J8:FLR
  <E> Seapoint CHL Fluorometer
  <F> Wetlabs CDOM Fluorometer
      Port J4i:SER
  <H> ProOceanus CH4
  <M> OceanServer5000 MotionPack
      Port J5i:SER
  <K> ProOceanus CO2

Enable the "Nortek AquaDopp2 DVS" [Y] ? y ← Nortek Model
```

Figure 3-1: Type 1 or 2 to Enable the Aquadopp Sensor

Section 3.1 Nortek Aquadopp II ACM Sensor

MMP Release v5.00 firmware and higher supports the Nortek Aquadopp II Acoustic Doppler Current Meter (ACM). The ACM file for each profile contains the first Aquadopp record ('ANNNNNNN.DAT' where 'N' is the profile number).

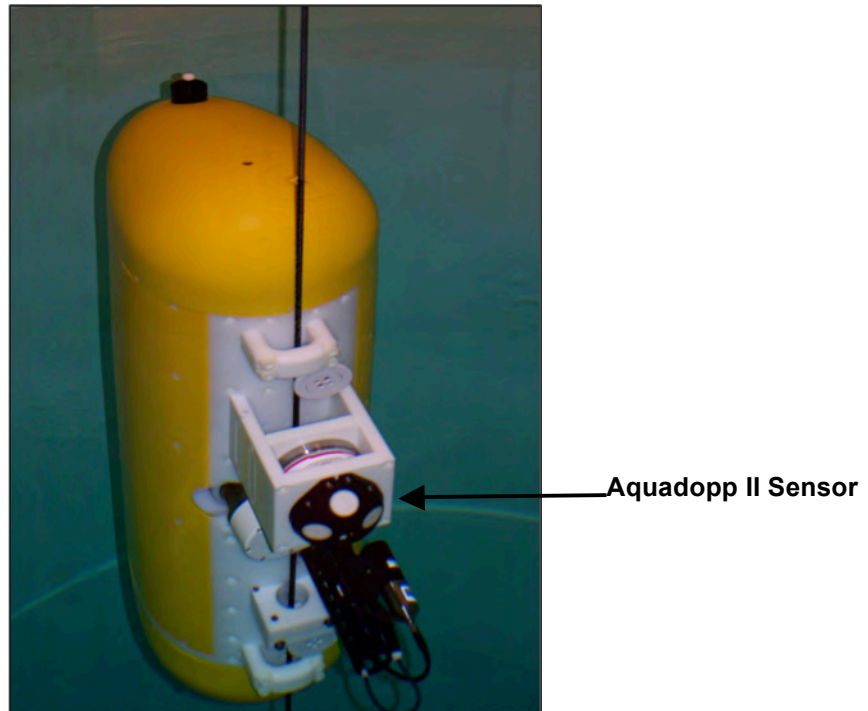


Figure 3.1-1: MMP with Aquadopp II Sensor

Aquadopp II Data Details

Aquadopp II data is logged in the ACM file ('ANNNNNNN.DAT' where 'N' is the profile number). Files stored on the MMP controller flash card are binary files. The examples that follow show the text format created by the Profiler Unpacker. See the 'Unpacking Deployment Data' chapter in the MMP User Manual for more about unpacking deployment data.

```

Profile 2
MM-DD-YYYY HH:MM:SS      Sndm/s      TmpC      Heading      Pitch      Roll      magnHx      magnHy      magnHz
12-07-2012 16:30:16.000  1500.0000  17.6400  342.6000  0.4000  0.3000  -460  65  193
12-07-2012 16:30:16.500  1500.0000  17.6400  342.6000  0.4000  0.3000  -460  65  193
12-07-2012 16:30:17.000  1500.0000  17.6400  342.1000  0.4000  0.2000  -460  65  190
12-07-2012 16:30:17.500  1500.0000  17.6400  342.1000  0.4000  0.2000  -460  65  190
12-07-2012 16:30:18.000  1500.0000  17.6400  342.3000  0.3000  0.3000  -460  64  190
12-07-2012 16:30:18.500  1500.0000  17.6400  342.3000  0.3000  0.3000  -460  64  190
. . .
12-07-2012 16:35:10.500  1500.0000  17.6400  342.1000  0.4000  0.3000  -460  65  190
  
```

Figure 3.1-2: MMP with Aquadopp II Data (screen 1 of 3)

```

Beams  Cells  Beam1  Beam2  Beam3  Beam4  Beam5  Vel[0,0]  Vel[1,0]  Vel[2,0]  Vel[3,0]
4      1      1      2      3      4      0      1.32030  0.31160  0.89480  0.45590
4      1      1      2      3      4      0      1.33630  0.02960  0.91070  0.00270
4      1      1      2      3      4      0      0.91700  0.02480  0.94530  0.00540
4      1      1      2      3      4      0      2.15710  -0.01220  0.94610  0.00300
4      1      1      2      3      4      0      2.07930  -0.01710  0.92470  0.00130
4      1      1      2      3      4      0      2.13280  0.00210  0.94890  0.00360
. . .
4      1      1      2      3      4      0      1.49030  0.00020  -0.00210  0.03870
  
```

Figure 3.1-3: MMP with Aquadopp II Data (screen 2 of 3)

```

Amp[0,0]  Amp[1,0]  Amp[2,0]  Amp[3,0]  Corr[0,0]  Corr[1,0]  Corr[2,0]  Corr[3,0]
071      045      044      043      023      009      032      011
073      123      098      112      016      096      075      097
073      103      097      103      015      070      071      091
073      100      098      101      016      063      071      091
072      099      099      101      004      065      069      094
072      097      099      100      009      067      078      094
. . .
072      107      100      089      032      093      078      034
Profile 2
AquaDopp2 turned on at 12/07/2012 16:30:02
AquaDopp2 turned off at 12/07/2012 16:35:15097
  
```

Figure 3.1-4: MMP with Aquadopp II Data (screen 3 of 3)

Data Column Definitions

The section that follows details the full (non-reduced) Aquadopp II data ACM files. The column names provided by McLane are included with a description of represented units and human readable names.

Heading	Parameter	Units	Comments
MM-DD-YYYY	Date	Month-Day-Year format	
HH:MM:SS	Time	Hour-Minute-Second.Fractional Second format	
Sndm/s	Speed of Sound Constant	m/s	Speed of Sound Constant
TmpC	Temperature	°C	
Heading	Sensor & Profiler Heading	Degrees	
Pitch	Sensor & Profiler Pitch	Degrees	Positive Bow Up
Roll	Sensor & Profiler Roll	Degrees	Positive Starboard Down
magnHx	Magnitude Vector		Instrument X direction magnetometer value
magnHy	Magnitude Vector		Instrument Y direction magnetometer value
magnHz	Magnitude Vector		Instrument Z direction magnetometer value
Beams	Number of Beams Enabled for the profile		3 for Upward Profiles 3 for Downward Profiles 4 for Stationary Profiles
Cells	Number of Cells per Beam		Fixed at 1
Beamx	Transducer Mapping to data fields for Velocity, Amplitude and Correlation data		Beam5 is not used in this sensor. Always set to zero.
Vel[x-1, 0]	Beam Velocities	mm/s	Beam Velocity for the transducer mapped to the corresponding Beam number.
Amp[x-1, 0]	Beam Amplitude	Counts	Return signal amplitude for the transducer mapped to the corresponding Beam number.
Corr[x-1, 0]	Beam Correlation	%	A measure of signal quality. See Nortek User Guide for more information

Aquadopp II Beam Configuration

Physical sensor /beam orientation is important and corresponds with the data mapped in the ACM files. Mount the Aquadopp II so that the arrow points to the top of the Profiler as shown in Figure 3.1-5.

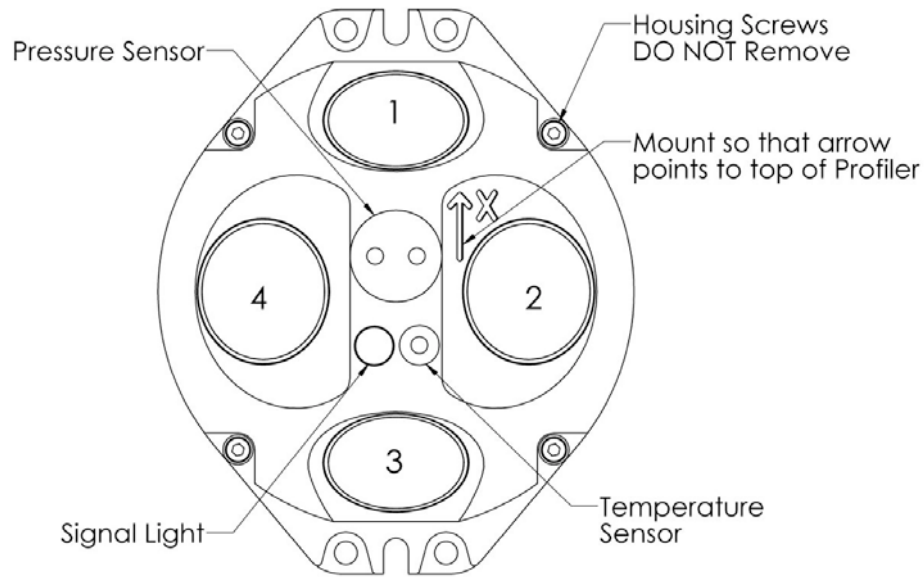


Figure 3.1-5: Aquadopp II Sensor Orientation

Transducer Mapping

The Aquadopp II provides for mapping a physical transducer to a specific “beam” within the dataset. The MMP controller will command the use of a specific set of beams to use depending on the profiling direction as shown below:

Profiling Direction	Beam 1	Beam 2	Beam 3	Beam 4
Up	ON	ON	OFF	ON
Down	OFF	ON	ON	ON
Stationary	ON	ON	ON	ON



The Aquadopp II data contains a field for Beam 5 which is not used on this sensor.

The value in each row for these columns specifies which physical beam (in this case 1-4) is mapped to that dataset beam. Below is an example and its interpretation

The example below shows the case for a downward traveling profile.

Beams	Cells	Beam1	Beam2	Beam3	Beam4	Beam5
3	1	2	3	4	0	0

The first and second columns (“Beams” and “Cells”) indicate there are 3 beams active (first column), with 1 cell in each beam (second column).

Data from physical beam 2 (this should be one of the horizontally oriented beams) is contained in the first data field (i.e. Beam1), data from physical beam 3 in the second data field (Beam2), and physical beam 4 in the third data field (Beam3). Beam4 is zero indicating it is not used in this profile.

Data Reduction and Data Decimation

Data file reduction takes place within the Profiler firmware based on commands sent from the Surface Controller. Compressed Aquadopp II data files must be parsed using the file AQUADOPP.CFG. Data file decimation sets the number of data records the surface controller retrieves upon request. Appendix A in this User Manual ‘ Inductive File Transmission Protocol’ explains more about data file reduction, data decimation and Profiler Inductive commands.

Aquadopp ACM Data Reduction with Inductive Communications

MMP Release v5.07 firmware provides AquaDopp II ACM data file reduction which allows the user to reduce the data fields the AquaDopp II collects/transmits inductively. The reduced file has a .DEC file extension. For example, A00000099.DAT reduction file would be A00000099.DEC. Included fields are stored in the .DEC file in order. Data field configuration is defined in AQUADOPP.CFG which is stored on the Profiler's CompactFlash disk. See the 'Inductive Communications' chapter in this User Manual for more information.



White space between the comma separated digits in the AQUADOPP.CFG configuration are optional.

The field reduction is specified by a configuration file that is stored on the Profiler's CompactFlash disk. This file must be named AQUADOPP.CFG. The contents of AQUADOPP.CFG file are used to determine which fields in the full AquaDopp2 DAT record will be stored in the reduced DEC file.

Any line in this file that starts with a pound-sign character (#) will be treated as a comment and is ignored. The first line that does not start with a pound-sign is taken to be a comma-separated list of flags that indicate whether or not to include a particular field in the reduced DEC file. A '1' indicates the field should be included. A '0' indicates it should not be included.

An example of AQUADOPP.CFG contents follows. This example also represents the default behavior, if the CFG file is missing, corrupt or unreadable. (The default reduced size is approximately 25% of the original full DAT file; e.g., a ~400kb DAT file results in a ~100kb DEC file.)

```

-----
# Lines, like this one, that start with the pound-sign are ignored.
# The following line has the names of each field, in the order expected by the Profiler's
reduction routine. The user can edit or eliminate this line as desired.
# Time, SoundSpeed, TempC, Heading, Pitch, Roll, magX, magY, magZ, Beams, Cells, Beam1, Beam2, Beam3,
Beam4, Beam5, Vscale, Vel0, Vel1, Vel2, Amp0, Amp1, Amp2, Cor0, Cor1, Cor2
1, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 1, 1, 1, 1, 1, 1,
1, 0, 0, 0
# The scanning routine stops parsing after it sees any line that does not start with a
pound-sign, so anything goes after the above line.
# The above comma-separated flags will be scanned to determine whether or not to include
that particular field in the reduced output. White space is optional.
# Any included fields are stored in the DEC file in the exact order shown in the above
list. Reordering the commented names has no effect, other than cosmetically.
-----

```

The following table contains the names, in order, of each possible field to include, the number of bytes it will occupy in the DEC file if included, and the type of variable to expect.

Note : In the tables below **F = field; B = bytes; T = type**

F	Time	Sound Speed	Temp°C	Heading	Pitch	Roll	mag X	Mag Y	Mag Z	Beams	Cells	Beam 1	Beam 2	Beam 3	Beam 4	Beam 5
B	6	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
T	ubyte	uint	int	uint	int	int	int	int	int	ubyte	ubyte	ubyte	ubyte	ubyte	ubyte	ubyte

F	Vscale	Vel0	Vel1	Vel2	Amp0	Amp1	Amp2	Cor0	Cor1	Cor2
B	1	2	2	2	1	1	1	1	1	1
T	byte	int	int	int	ubyte	ubyte	ubyte	ubyte	ubyte	ubyte

The variable types are described as follows:

type	name	bytes
byte	signed byte	1
ubyte	unsigned byte	1
uint	unsigned integer	2
int	signed integer	2
ulong	unsigned long integer	4

Using Bench Test Options

The main Bench Tests and Aquadopp Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu type 5 at the prompt to display the Bench Tests menu.

```
Config: MPP_IM_CT                               CF2 V5.14 of Jun  2 2014
          McLane Research Laboratories, USA
          Pattern Profiler
          S/N: ML13145-071

          Pattern Profiler
          Main Menu

          Fri Jun  6 13:20:13 2014

<1> Set Time           <5> Bench Test
<2> Diagnostics       <6> Deploy Profiler
<3> Flash Card Ops    <7> Offload Deployment Data
<4> Sleep             <8> Contacting McLane
<C> Configure
Selection [ ] ?
```

Figure 3.1-6: Profiler Main Menu

```
Config: MPP_IM_CT                               CF2 V5.14 of Jun  2 2014

          Pattern Profiler
          Bench Tests

          Fri Jun  6 13:20:17 2014

CTD utilities:
<1> Seabird 41CP-IDO CTD communication
<2> Seabird 41CP-IDO CTD pressure
<3> Seabird 41CP-IDO CTD average pressure
<4> Seabird 41CP-IDO CTD temperature record
<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass

System evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<D> Detailed schedule
<S> Recover schedule

Sensor & Option tests:
<I> Seabird Inductive Modem
Exit:
```

Figure 3.1-7: Profiler Bench Tests Main Menu

2. From the main Bench Tests menu type 5 at the prompt to display the Nortek Aquadopp Bench Test Menu.

3. Type *1* to connect directly with the Aquadopp.

```
Selection [] ? 5
-----
Config: MPP_IM_CT_CM_PA_SC_MP          CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                AQUADOPP Bench Test Menu
-----
                Tue Mar 11 15:39:47 2014

<1> Direct communications (19200 Baud)
<2> restore McLane parameters
<3> restore Factory parameters
<4> Report parameter settings
<5> Perform a profile test loop
<6> Set sampling rate (1 Hz)
<7> Set AquaDopp clock
<8> Read AquaDopp clock
<9> Erase sensor data

<M> return to previous Menu
```

Figure 3.1-8: Aquadopp Bench Test Menu



The Profiler communicates with the Aquadopp II at 19200 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 3-1-9). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****  
  
-Êûx-òÄ-fûx-` ,ò12x-Ê‡-ò-ûfx f12òx-Û12ò-òÄ-Ê-  
  
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]  
command finished.
```

Figure 3.1-9: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu displays the Baud Rate menu (Figure 3-1-10). Use this menu option to temporarily connect at the sensor’s current baud rate. Once connected to the sensor, change to the Profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013  
  
-----  
                Pattern Profiler  
                Select new Baud rate  
-----  
                Fri Jan 11 13:48:30 2013  
  
<1> 1200  
<2> 2400  
<3> 4800  
<4> 9600  
<5> 19200  
<6> 38400  
<7> 57600  
  
<G> Go to COMM session  
      Selection  [] ? g
```

Figure 3.1-10: Baud Rate Menu

Direct Connection to the Aquadopp

1. Type *1* to connect directly with the Aquadopp ACM.

```
Selection  [] ? 1

01/02/13 14:03:56 AQUADOPP 19.2 kBaud communication channel opened.
01/02/13 14:03:56 AQUADOPP Powered on. . . .
01/02/13 14:03:57 AQUADOPP Sending command [ID]. .
01/02/13 14:03:57 AQUADOPP Identified as V2020, S/N 100014.
01/02/13 14:03:57 AQUADOPP Powered off.
01/02/13 14:03:57 AQUADOPP 19.2 kBaud communication channel closed.

01/02/13 14:03:59 AQUADOPP Press ^C to terminate COMM session.
01/02/13 14:04:00  SYSTEM Press ^B to change or confirm Baud rate.

01/02/13 14:04:00 AQUADOPP 19.2 kBaud communication channel opened.
01/02/13 14:04:00 AQUADOPP Powered on.
*****
AQUADOPP2 - NORTEK AS.
Version 2020 (McLane) (Dec 14 2012 11:25:13)
COMMAND MODE
OK
ID
AQUADOPP2,100014
```

Figure 3.1-11: Option <1> Direct Communications with the Aquadopp

Restore Factory Settings

Options <2> and <3> from the Aquadopp Bench Test menu (Figure 3.1-12) restore the McLane or Nortek factory settings on the Aquadopp sensor. This option is for the Aquadopp II. The Aquadopp (HR) is configured directly. Using option <2> requires the password *mclane*. Using option <3> also requires a password. Contact McLane before resetting to the factory parameters.

```
Selection  [] ? 2 Password: *****

01/02/13 14:04:18 AQUADOPP 19.2 kBaud communication channel opened.
01/02/13 14:04:18 AQUADOPP Powered on. . . .
01/02/13 14:04:18 AQUADOPP Sending command [ID]. .
01/02/13 14:04:19 AQUADOPP Identified as V2020, S/N 100014.
01/02/13 14:04:19 AQUADOPP Sending command [SETDEFAULT,ALL]. .
01/02/13 14:04:19 AQUADOPP Sending command [SETINST,BR=19200,RS=232,LED=1]. .
01/02/13 14:04:20 AQUADOPP Sending command
[SETPLAN,MICP=1,CP=0,DICP=0,VD=1,MV=10,SA=35,BURST=1,MIBURST=0]. .
01/02/13 14:04:21 AQUADOPP Sending command
[SETPLAN,DIBURST=0,SV=1500,FN="TELEMETRYFILE.BIN",SO=0]. .
01/02/13 14:04:23 AQUADOPP Sending command
[SETTM,SD=1,SA=1,CD=1,PD=1,TV=1,TA=1,TC=1,TVBT=0,TABT=0,TCBT=0,TDBT=0]. .
01/02/13 14:04:24 AQUADOPP Sending command
[SETTCP,NC=01,CS=0.5,BD=0.3,CY="BEAM",PL=0,AI=1,DF=0]. .
01/02/13 14:04:25 AQUADOPP Sending command
[SETBURST,NC=1,NB=0,CS=0.23,BD=0.15,CY="BEAM",PL=-9]. .
01/02/13 14:04:27 AQUADOPP Sending command
[SETBURST,SR=2,NS=1024,VR=5.00,VP=1.00,DF=2,NPING=1]. .
01/02/13 14:04:28 AQUADOPP Sending command [BOARDSENSET,22,4]. .
01/02/13 14:04:28 AQUADOPP Sending command [CALSAVE]. .
01/02/13 14:04:29 AQUADOPP Sending command [SAVE,ALL]. .
01/02/13 14:04:30 AQUADOPP Powered off.
01/02/13 14:04:30 AQUADOPP 19.2 kBaud communication channel closed.

01/02/13 14:04:30 AQUADOPP Was able to restore McLane parameters.
```

Figure 3.1-12: Option <2> Restore McLane Parameters



The Aquadopp II parameters are specific to the settings configured by McLane. Changing or resetting to the factory settings prevents the Aquadopp II from working correctly with the Profiler..

Display Sensor Settings

Option <4> (available for the Aquadopp II only) from the AquaDopp Bench Test menu displays the current Aquadopp parameters.

```
Selection  [] ? 4

01/02/13 14:04:35 AQUADOPP 19.2 kBaud communication channel opened.
01/02/13 14:04:35 AQUADOPP Powered on. . . .
01/02/13 14:04:36 AQUADOPP Sending command [ID]. .
01/02/13 14:04:36 AQUADOPP Identified as V2020, S/N 100014.

01/02/13 14:04:36 AQUADOPP Sending command [GETCLOCK]. .
01/02/13 14:04:37 AQUADOPP 2013,1,2,11,54,42.

01/02/13 14:04:37 AQUADOPP Sending command [GETINST]. .
01/02/13 14:04:37 AQUADOPP 19200,232,1.

01/02/13 14:04:37 AQUADOPP Sending command [GETPLAN]. .
01/02/13 14:04:37 AQUADOPP 1,0,0,1,10,35,1,0,0,1500,TELEMETRYFILE.BIN,0,0.

01/02/13 14:04:37 AQUADOPP Sending command [GETTM]. .
01/02/13 14:04:38 AQUADOPP 1,1,1,1,1,1,1,0,0,0,0.

01/02/13 14:04:38 AQUADOPP Sending command [GETTCP]. .
01/02/13 14:04:38 AQUADOPP 1,0.50,0.30,BEAM,0.00,1,0.00000,0.00,0.

01/02/13 14:04:38 AQUADOPP Sending command [GETBURST]. .
01/02/13 14:04:38 AQUADOPP 1,0,0.23,0.15,BEAM,-9.00,2,1024,5.00,1.00,2,1.

01/02/13 14:04:38 AQUADOPP Sending command [GETUSER]. .
01/02/13 14:04:39 AQUADOPP 0.00,0.00,0,0,0.

01/02/13 14:04:39 AQUADOPP Powered off.
01/02/13 14:04:39 AQUADOPP 19.2 kBaud communication channel closed.
```

Figure 3.1-13: Option <4> Report Parameter Settings

Perform Profile Test Loop

Option <5> (available for the Aquadopp II only) from the Aquadopp Bench Test menu runs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile, as shown in Figure 3.1-14.

```
Selection  [] ? 5

Enter minutes per profile (1-60) [5] ? 2

Automatically cycle through sampling rates [N] ?

01/02/13 14:06:14 AQUADOPP Automated verification of sensor settings.
01/02/13 14:06:14 AQUADOPP 19.2 kBaud communication channel opened.
01/02/13 14:06:14 AQUADOPP Powered on. . . .
01/02/13 14:06:15 AQUADOPP Sending command [ID]. .
01/02/13 14:06:15 AQUADOPP Identified as V2020, S/N 100014.

Format the AquaDopp disk? [N] ? n
Erase AquaDopp data [N] ? y ARE YOU SURE [N] ? y

01/02/13 14:06:21 AQUADOPP Sending command [ERASE, CODE=9999]. .
01/02/13 14:06:22 AQUADOPP All data erased.
01/02/13 14:06:23 AQUADOPP Clock write 01/02/2013 14:06:23.
01/02/13 14:06:23 AQUADOPP Sending command
[SETCLOCK, MONTH=01, DAY=02, YEAR=2013, HOUR=14, MINUTE=06, SECOND=23]. .
01/02/13 14:06:24 AQUADOPP Sending command [GETCLOCK]. .
01/02/13 14:06:24 AQUADOPP Clock reads 01/02/2013 14:06:23.

01/02/13 14:06:24 AQUADOPP Sending command [SETDEFAULT, ALL]. .
01/02/13 14:06:25 AQUADOPP Sending command [SETINST, BR=19200, RS=232, LED=1]. .
01/02/13 14:06:26 AQUADOPP Sending command
[SETPLAN, MICP=1, CP=0, DICP=0, VD=1, MV=10, SA=35, BURST=1, MIBURST=0]. .
01/02/13 14:06:27 AQUADOPP Sending command
[SETPLAN, DIBURST=0, SV=1500, FN="TELEMETRYFILE.BIN", SO=0]. .
01/02/13 14:06:28 AQUADOPP Sending command
[SETTM, SD=1, SA=1, CD=1, PD=1, TV=1, TA=1, TC=1, TVBT=0, TABT=0, TCBT=0, TDBT=0]. .
01/02/13 14:06:30 AQUADOPP Sending command
[SETTCP, NC=01, CS=0.5, BD=0.3, CY="BEAM", PL=0, AI=1, DF=0]. .
01/02/13 14:06:31 AQUADOPP Sending command
[SETBURST, NC=1, NB=0, CS=0.23, BD=0.15, CY="BEAM", PL=-9]. .
01/02/13 14:06:32 AQUADOPP Sending command
[SETBURST, SR=2, NS=1024, VR=5.00, VP=1.00, DF=2, NPING=1]. .
01/02/13 14:06:33 AQUADOPP Sending command [BOARDSENSSET, 22, 4]. .
01/02/13 14:06:34 AQUADOPP Sending command [CALSAVE]. .
01/02/13 14:06:35 AQUADOPP Sending command [SAVE, ALL]. .
01/02/13 14:06:35 AQUADOPP Powered off.
01/02/13 14:06:36 AQUADOPP Power-down delay .....
01/02/13 14:06:41 AQUADOPP 19.2 kBaud communication channel closed.
01/02/13 14:06:41 SYSTEM Deleting A0000000.DAT

Press ^C to exit the loop
```

Figure 3.1-14: Option <5> Perform a Profile Test Loop

Set Sampling Rate

Option <6> (available for the Aquadopp II only) from the AquaDopp Bench Test menu sets the sampling rate.

```
Selection  [] ? 6

Enter new sampling rate (1|2|4|8|10 Hz) (1-10) [10] ? 5
Invalid AQUADOPP sampling rate: 5 ← Aquadopp rate must be 1, 2, 4, 8 or 10
Enter new sampling rate (1|2|4|8|10 Hz) (1-10) [5] ? 2
. . .
```

Figure 3.1-15: Option <6> Set Sampling Rate



If a rate other than the allowed rate is typed, the firmware displays an error message. The sampling rate ranges from 1-10 to accommodate other ACM's. However, the Aquadopp accepts only sampling rates of 1, 2, 4, 8, 10 Hz as indicated on the display.

Manual Aquadopp Clock Reset

Option <7> (not shown) (available for the Aquadopp II only) from the Aquadopp Bench Test menu provides a way to manually reset the Aquadopp clock to the Profiler real-time clock (RTC). Before each profile, the Profiler firmware automatically sets the Aquadopp clock to the Profiler. This option provides a way to manually perform the clock reset for testing purposes.

Selecting <8> from the Aquadopp Bench Test Menu displays the Aquadopp clock reading.

```
Selection  [] ? 8

12/07/12 13:19:46 AQUADOPP 19.2 kBaud communication channel opened.
12/07/12 13:19:46 AQUADOPP Powered on. . . .
12/07/12 13:19:47 AQUADOPP Sending command [ID]. .
12/07/12 13:19:47 AQUADOPP Identified as V2018, S/N 100003.
12/07/12 13:19:47 AQUADOPP Sending command [GETCLOCK] ← Clock Reading
12/07/12 13:19:47 AQUADOPP Clock reads 12/07/2012 13:19:47.

12/07/12 13:19:47 AQUADOPP Powered off.
12/07/12 13:19:47 AQUADOPP 19.2 kBaud communication channel closed.
```

Figure 3.1-16: Option <8> Read AquaDopp Clock

Erase Sensor Data

Option <9> (available for the Aquadopp II only) from the Aquadopp Bench Test Menu (not shown) provides a way to manually clear the data from the Aquadopp SD storage card. At the start of each deployment, the Profiler firmware automatically commands the Aquadopp to erase the data stored internally. This option provides a manual way to clear the data from the Aquadopp internal storage for testing purposes. Selecting <M> returns to the previous menu.

Aquadopp Heading, Pitch and Roll

Option <6> from the main Bench Test Menu (Figure 3.1-17) 'Nortek Aquadopp DVS Tilt & Compass' provides heading, pitch and roll output which can be used to perform a spin test.



Power of 11V or greater is required for bench testing the Aquadopp DVS tilt & compass.

```
Selection [] ? 6

Displays Heading, Pitch & Roll outputs
for use while mounting the ACM pressure housing.

Press ^C to terminate operation.

01/03/13 15:59:49 AQUADOPP 19.2 kBaud communication channel opened.
01/03/13 15:59:49 AQUADOPP Powered on. . . .
01/03/13 15:59:50 AQUADOPP Sending command [ID]. .
01/03/13 15:59:50 AQUADOPP Identified as V2020, S/N 100017.
01/03/13 15:59:50 AQUADOPP Sending command [ERASE, CODE=9999]. .
01/03/13 15:59:51 AQUADOPP Sending command [SETBURST, SR=1]. .
01/03/13 15:59:51 AQUADOPP Sending command [SETPLAN, VD=0, SO=1]. .
01/03/13 15:59:52 AQUADOPP Sending command [START]. .

  DATE      TIME      HEADING    TX      TY      MagX      MagY      MagZ
01/03/13 15:59:53      2.9     10.4     -1.9     -510     -30      148 .
01/03/13 15:59:54      0.0      8.9     -3.7     -510     -33      149 .
01/03/13 15:59:55     15.3      9.3     -1.2     -510     -73      141 .
01/03/13 15:59:56     35.7      8.2      0.6     -507    -124      110 .
01/03/13 15:59:57     55.4      9.5      3.0     -504    -163       50 .
01/03/13 15:59:58     80.1     14.6     11.1     -505    -136      -80 .
01/03/13 15:59:59     89.2     16.6     19.0     -507     -81    -131 .
01/03/13 16:00:00    107.0      6.0     17.6     -516     -45    -110 .
01/03/13 16:00:01    133.5     -0.9     13.4     -509     -42    -142 .
01/03/13 16:00:02    176.8     -0.2      2.5     -484      10    -218 .
01/03/13 16:00:03    198.9     -0.8     -1.7     -495      54    -190 .
01/03/13 16:00:04    234.8      4.5     -5.6     -479     156    -178 .
01/03/13 16:00:05    256.6      5.6      5.5     -471     236     -93 .
01/03/13 16:00:06    297.3     10.4      6.5     -487     221      -6 .
01/03/13 16:00:07    325.5      1.6      7.0     -498     152     118 .
01/03/13 16:00:08    350.4      9.5     12.3     -495     147     138 .
01/03/13 16:00:09     10.7      4.5      5.8     -513      16     155 .
01/03/13 16:00:10     27.1      5.3     -3.2     -495    -133     160 .
01/03/13 16:00:11      9.6      7.0     -4.1     -509     -73     152 [^C]

01/03/13 16:00:12 AQUADOPP Sending command [#####].
01/03/13 16:00:12 AQUADOPP Sending command [K1W%!Q].
01/03/13 16:00:12 AQUADOPP Sending command [K1W%!Q]. .
01/03/13 16:00:13 AQUADOPP Sending command [MC].
01/03/13 16:00:13 AQUADOPP Powered off.
01/03/13 16:00:13 AQUADOPP Power-down delay .....
01/03/13 16:00:18 AQUADOPP 19.2 kBaud communication channel closed..
```

Figure 3.1-17: Bench Tests Menu Option <6> Aquadopp DVS Tilt & Compass

Inserting the Mooring Cable in the Aquadopp II Hinge Plate

The Mooring Wire is inserted in the Aquadopp II hinge plate prior to deployment.

1. Place the MMP in a sling or other supported surface and remove the Top skin.
2. Using a hex driver, remove the four plastic screws from the Aquadopp II hinge plate.

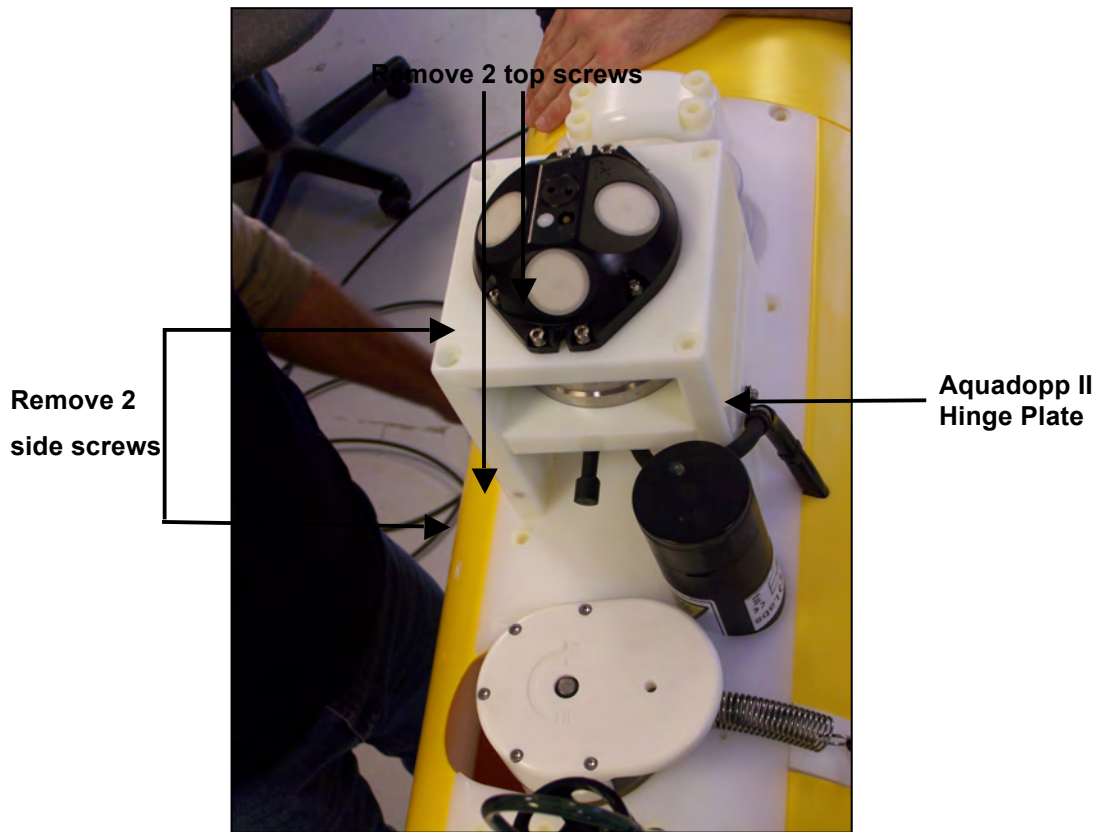


Figure 3.1-18: Remove Four Plastic Screws

3. With the screws removed, swing the hinge plate open.

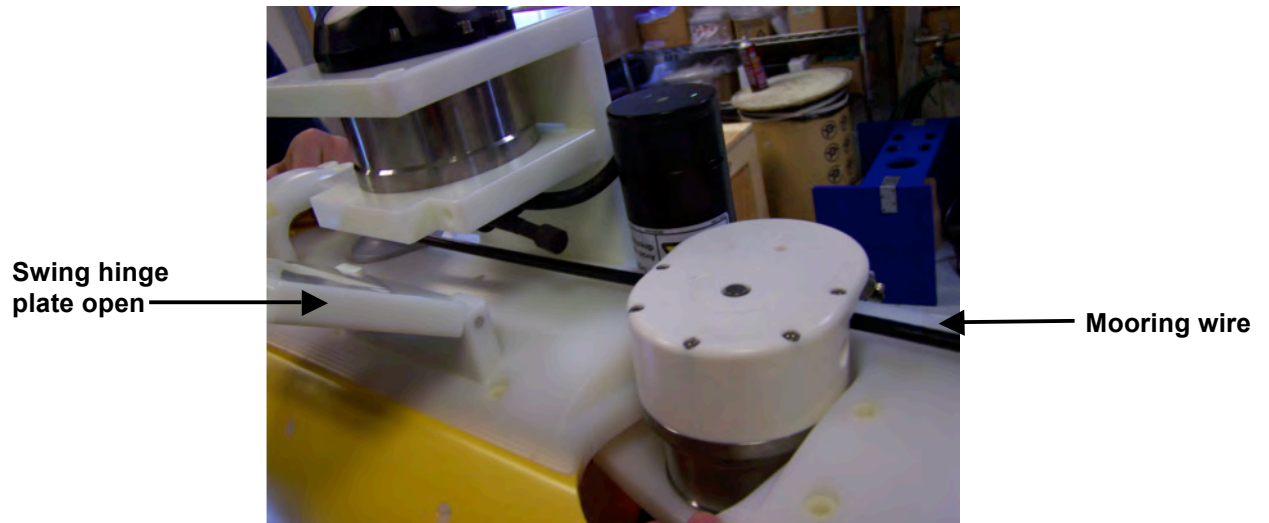


Figure 3.1-19: Positioning the Mooring Wire

4. Position the mooring wire under the Aquadopp II and through to the cable guide.
5. Close the hinge and re-secure the four plastic screws.

Removing the Aquadopp II from the MMP

To disconnect and remove the Aquadopp II from the Profiler, complete the following steps:

1. Lay the MMP on its side on a stable surface and remove the Top skin.
2. Using a hex driver, loosen only the four outer screws that connect the sensor to the hinge plate mount and slide the Aquadopp II from the hinge plate.



Do not remove any other screws, they will disassemble the sensor.

3. Using an Allen Wrench, (included in the toolkit), remove the screws from the Aquadopp II hinge plate and remove the plate.

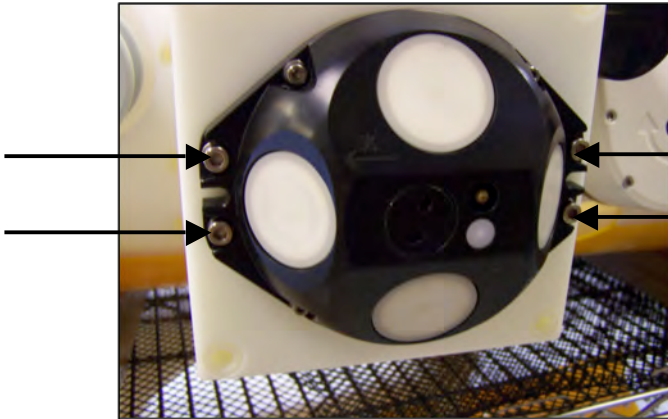


Figure 3.1-20: Loosen Four Screws

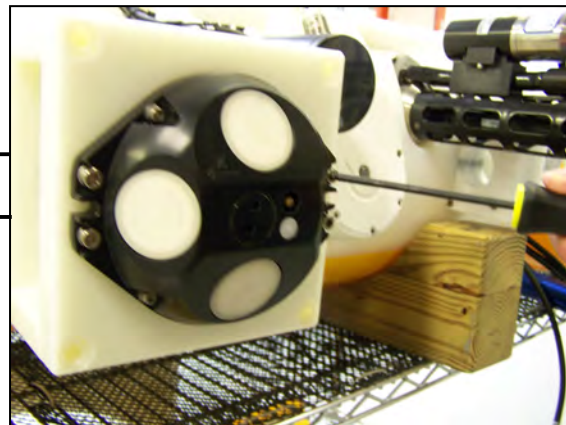


Figure 3.1-21: Unscrew from Hinge Plate

- Using an Allen wrench, loosen the four screws that secure the Aquadopp II at the back of the hinge plate mount.
- Detach the bulkhead connector from the Aquadopp II.

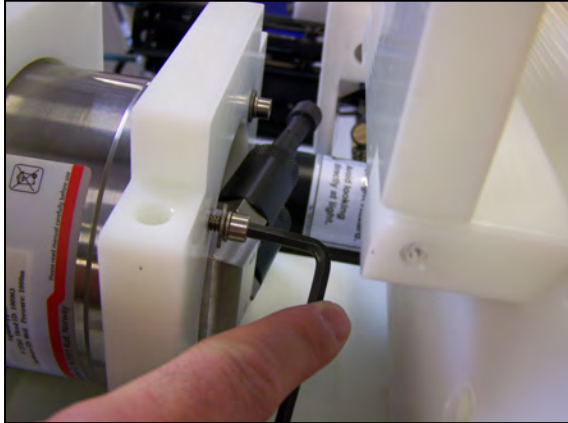


Figure 3.1-22: Loosen Back Screws



Figure 3.1-23: Detach Bulkhead Connector

- Slide the Aquadopp II out the front of the mount.

Connecting the Aquadopp II Sensor

To re-install the Aquadopp II sensor, complete the following steps:

1. Slide the Aquadopp II back into the hinge plate mount.
2. Connect the bulkhead connector. The profiler cable plugs into the connector labeled 'R'. The dummy plug connects to the slot labeled 'E'.



Figure 3.1-24: Reconnect Bulkhead Connector

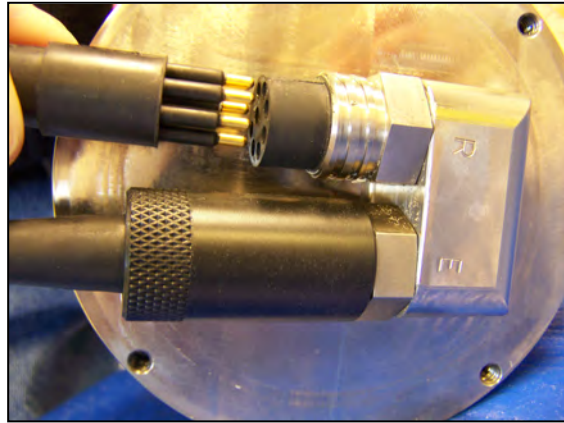


Figure 3.1-25: Connect Bulkhead Connector

3. Secure the screws that fasten the Aquadopp II to the hinge plate mount.
4. Tighten the screws that secure the hinge plate mount to the MMP.

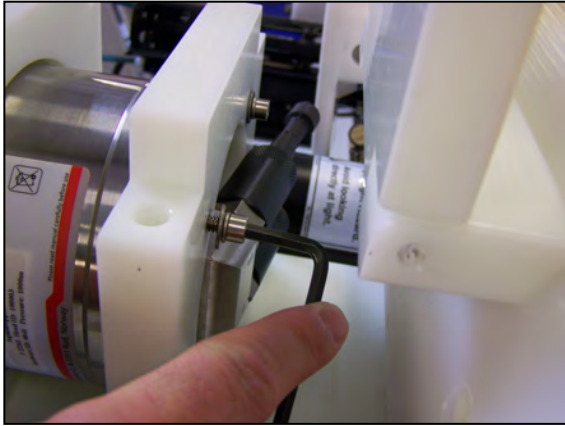


Figure 3.1-26: Tighten Back Screws

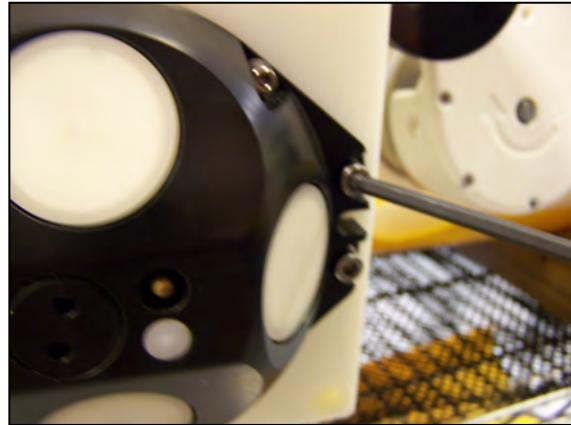


Figure 3.1.27: Secure to Hinge Plate



Figure 3.1.28: Tighten Hinge Plate Screws

5. Tighten the screws that secure the hinge plate mount to the MMP.
6. Re-attach MMP skin.

Notes

Section 3.2

AquaPro HR ACM Sensor

The Nortek AquaPro (HR) integration is a prototype implementation on the MMP. The AquaPro (HR) is a customized interface and does not follow the standard conventions of MMP sensor interactions. Although support for this sensor was first available in v4.18, continued development of this sensor integration has required firmware changes on both the MMP controller and the AquaPro. Contact McLane for details before planning a deployment with an AquaPro series sensor. AquaPro stores all data on the sensor and does not transfer data to the MMP controller at the end of the profile. The data stored on the AquaPro must be retrieved after deployment recovery. Contact Nortek for instructions for retrieval and processing of the data file(s).

The user configures AquaPro directly. Refer to the Nortek AquaPro documentation for more detailed instructions about sensor configuration.

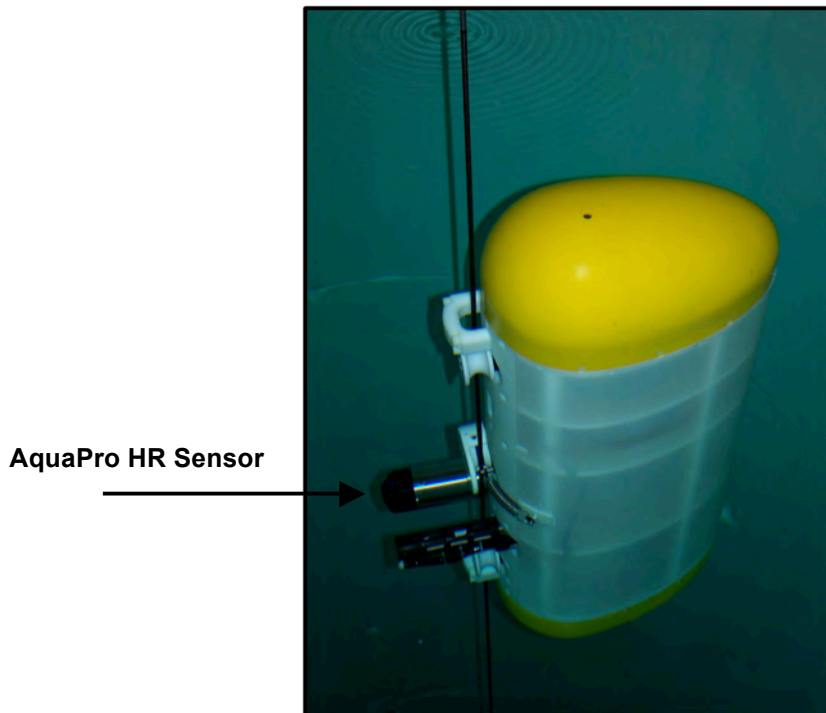


Figure 3.2-1: MMP with AquaPro/Aquadopp HR Sensor

Using Bench Test Options

The main Bench Tests and AquaPro HR Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu type 5 at the prompt to display the Bench Tests Menu.

```
Config: MPP_IM_CT                               CF2 V5.14 of Jun  2 2014
          McLane Research Laboratories, USA
          Pattern Profiler
          S/N: ML13145-071

          Pattern Profiler
          Main Menu

          Fri Jun  6 13:20:13 2014

<1> Set Time           <5> Bench Test
<2> Diagnostics       <6> Deploy Profiler
<3> Flash Card Ops    <7> Offload Deployment Data
<4> Sleep              <8> Contacting McLane
<C> Configure

Selection [ ] ?
```

Figure 3.2-2: Profiler Main Menu

```
Config: MPP_IM_CT                               CF2 V5.14 of Jun  2 2014

          Pattern Profiler
          Bench Tests

          Fri Jun  6 13:20:17 2014

CTD utilities:
<1> Seabird 41CP-IDO CTD communication
<2> Seabird 41CP-IDO CTD pressure
<3> Seabird 41CP-IDO CTD average pressure
<4> Seabird 41CP-IDO CTD temperature record

<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass

System evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<D> Detailed schedule
<S> Recover schedule

Sensor & Option tests:
<I> Seabird Inductive Modem

Exit:
```

Figure 3.2-3: Profiler Bench Tests Main Menu

2. From the main Bench Tests menu type *5* at the prompt to display the Nortek Aquadopp Bench Test Menu.
3. Type *1* to connect directly.

```
Selection [] ? 5
-----
Config: MPP_IM_CT_CM_PA_SC_MP          CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                AQUADOPP Bench Test Menu
-----
                Tue Mar 11 15:39:47 2014

<1> Direct communications (19200 Baud)
<2> restore McLane parameters
<3> restore Factory parameters
<4> Report parameter settings
<5> Perform a profile test loop
<6> Set sampling rate (1 Hz)
<7> Set AquaDopp clock
<8> Read AquaDopp clock
<9> Erase sensor data

<M> return to previous Menu
```

Figure 3.2-4: AquaPro Bench Test Menu



The Profiler communicates with the Aquadopp (HR) at 9600 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 3-2-5). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****  
-Êûx-òÄ-fûx-` ,ò30x-Ê‡-ò-ûfx30òx-Ü30ò-òÄ-Ê-  
  
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]  
command finished.
```

Figure 3.2-5: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu displays the Baud Rate menu (Figure 3-2-6). Use this menu option to temporarily connect at the sensor's current baud rate. Once connected to the sensor, change to the Profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013  
  
-----  
                Pattern Profiler  
                Select new Baud rate  
-----  
                Fri Jan 11 13:48:30 2013  
  
<1> 1200  
<2> 2400  
<3> 4800  
<4> 9600  
<5> 19200  
<6> 38400  
<7> 57600  
  
<G> Go to COMM session  
      Selection [ ] ? g
```

Figure 3.2-6: Baud Rate Menu

Direct Connection to AquaPro HR

1. Type *1* to connect directly with the AquaPro.

```
Selection [M] ? 1

14:15:40 AQUADOPP Communication channels opened.
14:15:40 AQUADOPP Powered on. ....
14:15:41 AQUADOPP Sending command [ID]. .
14:15:42 AQUADOPP Identified as V3.11, AQD 9340.
14:15:42 AQUADOPP Powered off.
14:15:42 AQUADOPP Power-down delay .....
14:15:47 AQUADOPP Communication channels closed.

14:15:48 AQUADOPP Press ^C to terminate COMM session.
14:15:48 AQUADOPP Communication channels opened.
14:15:48 AQUADOPP Powered on.

*****

HR-AQUAPRO

NORTEK 2010

Version 3.11

Command mode

[^C]
```

Figure 3.2-7: Option <1> AquaPro Communications

Halt Data Logging

Option <2> from the AquaPro Bench Test Menu halts data logging, to manually return the AquaPro to command mode (the AquaPro has two modes - Command and Logging). During the “Automated Sensor Verification” the AquaPro is set to logging mode. Each time the AquaPro powers on, the mode last in continues.

This option requires the password *mclane*. This command is password protected to avoid accidentally disabling the AquaPro logging.

```
Selection [M] ? 2 Password: mclane

14:15:31 AQUADOPP Communication channels opened.
14:15:31 AQUADOPP Powered on. ....
14:15:32 AQUADOPP Sending command [ID]. .
14:15:32 AQUADOPP Identified as V3.11, AQD 9340.
14:15:32 AQUADOPP Powered off.
14:15:32 AQUADOPP Power-down delay .....
14:15:37 AQUADOPP Communication channels closed.
```

Figure 3.2-8: Option <2> Halt Data Logging

Manual AquaPro Clock Reset

Option <3> (not shown) from the Aquadopp Bench Test menu provides a way to manually reset the AquaPro clock to the Profiler real-time clock (RTC). Before each profile, the Profiler firmware automatically sets the AquaPro clock to the Profiler. This option provides a way to manually perform the clock reset for testing purposes.

Selecting <4> from the Aquadopp Bench Test Menu displays the AquaPro clock reading.

```
Selection [M] ? 4

14:16:02 AQUADOPP Communication channels opened.
14:16:03 AQUADOPP Powered on. ....
14:16:04 AQUADOPP Sending command [ID]. .
14:16:04 AQUADOPP Identified as V3.11, AQD 9340.
14:16:05 AQUADOPP Reading clock as 05/10/11 14:15:56. ← Aquadopp Clock Reading
14:16:05 AQUADOPP Powered off.
14:16:05 AQUADOPP Power-down delay .....
14:16:10 AQUADOPP Communication channels closed.
```

Figure 3.2-9: Option <4> Read Clock

Perform Profile Test Loop

Option <5> from the Aquadopp Bench Test menu performs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile.

```
Selection [M] ? 5

14:16:13 AQUADOPP Automated verification of sensor settings.
14:16:13 AQUADOPP Communication channels opened.
14:16:13 AQUADOPP Powered on. ....
14:16:15 AQUADOPP Sending command [ID]. .
14:16:15 AQUADOPP Identified as V3.11, AQD 9340.
14:16:15 AQUADOPP Sending command [SC].
14:16:15 AQUADOPP Setting clock to 05/10/11 14:16:15. .
14:16:17 AQUADOPP Reading clock as 05/10/11 14:16:16.

Erase ALL AquaDopp data? Are you sure (Yes/No) [N] ? y

14:16:21 AQUADOPP Sending command [FO]. .
14:16:24 AQUADOPP Erased data.
14:16:24 AQUADOPP Sending command [SR]. .
14:16:27 AQUADOPP Started data logging.
14:16:27 AQUADOPP Powered off.
14:16:27 AQUADOPP Power-down delay .....
14:16:32 AQUADOPP Communication channels closed.

Press ^C to exit the loop

14:16:33 AQUADOPP Preparing for profile 0.
14:16:34 AQUADOPP Identified as V3.11, AQD 9340.
14:16:39 AQUADOPP 14:16:35 11.1Vb 20.2°C 300.9H 27.1P 24.7R.
14:16:39 AQUADOPP Acquiring for 30 seconds.

14:17:16 AQUADOPP Data logging halted.
14:17:16 AQUADOPP Opening A0000000.DAT for profile 0.
14:17:16 AQUADOPP Writing 2 byte header for profile 0.
14:17:17 AQUADOPP Writing 440 byte data block for profile 0.
14:17:17 AQUADOPP Writing 448 byte trailer for profile 0.
14:17:17 AQUADOPP Closing A0000000.DAT for profile 0.
14:17:18 AQUADOPP Test profile 0 succeeded.
Press ^C to exit the loop

14:17:18 AQUADOPP Preparing for profile 1.
14:17:19 AQUADOPP Identified as V3.11, AQD 9340.
14:17:24 AQUADOPP 14:17:20 11.1Vb 20.2°C 301.0H 27.1P 24.7R.
14:17:24 AQUADOPP Acquiring for 30 seconds.

. . .
```

Figure 3.2-10: Option <5> Perform a Profile Test Loop

AquaPro Heading, Pitch and Roll

Option <6> from the main Bench Test Menu 'Nortek Aquadopp DVS Tilt & Compass' provides heading, pitch and roll output for performing a spin test.



Power of 11V or greater is required for bench testing the Aquadopp DVS tilt & compass.

```
Selection [M] ? 6

Displays Heading, Pitch & Roll outputs
for use while mounting the ACM pressure housing.

Press ^C to terminate operation.

14:14:36 AQUADOPP Communication channels opened.
14:14:36 AQUADOPP Powered on. ....
14:14:37 AQUADOPP Sending command [ID]. .
14:14:38 AQUADOPP Identified as V3.11, AQD 9340.
14:14:38 AQUADOPP Sending command [ST]. .

14:14:42 AQUADOPP 269.8 Heading, 27.2 Pitch, 24.7 Roll.
14:14:45 AQUADOPP 269.8 Heading, 27.2 Pitch, 24.7 Roll.
14:14:49 AQUADOPP 270.0 Heading, 27.2 Pitch, 24.8 Roll.
14:14:52 AQUADOPP 270.1 Heading, 27.1 Pitch, 24.7 Roll.
14:14:56 AQUADOPP 270.1 Heading, 27.1 Pitch, 24.7 Roll.
14:14:59 AQUADOPP 270.4 Heading, 27.2 Pitch, 24.7 Roll.
14:15:02 AQUADOPP 282.0 Heading, 27.1 Pitch, 24.7 Roll.
14:15:05 AQUADOPP 301.1 Heading, 27.1 Pitch, 24.7 Roll.
14:15:09 AQUADOPP 301.0 Heading, 27.2 Pitch, 24.6 Roll.
14:15:12 AQUADOPP 301.0 Heading, 27.2 Pitch, 24.7 Roll.

14:15:14 AQUADOPP Sending command [@@@@@K1W%!Q].
.....

14:15:15 AQUADOPP Sending command [MC]. .
14:15:15 AQUADOPP Powered off.
14:15:16 AQUADOPP Power-down delay .....
14:15:21 AQUADOPP Communication channels closed.
```

Figure 3.2-11: Bench Tests Menu Option <6> Aquadopp DVS Tilt & Compass

Chapter 4

Falmouth Scientific ACMPlus Sensor

The Falmouth Scientific Inc. acoustic current meter (ACMPlus) sensor is configurable to measure current velocity in 2 horizontal dimensions (2d) (north/south and east/west) and a third measurement during up/down motion (3d). The sensor has four “sting” fingers that extend at a 45° angle away from a central post. For more information, refer to the Falmouth Scientific Inc. website (www.falmouth.com) or contact Falmouth Scientific, Inc.



Figure 4-1: MMP with FSI ACMPlus

The ACMPlus fingers are labeled +X, +Y, -X, -Y for orientation. The +Y and -Y fingers align on a vertical plane and the +X and -X fingers align on a horizontal plane. Mount the sting with the -Y finger up.

Collecting Data with the FSI ACMPPlus

A sample unpacked ACMPPlus file is shown in Figure 4-2.

Sample rate: 2.0000 Hz

Profile 2

MM-DD-YYYY	HH:MM:SS	HDNG	TX	TY	HX	HY	HZ	VPAB	VPCD	VPEF	VPGH
01-11-2013	16:15:17	290.55	3.02	-3.04	0.0724	-0.2763	-0.9584	0.05	-3.58	1.54	1.88
01-11-2013	16:15:18	289.23	1.80	-0.35	0.0693	-0.2790	-0.9578	0.32	-3.80	1.49	1.97
01-11-2013	16:15:18	290.03	1.72	-0.42	0.0754	-0.2787	-0.9574	0.18	-3.49	1.80	1.90
01-11-2013	16:15:19	289.00	1.72	-0.35	0.0694	-0.2792	-0.9577	-0.09	-3.69	1.84	1.85
01-11-2013	16:15:19	289.82	1.65	-0.42	0.0764	-0.2812	-0.9566	0.32	-3.53	1.53	1.97

← Display shortened to save space

...

Path Velocities

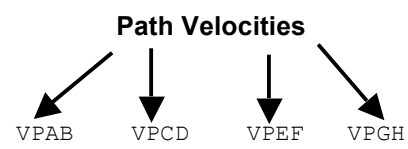


Figure 4-2: FSI ACMPPlus Data

Configuring the Firmware to Use the FSI ACMPlus Sensor

The MMP System Configuration menu specifies the active sensors. The Profiler firmware supports settings for both 2d and 3d FSI ACMPlus measurements. To enable an FSI ACMPlus, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*. Select <2> Falmouth Scientific 3d ACMPlus and then type *Y* to enable the sensor.
2. Select [*X*] to exit and save the entry.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013
-----
                Pattern Profiler
                System Configuration
-----
                Wed Nov 13 10:05:02 2013
System Parameters:
<0> Battery capacity                240 Ah
<I> Telemetry ----- ENABLED IMM @ 1200 baud
Sensor Suite:
Connector J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
Connector J5:ACM
<2> Falmouth Scientific 3d ACM+ --- ENABLED ← FSI ACMPlus
    Port J6:IMM
    <I> Telemetry
    Port J4:SSP
    <B> BioSuite Triplet/PAR
    <J> Wetlabs ECO FLBBCD
    <N> Satlantic SUNA Nitrate
    <O> Aanderaa Optode----- ENABLED
    <U> bbe FluoroProbe
    <W> Wetlabs ECO BBFL2
    <Y> Wetlabs ECO FLBB2K
    <@> Wetlabs FLNTURTD
    Port J10:SPR
    <L> Wetlabs ECO FLBB (RT)/D
    <P> Biospherical PAR
    Port J7:TRB
    <T> Seapoint IR Turbidity ----- ENABLED @ 5 samp/avg, Autogain
    Port J8:FLR
    <E> Seapoint CHL Fluorometer
    <F> Wetlabs CDOM Fluorometer
    Port J4i:SER
    <H> ProOceanus CH4
    <M> OceanServer5000 MotionPack
    Port J5i:SER
    <K> ProOceanus CO2
Exit:
<X> Save changes      <^C> Cancel changes
```

Figure 4-3: System Configuration Menu

Using Bench Test Options

The main Bench Tests and FSI ACMPPlus Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu, type 5 at the prompt to display the Bench Tests Menu.

```
Config: MPP_CT                               CF2 V5.00 of Jan 11 2013
                                           _____
                                           McLane Research Laboratories, USA
                                           Pattern Profiler
                                           S/N: ML12345-001
                                           _____
                                           Main Menu
                                           _____
                                           Tue Feb 19 07:16:21 2013
<1> Set Time                               <5> Bench Test ←
<2> Diagnostics                           <6> Deploy Profiler
<3> Flash Card Ops                        <7> Offload Deployment Data
<4> Sleep                                  <8> Contacting McLane
<C> Configure
```

Figure 4-4: Profiler Main Menu

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP           CF2 V5.00 of Jan 10 2013
                                           _____
                                           Pattern Profiler
                                           Bench Tests
                                           _____
                                           Fri Jan 11 13:40:04 2013
Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Falmouth Scientific 3d ACM+ communication
<6> Falmouth Scientific 3d ACM+ tilt & compass

System Evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<0> Battery endurance
<D> Detailed schedule
<S> Recover schedule

System Sensor & Option Tests:
<I> Seabird Inductive Modem
<L> Wetlabs ECO FLBB(RT)/D
<M> OceanServer5000 MotionPack
<O> Aanderaa Optode

Exit:
```

Figure 4-5: Profiler Bench Tests Menu



The sensor-specific Bench Tests menus are the same for the FSI 3d and 2d ACM settings. The examples shown in this section feature the ACMPlus.

2. From the main Bench Tests menu, Type *5* at the prompt to display the Falmouth Scientific 3d (or 2d) ACMPlus Bench Test Menu.
3. Type *1* to connect directly with the ACMPlus.

```
-----  
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013  
  
-----  
                Pattern Profiler  
Falmouth Scientific 3d ACM+ Bench Test Menu  
-----  
  
                Fri Jan 11 13:48:23 2013  
  
<1> Direct communications (19200 Baud) ← Direct Communication  
<2> Restore McLane parameters  
<3> Restore factory parameters  
<4> Report parameter settings  
<5> Perform a profile test loop  
<6> Set sampling rate (2 Hz)  
<7> Set ACM+ clock  
<8> Read ACM+ clock  
<9> Erase sensor data  
  
<M> return to previous Menu  
  
Selection  [] ? 1
```

Figure 4-6: ACMPlus 3d Bench Tests Menu



The Profiler communicates with the FSI ACMPlus at 19200 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 4-7). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` ,ò6x-Ê+-ò-ûfx6òx`Ü6ò-òÄ-Ê
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 4-7: Baud Rate Communication Error Examples

```
-----
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Select new Baud rate
-----
                Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600
<G> Go to COMM session
Selection  [] ? g
```

Figure 4-8: Baud Rate Menu

Direct Sensor Connection

Once connected directly with the ACMPlus, typing commands at the command prompt provides additional sensor information.

```
Selection      [] ? 1
1/11/13 13:48:34 FSI/ACM+ Press ^C to terminate COMM session.

01/11/13 13:48:34  SYSTEM Press ^B to change or confirm Baud rate.
01/11/13 13:48:35 FSI/ACM+ 19.2 kBaud communication channel opened.
01/11/13 13:48:35 FSI/ACM+ Powered on.

*****
starting...

3DACM+ Acoustic Current Meter
Falmouth Scientific Inc.
(c) 2009-2012 All Rights Reserved

FW Version v3.20

S/N : 1024
USER ID : ML12936-02D
RS232 serial connection
Memory Card Initialized
Current RTC date/time      : 2013-01-11 13:40:18
RTC TEMP = 17.50 C

Logging Ops Set
TILT is ON
COMP is ON
Fingers DOWN
O>
O>run
Running,
Fingers DOWN
Tilt function is ON Compass function is ON
Logging Ops Set

Continuous Ops Cleared
2013-01-11 13:40:43.5,  -2.59,  -45.00,  -0.1848,  0.9828,  0.0009,  -
15.21,  7.38,  -50.25,  -27.29
2013-01-11 13:40:45.0,  -2.75,  -45.00,  -0.1850,  0.9827,  0.0009,  -
14.17,   7.24,  -49.49,  -28.02
2013-01-11 13:40:46.0,  -2.35,  -45.00,  -0.1850,  0.9827,  0.0010,  -
14.78,   7.24,  -48.85,  -28.77
. . .
```

Figure 4- ← Display shortened to save space

Restore McLane and Factory Settings

Option <2> and <3> from the Falmouth Scientific 3d ACMPlus Bench Tests menu restore the McLane or FSI factory settings on the ACMPlus sensor. Using option <2> requires the password *McLane* (the first three characters *MCL* can also be typed). Using option <3> (not shown) also requires a password. Contact McLane before resetting to the factory parameters.

```
Selection  [] ? 2 Password: ***

01/11/13 14:01:20 FSI/ACM+ 19.2 kBaud communication channel opened.
01/11/13 14:01:20 FSI/ACM+ Powered on. . . . .
01/11/13 14:01:22 FSI/ACM+ Identified as V3.20, S/N 1024. . . . .
01/11/13 14:01:22 FSI/ACM+ Sending command [ECHO=ON]. .
01/11/13 14:01:22 FSI/ACM+ Sending command [USRID=ML12936-02D]. .
01/11/13 14:01:23 FSI/ACM+ Sending command [SRATE=2]. .
01/11/13 14:01:23 FSI/ACM+ Sending command [ERASE]. .
01/11/13 14:01:23 FSI/ACM+ Sending command [LOG=ON]. .
01/11/13 14:01:23 FSI/ACM+ Sending command [VBOSE=ON]. .
01/11/13 14:01:24 FSI/ACM+ Sending command [COPS=OFF]. .
01/11/13 14:01:24 FSI/ACM+ Sending command [VEL=ON]. .
01/11/13 14:01:24 FSI/ACM+ Sending command [COMP=ON]. .
01/11/13 14:01:25 FSI/ACM+ Sending command [TILT=ON]. .
01/11/13 14:01:25 FSI/ACM+ Sending command [TSTMP=ON]. .
01/11/13 14:01:25 FSI/ACM+ Sending command [HDNG=ON]. .
01/11/13 14:01:25 FSI/ACM+ Sending command [TX=ON]. .
01/11/13 14:01:26 FSI/ACM+ Sending command [TY=ON]. .
01/11/13 14:01:26 FSI/ACM+ Sending command [HX=ON]. .
01/11/13 14:01:26 FSI/ACM+ Sending command [HY=ON]. .
01/11/13 14:01:26 FSI/ACM+ Sending command [HZ=ON]. .
01/11/13 14:01:26 FSI/ACM+ Sending command [VPATH=ON]. .
01/11/13 14:01:27 FSI/ACM+ Sending command [SAVE]. .

01/11/13 14:01:27 FSI/ACM+ Powered off.

01/11/13 14:01:27 FSI/ACM+ 19.2 kBaud communication channel closed.

01/11/13 14:01:28 FSI/ACM+ Was able to restore McLane parameters.
```

Figure 4-10: <2> Restore McLane Parameters



The firmware requires the settings configured by McLane. Changing settings, or resetting to the factory settings prevents the FSI 3D ACMPlus sensor from working correctly with the profiler.

Display Current Settings

Option <4> displays the current FSI 3D ACMPlus settings.

```
Selection  [ ] ? 4

01/11/13 13:50:15 FSI/ACM+ 19.2 kBaud communication channel opened.
01/11/13 13:50:15 FSI/ACM+ Powered on. . . . .
01/11/13 13:50:17 FSI/ACM+ Identified as V3.20, S/N 1024. . . . .
01/11/13 13:50:18 FSI/ACM+ Sending command [RCFG]. . . . .

VER=3.20

Current RTC date/time      : 2013-01-11 13:41:59
RTC TEMP = 17.75 C
Current DDATE yyyy-mm-dd  : 2012-12-14
Current DTIME  hh:mm:ss   : 11:35:25
Wake time/date passed
ITIME: 00:00:00
OTIME: 00:00:00

Averaging Interval: 00:00

CRC=OFF
VEL=ON
COMP=ON
TILT=ON
NRML=ON
SRATE=2.0000Hz

id,avn,ave,avu,aspd,avdir,atlt,TSTMP,ctd,hdng,batt,vx,vy,vz,TX,TY,HX,HY,HZ,vn,ve
,vu,stemp,sv,spres,aux1,aux2,VPATH 43

LOG=ON

Address ops clear

COPS=OFF

OPEN MODE Keyboard Idle Time = 5 Minutes
O>

Press any key to continue.

01/11/13 13:50:23 FSI/ACM+ Sending command [RCAL]. . . . .
S/N=1024
VER=3.20

CDATE=26NOV12
USER ID=ML12936-02D
```

Figure 4-11: <4> Report Parameter Settings (screen 1 of 2)

```
LAT=41.6586685
LON=-70.6105270
DECL= 0.0000000
ABOF=-1.083200e+00
CDOF=-1.638578e+00
EFOF=8.051894e-01
GHOF=1.997222e+00
ABSL=1.000000e+00
CDSL=1.000000e+00
EFSL=1.000000e+00
GHSL=1.000000e+00
K1=4.960472e-01
K2=-2.982793e-01
K3=0.000000e+00
K4=0.000000e+00
K5=4.876101e-01
K6=-2.937588e-01
K7=0.000000e+00
K8=0.000000e+00
T0=0.000000e+00
SAL=0.000000e+00
DBAR=0.000000e+00
STOFF=0.000000e+00
STSLP=9.675000e-03
VELXS=0.000000e+00
ZHX=-6.988999e+02
ZHY=5.435000e+01
ZHZ=6.565000e+01
T11=1.657487e-04
T21=-5.302293e-07
T12=9.749364e-07
T22=1.528757e-04
T13=-1.218257e-06
T23=-1.148897e-06
T31=2.149869e-06
T32=5.860501e-07
T33=1.565859e-04
DEX=0.000000e+00
DEY=0.000000e+00
DEZ=0.000000e+00
O>
```

Press any key to continue.

01/11/13 13:50:29 FSI/ACM+ Powered off.

01/11/13 13:50:29 FSI/ACM+ 19.2 kBaud communication channel closed.

Figure 4.12: <4> Report Parameter Settings (screen 2 of 2)

Perform Profile Test Loop

Option <5> (not shown) runs a profile test loop. This test simulates an automated sensor verification and 5 minute profile.

Set Sampling Rate

Option <6> from the ACMPlus Bench Test Menu changes the sensor sampling rate. The default sampling rate is 2Hz.

```
Selection  [] ? 6
Enter new ACM+ sampling rate (1-10) [4] ? 3
-----
Config: MMP_CT_CM                               CF2 V5.13 of Apr 16 2014
-----
                Standard Profiler
      Falmouth Scientific 3d ACM+ Bench Test Menu
-----
                Thu Apr 17 13:58:45 2014

<1> Direct communications (19200 Baud)
<2> restore McLane parameters
<3> restore Factory parameters
<4> Report parameter settings
<5> Perform a profile test loop
<6> Set sampling rate (3 Hz) ← Sampling Rate Changed to 3Hz
<7> Set ACM+ clock
<8> Read ACM+ clock
<9> Erase sensor data
```

Figure 4-13: <6> Set Sampling Rate

Manual ACMPlus Clock Reset

Option <7> (not shown) from the ACMPlus Bench Test menu provides a way to manually reset the ACMPlus clock to the Profiler real-time clock (RTC). Before each profile, the Profiler firmware automatically sets the Aquadopp clock to the Profiler clock. This option provides a way to manually perform the clock reset for testing purposes.

Selecting <8> (not shown) from the ACMPlus Bench Test Menu displays the ACMPlus clock reading.

Erase Sensor Data

Option <9> (not shown) from the ACMPlus Bench Test Menu provides a way to manually clear the data from the ACMPlus SD storage card. At the start of each deployment, the Profiler firmware automatically commands the ACMPlus to erase the data stored internally. This option provides a manual way to clear the data from the ACMPlus internal storage for testing purposes. Selecting <M> returns to the previous menu.

Additional Sensor-Specific Test Options

From the main Bench Tests menu additional options can be selected for heading, pitch and roll output. This data can be used to perform a spin test.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Bench Tests
-----
                Fri Jan 11 13:40:04 2013
Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Falmouth Scientific 3d ACM+ communication
<6> Falmouth Scientific 3d ACM+ tilt & compass ← Additional Test Option
System Evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<0> Battery endurance
<D> Detailed schedule
<S> Recover schedule
System Sensor & Option Tests:
<I> Seabird Inductive Modem
<L> Wetlabs ECO FLBB (RT)/D
<M> OceanServer5000 MotionPack
<O> Aanderaa Optode
Exit:
<X> Main Menu
```

Figure 4-14: Main Bench Tests Menu

FSI 3D ACMPlus Tilt and Compass

Option <6> from the main Bench Tests menu provides heading, pitch and roll output.

```
Selection [] ? 6
Expecting FSI/ACM+ at 19200 baud. Change [N] ?

01/11/13 13:51:29 FSI/ACM+ 19.2 kBaud communication channel opened.
01/11/13 13:51:30 FSI/ACM+ Powered on.
*****
01/11/13 13:51:30 FSI/ACM+ Executing scripted commands. Please wait...
starting...

3DACM+ Acoustic Current Meter
Falmouth Scientific Inc.
(c) 2009-2012 All Rights Reserved
FW Version v3.20
S/N : 1024

USER ID : ML12345-02D
RS232 serial connection
Memory Card Initialized
Current RTC date/time : 2013-01-11 13:43:13
RTC TEMP = 17.75 C
Logging Ops Set
TILT is ON
COMP is ON
Fingers DOWN
O>
01/11/13 13:51:36 FSI/ACM+ ERROR! Didn't receive expected response from [
] command.
01/11/13 13:51:36 FSI/ACM+ Completed scripted commands.
01/11/13 13:51:36 FSI/ACM+ Press ^C to terminate COMM session.
01/11/13 13:51:36 SYSTEM Press ^B to change or confirm Baud rate.
    DATE        TIME        HEADING    TX        TY        HX        HY        HZ
O>
O>
O>run
Running,
Fingers DOWN
Tilt function is ON Compass function is ON
Logging Ops Set
Continuous Ops Cleared

2013-01-11 13:43:34.0,   -2.59,   -45.00,  -0.1847,   0.9828,   0.0008,  -14.36,
7.35,   -49.62,  -28.13

2013-01-11 13:43:36.5,   -2.35,   -45.00,  -0.1847,   0.9828,   0.0012,  -13.90,
7.21,   -50.85,  -29.14

. . .
[ ^C ]
*****
01/11/13 13:52:00 FSI/ACM+ Powered off.
01/11/13 13:52:00 FSI/ACM+ 19.2 kBaud communication channel closed.
```

Figure 4-15: Option <6> Falmouth Scientific 3d ACMPlus tilt & compass

Installing the ACMPlus Sting and Attaching to the Mooring Cable

The Profiler ships with the FSI ACMPlus sting secured inside the crate. Before deploying the Profiler, the ACMPlus sting must be oriented and attached to the hinged bracket extending forward of the MMP body. The hinged bracket swings out of the way when the mooring cable is inserted and allows the cable to pass beneath.

The ACM bracket aligns the ACMPlus sensor and mooring cable on the center line to properly position the MMP for taking measurements in relatively undisturbed flow. The ACMPlus fingers are labeled +X, +Y, -X, -Y for orientation. An off-center alignment introduces a left-right bias in the flow measurement because the sting is not symmetrically aligned with the flow streamlines around the body of the MMP.

Installing the ACMPlus Sting

1. Place the MMP in a sling or other supported surface on its side and remove the MMP skin.
2. Mount the sting with the -Y finger up. After the sting base plate is placed and the four bolts are finger-tightened (Figure 4-16), twist the sting and align it with the +Y and -Y fingers on a vertical plane and the +X and -X fingers on a horizontal plane.



Figure 4-16: Tighten ACM+ Sting

3. Lay the oil-filled cable through the slot in the port side of the MMP skin and along the grooves in the frame ribs and spacer posts and thread through the narrow slot in the hinged bracket. Do not force the cable immediately adjacent to the sting base plate through the slot.



The oil filled cable connecting the ACMPlus sting to the ACMPlus electronics housing is fragile. Gently maneuver this cable. Do not pull on or introduce a tight bend in the cable and avoid crimping the outer tube. Damage to the cable must be repaired by the manufacturer..

4. Release enough cable from the interior of the MMP so that the sting base plate is 15cm (6”) from the slot.
5. Squeeze the cable gently with two fingers, aligning the interior wires so that they do not cross over each other, and slide the cable through the slot.
6. Re-attach screws to secure ACMPlus sting. The hinged bracket is attached so that the sting will rest in position when the MMP is on the starboard (right) side.
7. Coil excess cable inside the Profiler and secure the cable to the hinged bracket with a plastic tie-wrap (Figure 4-17). Securing cable minimizes contact with the mooring cable running inside the bracket. The corner of the bracket has a hole to attach the tie-wrap. Reattach the MMP skin.



Figure 4-17: Secure Excess Cable

Inserting the Mooring Cable

1. Place the MMP in a sling or other supported surface on its side.
2. Using a hex driver, loosen the socket head nylon cap screws from the ACMPlus hinged bracket.



When securing and orienting the ACMPlus, place the MMP starboard (right) side down (with the McLane label visible on the drive motor). This position prevents the ACMPlus sting from pivoting down when loosening the cap screws that secure the hinged mounting bracket.

3. Lift the hinged bracket and swing the ACMPlus sting out of the way.

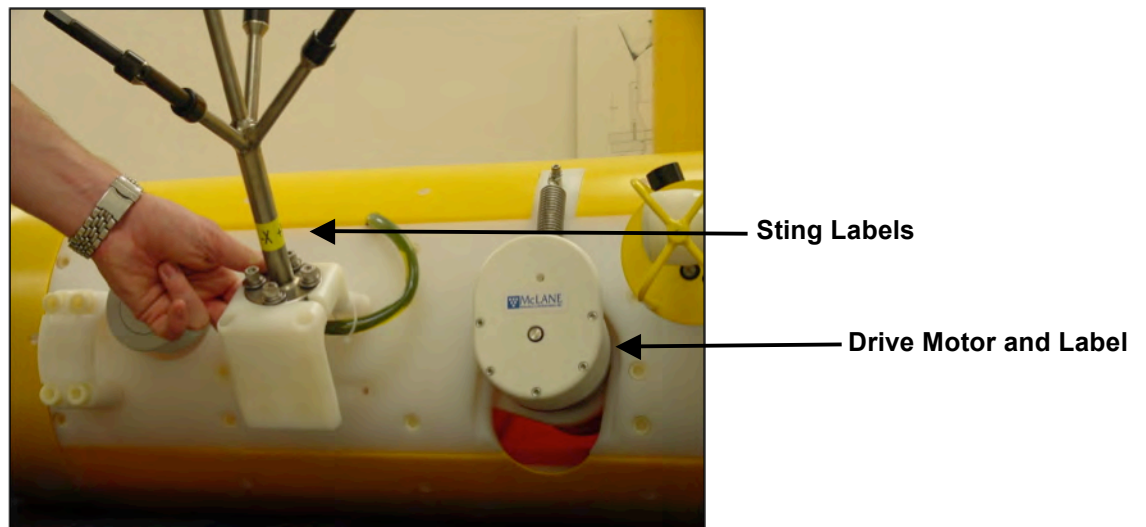


Figure 4-18: Releasing Hinged Mounting Bracket

4. Insert the mooring cable through the hinged bracket.
5. Reattach and tighten the socket head nylon cap screws to the hinged bracket.

Removing the ACMPlus Electronics Housing

If it is necessary to remove the ACMPlus electronics housing, complete the following steps:

1. Remove the port (left) side of the MMP skin
2. Move other sensors such as the CTD out of the way.
3. Unscrew the two socket head nylon cap screws securing the ACMPlus clamp to the angle brace and remove the clamp and ACMPlus housing together.
4. Loosen the four, recessed, socket head nylon cap screws to release the ACMPlus housing from the clamp.



Figure 4-19: Correct Positioning of ACMPlus Electronics Housing

Reinstalling the ACMPlus Electronics Housing

To reinstall the ACMPlus electronics housing, complete the following steps:

1. Locate the milled depression in the top face of the end cap. The depression may be hidden under a label or there may be a label with an arrow indicating its location or direction. The ACMPlus electronics housing should be mounted so that the depression points towards the front of the profiler.
2. Locate the mounting holes in the clamp to determine its orientation relative to the MMP frame.
3. Place the housing in the clamp and twist it to orient the milled depression to the front face of the clamp.
4. Tighten the clamp and reinstall the clamp/housing assembly.

Chapter 5

Nobska MAVS ACM Sensor

MMP Release v3.31 firmware and higher supports the Nobska Modular Acoustic Velocity Sensor (MAVS) Acoustic Current Meter (ACM). The MAVS is a self-logging sensor. Contact Nobska (www.nobska.net) for more information about the MAVS ACM sensor, firmware menus and communications protocol.

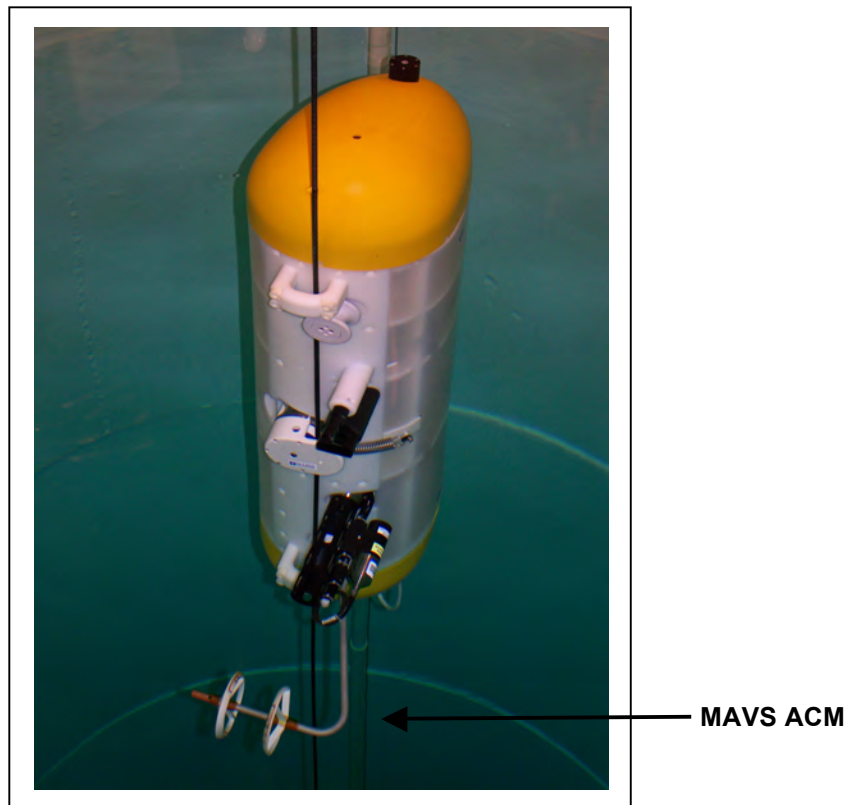


Figure 5-1: MMP with MAVS ACM

Collecting Data with the Nobska MAVS ACM

When a profile starts, the MMP communicates with the MAVS and begins MAVS ACM data collection. At the end of each profile, the MMP communicates with the MAVS again to retrieve collected ACM data.



The MAVS user documentation contains information about the MAVS communications protocol.

Profile 3									
pth0	pth1	pth2	pth3	MX	MY	MZ	P	R	
-0.6	-1.0	-0.6	0.0	-0.07	-0.20	-0.98	0.9	0.5	
-0.7	-0.6	-0.4	-0.1	-0.08	-0.18	-0.98	0.8	0.5	
-0.7	-0.5	-0.3	0.0	-0.08	-0.18	-0.98	0.8	0.4	
-0.7	-0.5	-0.3	0.1	-0.07	-0.20	-0.98	0.8	0.5	
-0.6	-0.7	-0.4	0.0	-0.07	-0.20	-0.98	0.8	0.5	
-0.7	-0.7	-0.2	0.1	-0.08	-0.20	-0.98	0.8	0.4	
-0.7	-0.7	-0.3	0.0	-0.07	-0.20	-0.98	0.8	0.5	
-0.8	-0.7	-0.4	0.2	-0.07	-0.22	-0.97	0.8	0.4	
-0.7	-0.7	-0.3	0.1	-0.07	-0.20	-0.98	0.8	0.5	
-0.7	-0.7	-0.6	0.1	-0.07	-0.20	-0.98	0.8	0.4	
-0.6	-0.7	-0.3	0.1	-0.07	-0.22	-0.97	0.8	0.5	
• • •	←	Display shortened for brevity							
-0.8	-0.7	0.1	0.1	-0.31	-0.21	-0.93	0.7	0.5	
-1.1	-0.8	-0.3	-0.4	-0.29	-0.19	-0.94	0.8	0.4	
-0.8	-0.8	-0.1	0.0	-0.31	-0.19	-0.93	0.9	0.4	
-0.5	-0.4	0.2	0.2	-0.30	-0.19	-0.93	0.7	0.5	
-1.1	-1.1	-0.4	-0.4	-0.31	-0.19	-0.93	0.8	0.5	
-1.0	-0.8	-0.3	-0.2	-0.30	-0.21	-0.93	0.8	0.5	
-0.6	-0.6	0.0	0.0	-0.31	-0.19	-0.93	0.7	0.5	
-0.9	-0.5	0.1	-0.1	-0.31	-0.19	-0.93	0.8	0.5	
Profile 3									
ACM turned on at 06/21/2013 16:01:36									
ACM turned off at 06/21/2013 16:06:48									

Figure 5-2: MAVS ACM Data



If the MAVS fails to communicate with the Profiler, the deployment continues but no data is logged for the MAVS.

Configuring the Firmware to Use the MAVS ACM

The MMP System Configuration menu specifies the active sensors. The MAVS sensor version must also be specified. Contact Nobska (www.nobska.net) with questions about your MAVS firmware version. To enable a MAVS ACM, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*. Select <2> Nobska MAVS ACM and then type *Y* to enable the sensor.
2. Select *X* to exit and save the entry.

```
Config: MMP_CT_CM                               CF2 V5.03 of May  8 2013
-----
                Standard Profiler
                System Configuration
-----
                Fri Jun 21 11:35:54 2013

System Parameters:
<0> Battery capacity                240 Ah
<D> File Deletion
<I> Inductive Telemetry

Sensor Suite:
Connector J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
Connector J5:ACM
<2> Nobska MAVS ACM ----- ENABLED mavs41p0 ← Nobska MAVS
Connector J8:FLR
<E> Seapoint CHL Fluorometer
<F> Wetlabs CDOM Fluorometer
Connector J7:TRB
<T> Seapoint IR Turbidity
Connector J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA Nitrate
<O> Aanderaa Optode
<W> Wetlabs ECO BBFL2
Connector J10:SPR
<L> Wetlabs ECO FLBB (RT)/D
<P> Biospherical PAR
Connector J4i:SER
<M> OceanServer5000 MotionPack
Exit:
<X> Save changes      <^C> Cancel changes
Selection [ ] ? 2
Enable the "Nobska MAVS ACM" [Y] ?
Select 1 = 41p0, 2 = 41p1, 3 = 41t1, 4 = 41t2 (1-4) [0] ? 1 ← MAVS Firmware ver
```

Figure 5-3: System Configuration Menu

Using Bench Test Options

The main Bench Tests and Nobska MAVS Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options the are available to installed sensors.

1. From the main Profiler Menu, type 5 at the prompt to display the Bench Tests Menu.

```
Config: MPP_CT                               CF2 V5.00 of Jan 11 2013
                                         _____
                                         McLane Research Laboratories, USA
                                         Pattern Profiler
                                         S/N: ML12345-001
                                         _____
                                         Main Menu
                                         _____
                                         Tue Feb 19 07:16:21 2013
<1> Set Time                               <5> Bench Test
<2> Diagnostics                           <6> Deploy Profiler
<3> Flash Card Ops                         <7> Offload Deployment Data
<4> Sleep                                  <8> Contacting McLane
<C> Configure
```

Figure 5-4: Profiler Main Menu

```
Config: MMP_CT_CM                           CF2 V5.03 of May 8 2013
                                         _____
                                         Standard Profiler
                                         Bench Tests
                                         _____
                                         Fri Jun 21 11:37:48 2013
Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Nobska MAVS ACM communication
<6> Nobska MAVS ACM tilt & compass
System Evaluation:
<7> Motor operation
<8> Release Brake
<9> Independent Watchdog
<0> Estimate deployment endurance
System Sensor & Option Tests:
Exit:
<X> Main Menu
```

Figure 5-5: Profiler Bench Tests Menu

2. From the main Bench Tests menu, type 5 at the prompt to display the Nobska MAVS Bench Test menu.
3. Type 1 to connect directly with the Nobska MAVS ACM.

```
-----  
Config: MMP_CT_CM                               CF2 V5.03 of May  8 2013  
  
-----  
Standard Profiler  
NDC/MAVS Bench Test Menu  
-----  
Fri Jun 21 11:42:23 2013  
  
<1> Direct communications (9600 Baud) ← Direct Communications  
<3> Retrieve configuration files  
<4> Report parameter settings  
<5> Perform a profile test loop  
  
<M> return to previous Menu  
  
Selection  [] ? 1  
  
06/21/13 11:42:26 NDC/MAVS Press ^X to terminate COMM session.  
06/21/13 11:42:26  SYSTEM Press ^B to change or confirm Baud rate.
```

Figure 5-6: Nobska MAVS Bench Tests Menu



The Profiler communicates with the MAVS ACM at 9600 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 5-7). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` , ò6x-Ê#-ò-ûfxf6òx Ü6ò-òÄ-Ê
04/23/14 12:50:37 NDC/MAVS ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 5-7: Baud Rate Communication Error Examples

```
E
-----
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013

-----
                Pattern Profiler
                Select new Baud rate
-----

                Fri Jan 11 13:48:30 2013

<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600

<G> Go to COMM session

Selection  [] ? g
```

Figure 5-8: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the MAVS, the MAVS firmware menus display (Figure 5-9). The MAVS Manual contains information about the MAVS communication protocol.



Pressing [CTRL]-[C] within 5 seconds is required to control the MAVS firmware and prevent autonomous MAVS operations from starting. Typing [CTRL]-[X] exits from the MAVS ACM Menus and returns to the MMP firmware. Typing [CTRL]-[S] from the Profiler MAVS Bench Test routines exits to the MAVS Bench Tests menu.

Retrieve Configuration Files

Option <3> (not shown) from the MAVS Bench Tests menu copies the MAVS configuration files to the Profiler that are necessary for the Profiler Unpacker.

Report Parameter Settings

Option <4> from the MAVS Bench Tests menu displays the current MAVS parameters.

```
Selection  [] ? 4

07/01/13 12:16:27  SYSTEM Verifying MAVS ...

07/01/13 12:16:28 NDC/MAVS 9.6 kBaud communication channel opened.
07/01/13 12:16:28 NDC/MAVS Powered on.
07/01/13 12:16:28 NDC/MAVS Initializing ... ..
07/01/13 12:16:41 NDC/MAVS Sending [^C] 3 times. ....
07/01/13 12:17:02 NDC/MAVS Sending command [N]. . . . .
07/01/13 12:17:02 NDC/MAVS Identified as mavs41p0, S/N 10305.
07/01/13 12:17:02 NDC/MAVS Powered off.
07/01/13 12:17:02 NDC/MAVS Power-down delay .....
07/01/13 12:17:07 NDC/MAVS 9.6 kBaud communication channel closed.
```

Figure 5-10: Nobska MAVS Direct Communications

Perform Profile Test Loop

Option <5> from the Nobska MAVS Bench Tests menu runs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile.

Additional Sensor-Specific Test Options

From the main Bench Tests menu Option <6> displays the heading, pitch and roll output. This data can be used to perform a spin test.

```
-----  
Config: MMP_CT_CM                               CF2 V5.03 of May  8 2013  
  
-----  
                Standard Profiler  
                Bench Tests  
  
-----  
                Fri Jun 21 11:37:48 2013  
  
Sensor Utilities:  
<1> Seabird 52MP CTD communication  
<2> Seabird 52MP CTD pressure  
<3> Seabird 52MP CTD average pressure  
<4> Seabird 52MP CTD temperature record  
<5> Nobska MAVS ACM communication  
<6> Nobska MAVS ACM tilt & compass ← Additional Test Option  
  
System Evaluation:  
<7> Motor operation  
<8> Release Brake  
<9> Independent Watchdog  
<0> Estimate deployment endurance  
  
System Sensor & Option Tests:  
  
Exit:  
<X> Main Menu
```

Figure 5-11: Main Bench Tests Menu

Nobska MAVS ACM Tilt and Compass

Compass/tilt options must be performed in the MAVS firmware menus as shown in Figure 5-11.

```
Selection [] ? 6  
  
Tilt & compass operations for the Nobska MAVS ACM must be  
performed through direct connection with that instrument.
```

Figure 5-12: Tilt/Compass Options must be performed in MAVS Firmware

Chapter 6

Wet Labs Optical Sensors – General Information

Wet Labs optical sensors collect a combination of optical measurements. Many sensitivity ranges can be ordered. There are many configurations available of similar units which result in different Model numbers. If you have questions about your specific model, consult the Wet Labs documentation that is included for your sensor.

Sensor Calibration

Wet Labs includes Calibration sheets with each sensor. Refer to the sensor-specific calibration information for guidelines.

This chapter explains integration with Wet Labs sensors as follows:

Chapter Contents	
Section 6.1	Wet Labs BBFL2
Section 6.2	Wet Labs FLBB(RT/D) or FLBBCD
Section 6.3	Wet Labs C-Star



The Wet Labs ECO series sensors (for example, BBFL2, FLBB(RT/D), FLBBCD) have a similar configuration and interface screens. Consult your Wet Labs documentation for unit-specific parameters.

Configuring the Firmware to Use the Wet Labs Optical Sensors

The Profiler System Configuration menu specifies the active sensors. To enable a Wet Labs Optical sensor, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select an option to enable a Wetlabs sensor and then type *Y* to enable the sensor.

```
Config: MPP_CT_FL_OP                               CF2 V5.24 of Oct 21 2015

-----
                Pattern Profiler
                System Configuration
-----
                Thu Oct 22 09:33:36 2015

System Parameters:
<0> Battery capacity                240 Ah

Sensor Suite:
  Port J9:CTD
  <1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
  <2> No ACM selected
  Port J6:IMM
  <I> Telemetry
  Port J4:SSP
  <B> BioSuite Triplet/PAR
  <J> Wetlabs ECO FLBBCD ----- ENABLED
  <N> Satlantic SUNA Nitrate
  <O> Aanderaa Optode
  <U> bbe FluoroProbe
  <W> Wetlabs ECO BBFL2
  <Y> Wetlabs ECO FLBB2K
  <@> Wetlabs FLNTURTD
  Port J10:SPR
  <L> Wetlabs ECO FLBB(RT)/D
  <P> Biospherical PAR
  <$> WetLabs CST Transmissometer --- ENABLED @ 36 avg, ~0.99 Hz
  Port J7:TRB
  <T> Seapoint IR Turbidity
  Port J8:FLR
  <E> Seapoint CHL Fluorometer
  <F> Wetlabs CDOM Fluorometer
  Port J4i:SER
  <H> ProOceanus CH4
  <M> OceanServer5000 MotionPack
  Port J5i:SER
  <K> ProOceanus CO2
  <#> Aanderaa Optode ----- ENABLED

Exit:
  <X> Save changes      <^C> Cancel changes
Selection [ ] ? x
```

Figure 6-1: System Configuration Menu

Using Bench Test Options

The main Bench Tests and Wet Labs Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler menu type 5 at the prompt to display Bench Tests Menu.

```
Config: MPP_CT                               CF2 V5.00 of Jan 11 2013
                                           _____
                                           McLane Research Laboratories, USA
                                           Pattern Profiler
                                           S/N: ML12345-001
                                           _____
                                           Main Menu
                                           _____
                                           Tue Feb 19 07:16:21 2013
<1> Set Time                               <5> Bench Test ←
<2> Diagnostics                            <6> Deploy Profiler
<3> Flash Card Ops                         <7> Offload Deployment Data
<4> Sleep                                  <8> Contacting McLane
<C> Configure
```

Figure 6-2: Profiler Main Menu

```
Configuration: MMP_IM_CT_CM_PA_SC          CF2 V5_00 of Nov 27 2012
                                           _____
                                           Bench Tests
                                           _____
                                           Wed Nov 28 14:49:11 2012
Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass
System Evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<0> Estimate deployment endurance
Sensor & Option Tests:
<I> Seabird Inductive Modem
<M> OceanServer5000 MotionPack
<P> Biospherical PAR
<W> Wetlabs ECO BBFL2
Exit:
<X> Main Menu
Selection ? w
```

Figure 6-3: Profiler Bench Tests Menu



The sensor-specific Bench Tests menus are the same for the Wetlabs Optical sensors unless noted.

2. From the Bench Tests menu, type an option at the prompt to display the Wet Labs Bench Test menu (Figure 6-4).
3. Type *1* to connect directly with the Wet Labs Optical Sensor.

```
Config: MPP_IM_CT_CM_PA_SC_MP          CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                WL/BBFL2 Bench Test Menu
-----
                Tue Mar 11 15:43:56 2014

<1> Direct communications (19200 Baud)
<2> Perform a profile test loop

<M> return to previous Menu

Selection [] ? 1

03/11/14 15:43:58 WL/BBFL2   Enter "!!!!!" (w/o quotes) to get sensor's
attention.

03/11/14 15:43:59 WL/BBFL2   Press ^C to terminate COMM session.
03/11/14 15:43:59  SYSTEM    Press ^B to change or confirm Baud rate.
```

Figure 6-4: Wet Labs BBFL2 Bench Test Menu

```
Config: MPP_CT_FL_OP          CF2 V5.24 of Oct 16 2015
-----
                Pattern Profiler
                WetLabs CST Transmissometer Bench Test Menu
-----
                Tue Oct 20 10:42:25 2015

<1> Direct communications (19200 Baud) ← Direct Communications
<2> Perform a profile test loop
<3> Set number of samples averaged (36 avg, ~0.99 Hz)
<4> Offload C-Star data files

<M> return to previous Menu

Selection [] ?
```

Figure 6-5: Wet Labs C-Star Bench Test Menu



The Profiler communicates with the Wet Labs Sensors at 19200 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 6-6). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` ,ò5x-Ê+-ò-ûfx5òxÜ5ò-òÄ-Ê
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 6-6: Baud Rate Communication Error Examples

```
Expecting WL/BBFL2 + at 19200 baud. Change [N] ? y
-----
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Select new Baud rate
-----
                Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600
<G> Go to COMM session
Selection [] ? g
```

Figure 6-7: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the Wet Labs Optical sensor, typing commands at the command prompt provides additional sensor information. Figure 6-8 shows direct communication with the BBFL2 model. Figure 6-9 shows direct communication with the FLBB(RT)/D which works the same as the FLBBCD model.

```
Selection [] ? 1

03/11/14 15:43:58 WL/BBFL2   Enter "!!!!!" (w/o quotes) to get sensor's
attention.

03/11/14 15:43:59 WL/BBFL2   Press ^C to terminate COMM session.
03/11/14 15:43:59  SYSTEM    Press ^B to change or confirm Baud rate.

03/11/14 15:44:00 WL/BBFL2   19.2 kBaud communication channel opened.
03/11/14 15:44:00 WL/BBFL2   Powered on.

*****

03/11/14      12:43:27      700   4130   695   1904   460   4130   541
03/11/14      12:43:29      700   4130   695   1904   460   4130   540
03/11/14      12:43:30      700   4130   695   1905   460   4130   540
03/11/14      12:43:31      700   4130   695   1904   460   4130   539
03/11/14      12:43:32      700   4130   695   1905   460   4130   540

. . . ← Display shortened for brevity

03/11/14      12:43:41      700    58    695    55    460    49    538
03/11/14      12:43:42      700    61    695    55    460    65    538

03/11/14      12:43:43      700    59    695    54    460    57    538
[^C]

*****

03/11/14 15:44:19 WL/BBFL2   Powered off.
03/11/14 15:44:19 WL/BBFL2   19.2 kBaud communication channel closed.
```

Figure 6-8: <1> BBFL2 Direct Communications

In the FLBB(RT)/D example shown next, the third and fifth columns display the wavelength settings on the specific sensor model (refer to the Wet Labs manual for more information). Time and Date columns display '9s' as these columns are only placeholders. The last column displays the Temperature if this option is enabled on the sensor. Otherwise, the last column displays placeholder data (Figure 6-9).

```

Selection [M] ? 1

09:48:53 WL/FLBB Enter "!!!!!" (w/o quotes) to get sensor's attention.

Expecting WL/FLBB at 19200 baud. Change (Yes/No) [N] ?

09:48:55 WL/FLBB Press ^C to terminate COMM session.
09:48:56 WL/FLBB Communication channels opened.
09:48:56 WL/FLBB Powered on.

*****Fluorescence*****Turb wave-*****
*****wave-length*****CHL length*****NTU*****Temp (if option is installed)*****
          ↓           ↓           ↓           ↓           ↓
99/99/99    99:99:99    695    56    700    78    547
99/99/99    99:99:99    695    56    700    79    547
99/99/99    99:99:99    695    55    700    78    546
99/99/99    99:99:99    695    56    700    78    546
99/99/99    99:99:99    695    55    700    77    546
99/99/99    99:99:99    695    54    700    77    546
99/99/99    99:99:99    695    54    700    78    546
99/99/99    99:99:99    695    55    700    85    546
99/99/99    99:99:99    695    55    700    80    546
99/99/99    99:99:99    695    54    700    690    546
99/99/99    99:99:99    695    2248    700    4130    545
99/99/99    99:99:99    695    2570    700    4130    545
99/99/99    99:99:99    695    4109    700    4130    545
99/99/99    99:99:99    695    4130    700    4130    545
. . .

99/99/99    99:99:99    695    53    700    76    532
99/99/99    99:99:99    695    55    700    75    532
99/99/99    99:99:99    695    54    700    75    532
99/99/99    99:99:99    695    53    700    77    532

!!
Ser FLBBRTD-2350
Ver FLNTU 4.08
Ave 30
Pkt 900

!!
$mnu

!!!!
$mnu
[^C]
*****
10:05:00 WL/FLBB Powered off.
10:05:00 WL/FLBB Communication channels closed.

```

Figure 6-9: Direct Communication with the FLBB(RT)/D

Perform Profile Test Loop

Option <2> performs a profile test loop as shown in Figure 6-10. The test simulates an automated sensor verification and a 5 minute profile.

```
Selection ? 2

Scat Chlr CDOM

11/28/12 14:49:24 WL/BBFL2 4130 1950 4130.
11/28/12 14:49:24 SYSTEM Suspending until 11/28/12 14:49:35 ... Awake

11/28/12 14:49:40 WL/BBFL2 4130 1956 4130.
11/28/12 14:49:40 SYSTEM Suspending until 11/28/12 14:49:50 ... Awake

11/28/12 14:49:54 WL/BBFL2 4130 1956 4130.
11/28/12 14:49:54 SYSTEM Suspending until 11/28/12 14:50:05 ... Awake

11/28/12 14:50:09 WL/BBFL2 4130 1951 4130.
11/28/12 14:50:09 SYSTEM Suspending until 11/28/12 14:50:20 ... Awake
```

Figure 6-10: Option <2> Perform Profile Test Loop

Installing the Optical Wet Labs Sensors in the Mounting Space

Both the FLBB(RT)/D, FLBBCD and BBFL2 models are installed and removed using the same procedure. The Wet Labs FLBB(RT)/D and FLBBCD sensors are supported on the Profiler by a custom bracket that must be correctly positioned and tightened.

To install the Wet Labs BBFL2, complete the steps in section 6.1. To install the Wet Labs FLBB(RT)/D or FLBBCD, complete the steps in section 6.2. To install the Wet Labs C-Star, complete the steps in Section 6.3.



Figure 6-11: BBFL2 Model- Installed

Notes

Section 6.1

Wet Labs BBFL2 Sensor

MMP firmware release version 4.13 and higher supports the Wetlabs BBFL2 Optical sensor. The BBFL2 collects a combination of Scatter, Chlorophyll Fluorometer counts and CDOM Fluorometer counts. For additional information about the Wet Labs BBFL2 sensor, refer to the Wet Labs web site (www.wetlabs.com) or contact Wet Labs.

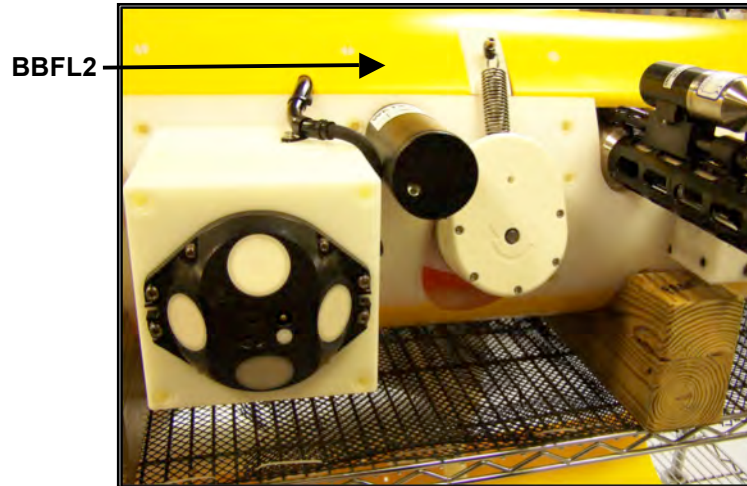


Figure 6.1-1: MMP with BBFL2 Installed – Side View

Collecting Data with the BBFL2

A sample unpacked Engineering file with BBFL2 data is shown below.

```
Profile 2

Sensors were turned on at 12/07/2012 16:30:02
Vehicle began profiling at 12/07/2012 16:32:02
```

Date,	[mA],	[V],	[dbar],	Par[mV],	scatSig,	chlSig,	CDOMSig
12/07/2012 16:32:02	-30,	12.1,	0.800,	10.80,	70,	53,	99
12/07/2012 16:32:08	-29,	12.1,	0.800,	12.80,	70,	52,	101
12/07/2012 16:32:14	-30,	12.1,	0.800,	13.80,	71,	53,	100
12/07/2012 16:32:19	-30,	12.1,	0.790,	14.00,	69,	55,	100
12/07/2012 16:32:25	-30,	12.1,	0.800,	17.40,	71,	54,	99
12/07/2012 16:32:31	-30,	12.1,	0.800,	11.40,	70,	53,	101

```
Ramp exit: SMOOTH RUNNING
Profile exit: STATIONARY EXPIRED

Vehicle motion stopped at 12/07/2012 16:33:07
Sensor logging stopped at 12/07/2012 16:35:15
```

Figure 6.1-2: ENG File with BBFL2 Data

Section 6.2

Wet Labs FLBB(RT)/D or FLBB CD Sensor

MMP firmware release version 4.30 and higher supports the Wet Labs FLNTRD/FLBB(RT)/D sensors, optical combination sensors that record fluorometer, turbidity and (if installed) temperature measurements. Firmware Release 5.19 and higher supports the FLBB CD, an optical sensor that records chlorophyll, backscatter and fluorescence in a single data stream.

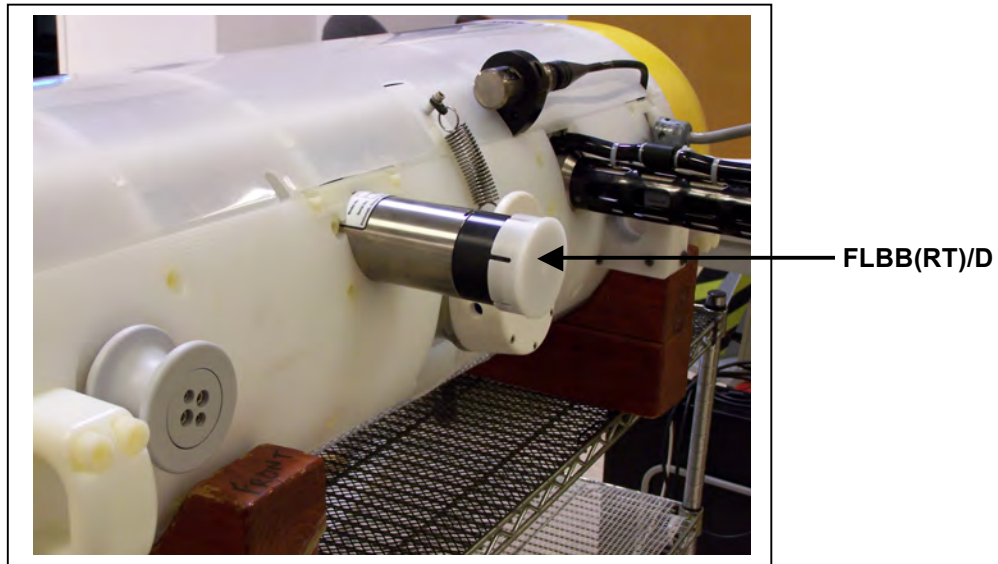


Figure 6.2-1: MMP with FLBB(RT)/D Installed

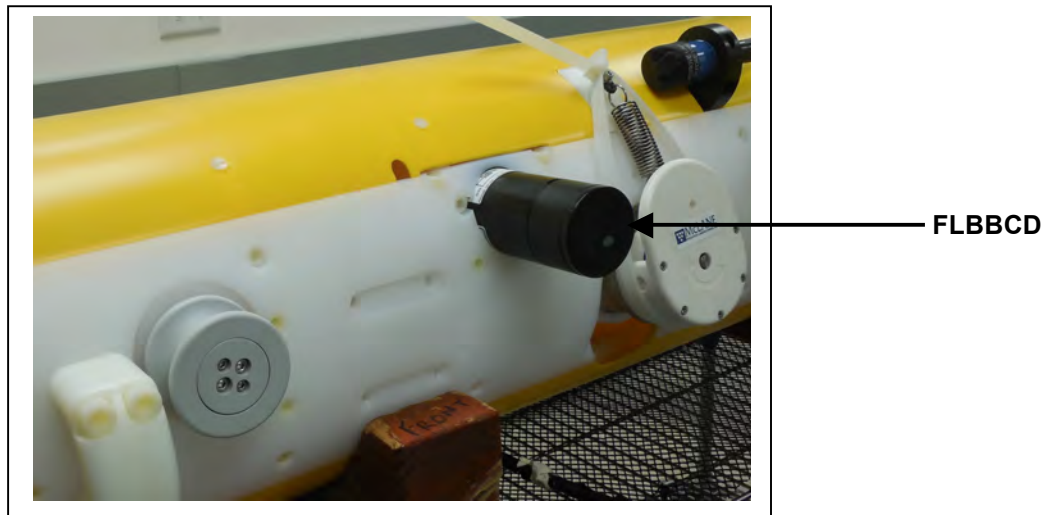


Figure 6.2-2: MMP with FLBB CD Installed

Collecting Data with the FLBB(RT)/D

A sample unpacked Engineering file is shown in Figure 6.2-3. The temperature data displays in thermistors. When the optional FLBB(RT)/D temperature is not installed, the temperature data is not used.

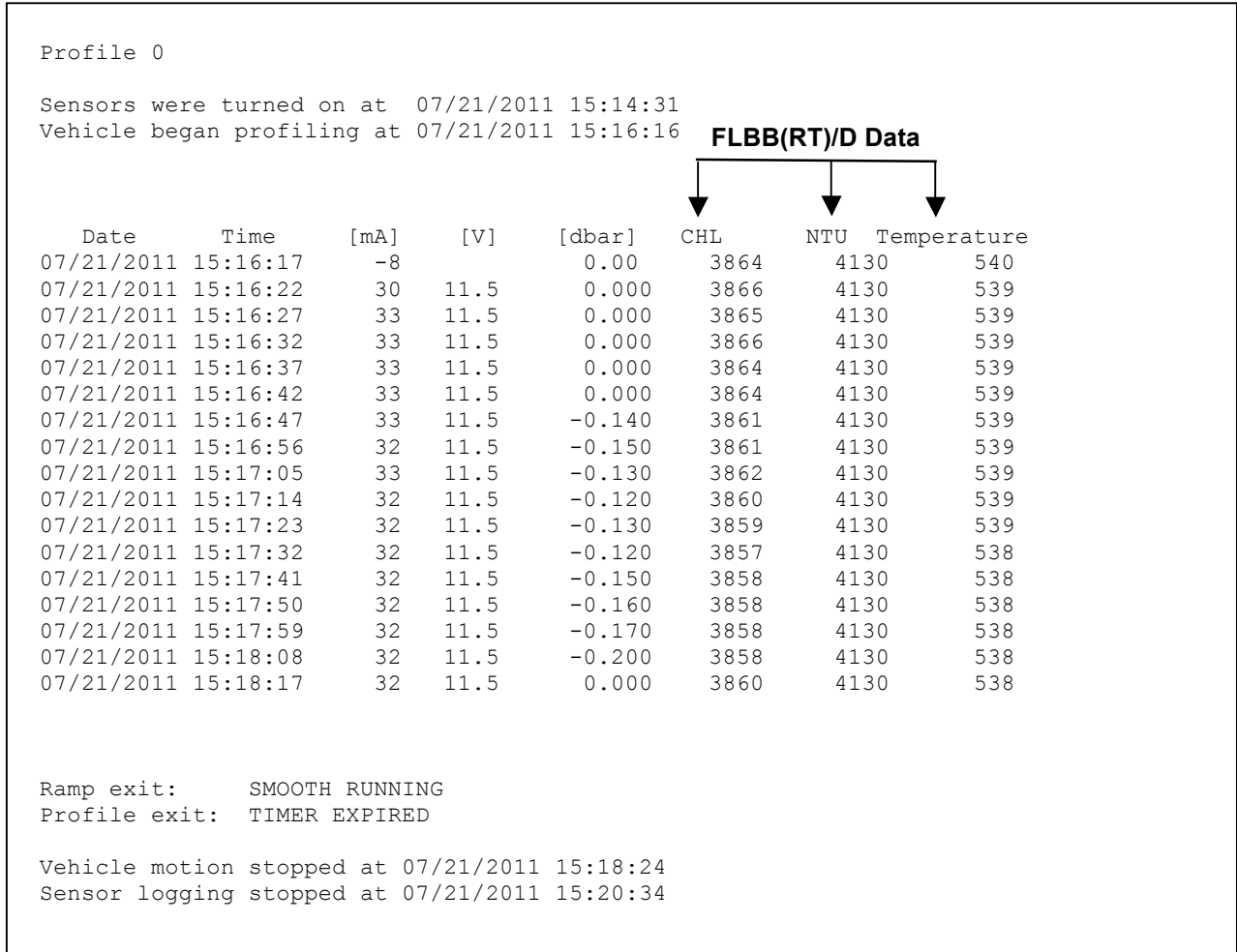


Figure 6.2-3: Engineering File, FLBB(RT)/D Fluorometer, Turbidity and Temperature Data

Collecting Data with the FLBBCD

A sample unpacked Engineering file with FLBBCD data is shown in Figure 6.2-4.

Profile 2							FLBBCD Data		
Sensors were turned on at 10/22/2015 11:00:02									
Vehicle began profiling at 10/22/2015 11:02:01									
Date	[mA]	[V]	dbar]	Oxygen[uM]	Optode	Temp[C]	Chl	bb	CDOM
10/22/2015 11:02:01	0	11.1	0.000	0.00	0.00	0.00	54	101	84
10/22/2015 11:02:05	90	11.0	0.000	0.00	0.00	0.00	55	106	85
10/22/2015 11:02:09	136	11.0	0.000	0.00	0.00	0.00	57	105	87
10/22/2015 11:02:12	186	10.9	0.000	0.00	0.00	0.00	53	98	83
10/22/2015 11:02:16	187	10.9	0.000	0.00	0.00	0.00	52	97	81
10/22/2015 11:02:19	181	10.9	0.000	0.00	0.00	0.00	53	97	87
10/22/2015 11:02:23	176	10.9	0.000	0.00	0.00	0.00	51	94	84
10/22/2015 11:02:26	176	10.9	0.000	0.00	0.00	0.00	50	94	83
10/22/2015 11:02:30	182	10.9	0.000	0.00	0.00	0.00	52	93	84
10/22/2015 11:02:40	181	10.9	3.430	164.90	18.07		50	84	89
10/22/2015 11:02:48	165	10.9	4.270	164.98	18.06		51	84	88
10/22/2015 11:02:56	165	10.9	5.120	164.85	18.06		54	82	86
10/22/2015 11:03:04	151	10.9	5.960	164.86	18.06		53	80	84
10/22/2015 11:03:12	155	10.9	6.800	164.61	18.05		53	84	85
10/22/2015 11:03:20	158	10.9	7.640	164.61	18.05		53	79	85
10/22/2015 11:03:28	153	10.9	8.490	164.58	18.05		51	80	86
10/22/2015 11:03:36	147	10.9	9.320	164.49	18.04		52	82	85
10/22/2015 11:03:44	149	10.9	10.170	164.49	18.04		51	82	86
Ramp exit: SMOOTH RUNNING									
Profile exit: BOTTOM PRESSURE									
Vehicle motion stopped at 10/22/2015 11:03:45									
Sensor logging stopped at 10/22/2015 11:05:52									

Figure 6.2-4: Engineering File, FLBBCD Chlorophyll, Backscatter and Fluorescence Data

Installing the FLBB(RT)/D or FLBBCD in the Mounting Space

To install the Wet Labs FLBB(RT)/D or FLBBCD sensor, complete the following steps.

1. With the MMP skin removed, connect the sensor cable and place the Wet Labs sensor in the mounting space.



Figure 6.2-5: Connecting the Sensor Cable



Figure 6.2-6: Placing the Sensor in the Mount

2. Place the white plastic mounting support over the Wet Labs sensor.
3. Using a hex driver, secure the two plastic screws.
4. Replace the MMP skin.



Figure 6.2-7: Placing the Mounting Support

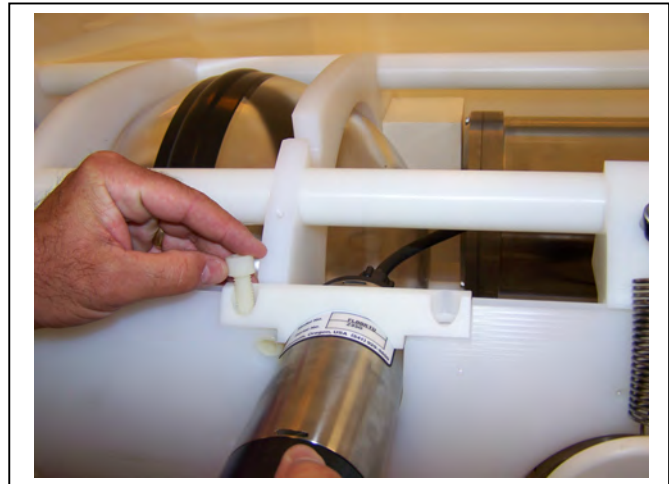


Figure 6.2-8: Securing the Mounting Support

Section 6.3

Wet Labs C-Star Sensor

MMP firmware release version 5.24 and higher supports the Wet Labs C-Star sensor, a transmissometer available in multiple wavelengths that records light beam transmittance. The Wet Labs documentation provided with the C-Star includes a calibration sheet. Refer to this sheet for information specific to your C-Star.

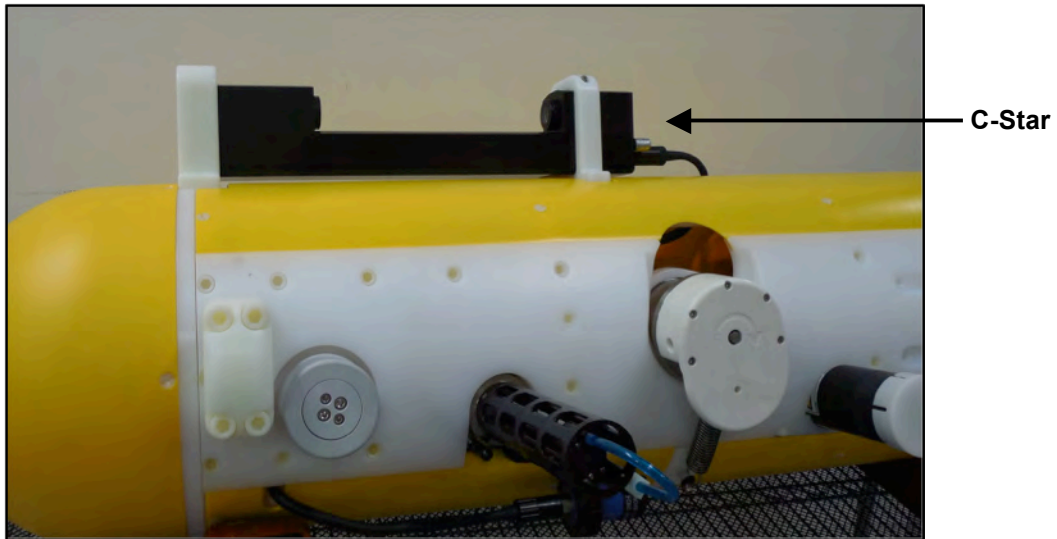


Figure 6.3-1: MMP with C-Star Installed

During system initialization, the firmware makes three attempts to confirm that the C-Star is connected. If the third attempt to confirm connection fails, the deployment continues without logging C-Star files.

C-Star Configuration and Samples Per Average

The Profiler System Configuration menu specifies the active sensors. The C-Star samples per average can also be changed on this screen. Valid entries are between 30 – 150 (the default is 36). The data collection speed (in Hz) changes based on samples per average. If the C-Star is already enabled, Samples per Average can be changed by typing \$ and typing *N* at the prompt to disable the C-Star. The next prompt allows entry of samples per average.

```
Config: MPP_CT_FL_OP                               CF2 V5.24 of Oct 21 2015

-----
                Pattern Profiler
                System Configuration
-----
                Thu Oct 22 09:33:36 2015

System Parameters:
<0> Battery capacity                240 Ah

Sensor Suite:
  Port J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
<2> No ACM selected
  Port J6:IMM
<I> Telemetry
  Port J4:SSP
<B> BioSuite Triplet/PAR
<J> Wetlabs ECO FLBBCD ----- ENABLED
<N> Satlantic SUNA Nitrate
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2
<Y> Wetlabs ECO FLBB2K
<@> Wetlabs FLNTURTD
  Port J10:SPR
<L> Wetlabs ECO FLBB (RT)/D
<P> Biospherical PAR
<$> WetLabs CST Transmissometer --- ENABLED @ 36 avg, ~0.99 Hz ←
  Port J7:TRB
<T> Seapoint IR Turbidity
  Port J8:FLR
<E> Seapoint CHL Fluorometer
<F> Wetlabs CDOM Fluorometer
  Port J4i:SER
<H> ProOceanus CH4
<M> OceanServer5000 MotionPack
  Port J5i:SER
<K> ProOceanus CO2
<#> Aanderaa Optode ----- ENABLED

Exit:
<X> Save changes      <^C> Cancel changes
Selection [] ? x
```

Figure 6.3-2: Configure C-Star - Sample Averaging

C-Star Data Details

C-Star data is logged in a 'T' file for each profile. During sensor warm-up and motor ramp, data is collected and averaged at the sampling rate defined on the Configuration menu. The sensor powers off during sensor warm down.

```
Profile 3

  s/n  ref  sig  raw      beam  therm
1739 11161 13095 14109    0.353  532
1739 11148 13081 14108    0.353  532
1739 11140 13071 14108    0.353  532
1739 11133 13065 14108    0.353  532
1739 11129 13059 14107    0.353  531
1739 11125 13055 14107    0.353  531
1739 11122 13051 14107    0.353  531
1739 11120 13048 14105    0.354  531
1739 11117 13046 14107    0.353  531
1739 11115 13044 14108    0.353  531
1739 11114 13041 14105    0.354  531
1739 11112 13039 14106    0.353  531
1739 11111 13038 14105    0.354  531
1739 11110 13037 14106    0.353  531
. . . .
1739 11079 13010 14112    0.352  529
1739 11079 13010 14112    0.352  529
1739 11079 13010 14112    0.352  529
1739 11079 13010 14112    0.352  529
1739 11079 13010 14112    0.352  529
1739 11079 13010 14112    0.352  529
1739 11079 13010 14112    0.352  529

Profile 3

C-STAR turned on at 10/16/2015 12:41:29
C-STAR turned off at 10/16/2015 12:53:55

744 samples at ~1.00 Hz
```

← Display shortened to save space

Figure 6.3-3: 'T' File C-Star Data

Using C-Star Bench Test Options

The main Bench Tests and Wet Labs Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors. Type \$ to display the Wet Labs C-Star Bench Tests menu.

```
Config: MPP_CT_FL_OP                               CF2 V5.24 of Oct 16 2015
-----
                Pattern Profiler
                Bench Tests
-----
                Tue Oct 20 10:42:20 2015

CTD utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record

System evaluation:
<7> Motor operation
<8> Release Brake
<9> Independent Watchdog
<D> Detailed schedule
<S> Recover schedule

Sensor & Option tests:
<J> Wetlabs ECO FLBCD
<#> Aanderaa Optode
<$> WetLabs CST Transmissometer

Exit:

<X> Main Menu

Selection [] ? $
```

Figure 6.3-4: Profiler Bench Tests Menu

```
Config: MPP_CT_FL_OP                               CF2 V5.24 of Oct 16 2015
-----
                Pattern Profiler
                WetLabs CST Transmissometer Bench Test Menu
-----
                Tue Oct 20 10:42:25 2015

<1> Direct communications (19200 Baud)
<2> Perform a profile test loop
<3> Set number of samples averaged (36 avg, ~0.99 Hz)
<4> Offload C-Star data files

<M> return to previous Menu

Selection [] ?
```

Figure 6.3-5: Wet Labs C-Star Bench Tests Menu

Direct Sensor Connection

Typing *I* from the WetLabs CST Transmissometer Bench Test Menu connects directly with the C-Star sensor. The Profiler communicates with the Wet Labs Sensors at 19200 baud. Once direct connection is established, typing commands at the command prompt provides additional sensor information. Figure 6.3-6 shows direct communication with the C-Star.

```
Selection [] ? 1

10/20/15 10:41:53 WL/FLBCD   Enter "!!!!!" (w/o quotes) to get sensor's
attention.

10/20/15 10:41:53 WL/FLBCD   Press ^C to terminate COMM session.

10/20/15 10:41:53   SYSTEM   Press ^B to change or confirm Baud rate.

10/20/15 10:41:54 WL/FLBCD   19.2 kBaud communication channel opened.

10/20/15 10:41:54 WL/FLBCD   Powered on.

*****

!21!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Ser FLBBCD2K-4069
Ver TripletD 4.07
Ave 19
Pkt 0

!!!!!!!!!! [^C]

*****

10/20/15 10:41:59 WL/FLBCD   Powered off.

10/20/15 10:41:59 WL/FLBCD   19.2 kBaud communication channel closed.

10/09/15 12:40:20 WL/Cstar   Powered off.
10/09/15 12:40:20 WL/Cstar   19.2 kBaud communication channel closed.
```

Figure 6.3-6: <I> C-Star Direct Communications

Perform Profile Test Loop

Option 2 performs a profile test loop as shown in Figure 6.3-7. The test simulates an automated sensor verification and a 5 minute profile.

```
Selection [] ? 2
Enter profile duration in minutes (1-60) [5] ? 1
Enter stop-check interval in seconds (2-60) [15] ? 2
10/20/15 10:42:36 WL/Cstar Automated verification of sensor settings.
10/20/15 10:42:36 WL/Cstar 19.2 kBaud communication channel opened.
10/20/15 10:42:37 WL/Cstar Powered on. ..
10/20/15 10:42:38 WL/Cstar Sending command [!!!!]. ... .
10/20/15 10:42:39 WL/Cstar Powered off.
10/20/15 10:42:39 WL/Cstar Power-down delay .....
10/20/15 10:42:44 WL/Cstar 19.2 kBaud communication channel closed.
Press ^C to exit the loop.
10/20/15 10:42:44 WL/Cstar Preparing for profile 0.
10/20/15 10:42:45 WL/Cstar Initializing logging ...
10/20/15 10:42:45 WL/Cstar 19.2 kBaud communication channel opened.
10/20/15 10:42:45 WL/Cstar Powered on. ..
10/20/15 10:42:47 WL/Cstar Opening 00000\T0000000.DAT for profile 0.
10/20/15 10:42:48 WL/Cstar Writing 2 byte header for profile 0.
10/20/15 10:42:48 WL/Cstar Logging initialized.
10/20/15 10:42:48 WL/Cstar Acquiring for 1 minute, with a 2 second StopCheck interval.
10/20/15 10:42:51 WL/Cstar 1739 s/n, 11127 ref, 13188 sig, 14249 raw, 0.313 beam, 537 therm.
10/20/15 10:42:53 WL/Cstar 1739 s/n, 11117 ref, 13176 sig, 14248 raw, 0.313 beam, 537 therm.
[^C]
10/20/15 10:42:53 WL/Cstar Halting profile 0.
10/20/15 10:42:53 WL/Cstar Halting logging ...
10/20/15 10:42:53 WL/Cstar Logging halted.
10/20/15 10:42:54 WL/Cstar Dumping data to disk for profile 0.
10/20/15 10:42:54 WL/Cstar Writing 22 byte trailer for profile 0.
10/20/15 10:42:54 WL/Cstar Closing 00000\T0000000.DAT for profile 0.
10/20/15 10:42:54 WL/Cstar Powered off.
10/20/15 10:42:54 WL/Cstar 19.2 kBaud communication channel closed.
10/20/15 10:42:54 WL/Cstar Test profile 0 succeeded. 6 samples
```

Figure 6.3-7: <2> C-Star Profile Test Loop

Set Samples Averaged

Option <3> changes the number of samples to average. Use this option to see how different sampling rates affect the processing speed (in Hz) of C-Star data collection. Type 3 and the password *set* to change the number of samples to average.

```
-----  
Config: MPP_CT_FL_OP                               CF2 V5.24 of Oct 30 2015  
-----  
                Pattern Profiler  
            WetLabs CST Transmissometer Bench Test Menu  
-----  
                Fri Nov  6 17:20:35 2015  
  
<1> Direct communications (19200 Baud)  
<2> Perform a profile test loop  
<3> Set number of samples averaged (36 avg, ~0.99 Hz)  
<4> Offload C-Star data files  
  
<M> return to previous Menu  
  
Selection [ ] ? 3 Password: ***  
  
11/06/15 17:20:41 WL/Cstar 19.2 kBaud communication channel opened.  
11/06/15 17:20:41 WL/Cstar Powered on. ..  
Enter Cstar samples to average (30-150) [36] ? 30  
  
11/06/15 17:20:45 WL/Cstar Sending command [!!!!]. .....  
11/06/15 17:20:46 WL/Cstar Sending command [$ave 30]. ...  
11/06/15 17:20:46 WL/Cstar Sending command [$sto]. .  
11/06/15 17:20:47 WL/Cstar Powered off.  
11/06/15 17:20:47 WL/Cstar Power-down delay .....  
11/06/15 17:20:52 WL/Cstar 19.2 kBaud communication channel closed.
```

Figure 6.3-8: <3> Set Number of Samples Averaged

Offload C-Star Data Files

Option <4> from the WetLabs CST Transmissometer Bench Test Menu offloads the C-Star data files.

```
Selection [] ? 4

11/06/15 17:20:55  SYSTEM Reading PROFILES.DAT ... done.

Enter the first profile to offload (0-141) [0] ? 140
Enter the last profile to offload (140-141) [141] ? 140

*****

Profile 140
C-Star serial #1739
Averaged samples 30

  ref   sig   raw   beam therm
11288   0     0  99.999  542
11275   0     0  99.999  542
11267   0     0  99.999  542
11260   0     0  99.999  542
11255   0     0  99.999  541
11251   0     0  99.999  541
11248   0     0  99.999  541
11245   0     0  99.999  541
11242   0     0  99.999  541
11240   0     0  99.999  541
11238   0     0  99.999  541
. . .
11176   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535
11175   0     0  99.999  535

Profile 140

C-Star turned on at 11/06/2015 17:05:44
C-Star turned off at 11/06/2015 17:18:31
920 samples at ~1.20 Hz

*****

Press any key to continue.
```

Figure 6.3-9: <4> Offload C-Star Data Files

Installing the C-Star in the Mounting Space

The MMP skin has mounting inserts for the top and bottom clamps that hold the C-Star. To attach the C-Star and mounting clamps, complete the following steps.

1. Place the MMP skin with the C-Star cable facing up.
2. Place the plastic bottom clamp in the MMP skin insert.



Figure 6.3-10: Installing Bottom Clamp

3. Using a 5/16" hex driver (provided in the toolkit), tighten the two nylon screws on each side of the bottom clamp.
4. Gently insert the C-Star in the plastic mounting clamp.



Figure 6.3-11: Tightening Nylon Screws



Figure 6.3-12: Inserting the C-Star

5. Insert nylon screws on both sides of the top clamp and tighten the clamp to the MMP body with a 5/16" hex driver (included in the toolkit).



Figure 6.3-13: Securing Top Clamp

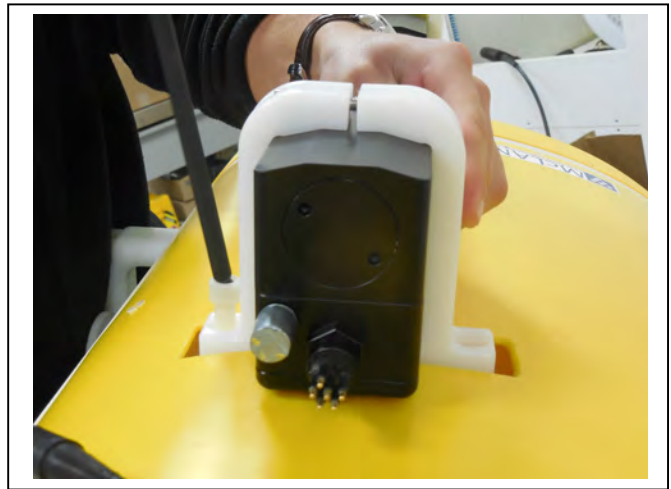


Figure 6.3-14: Tighten Top Clamp Nylon Screws

6. Tighten the the top clamp around the C-Star using a 3/16" hex driver.
7. Connect the C-Star sensor cable to the C-Star bulkhead connector. The cable will ship inside the MMP.

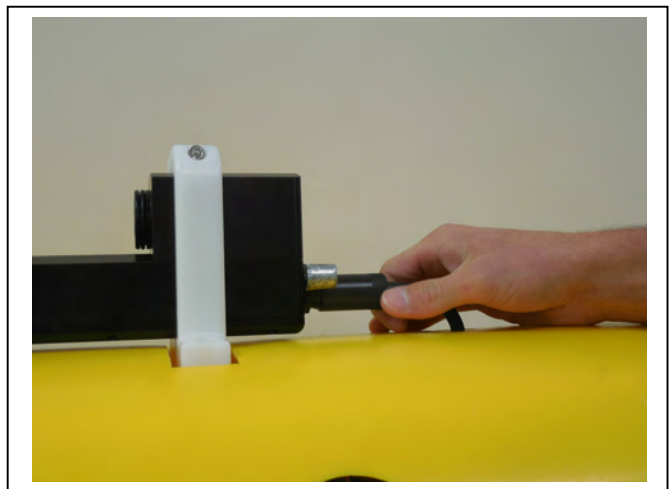
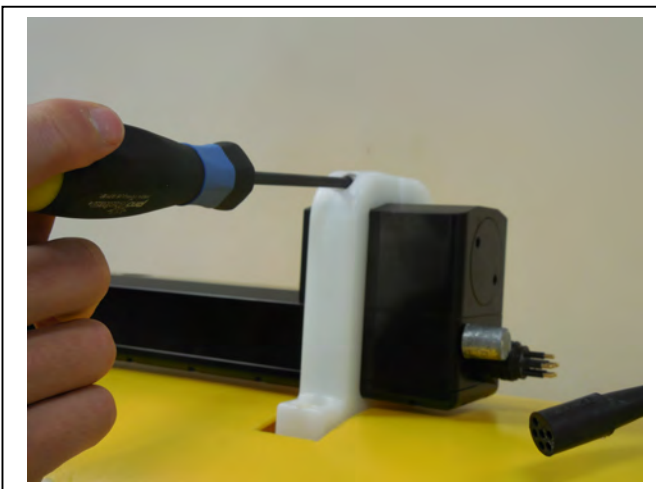


Figure 6.3-15: Tighten Top Clamp and Connect Bulkhead

Removing the C-Star from the MMP

To remove the C-Star from the MMP, complete the following steps:

1. Remove the two 3/8-16" nylon screws from the top clamp to release it from the MMP body.
2. Gently pull the C-STAR (with the top clamp still attached) away from the body, and up from the bottom clamp.
3. If necessary for storage and transportation, remove the two 3/8-16" nylon screws from the bottom clamp as well. The top clamp is tightened with a single 1/4-20 screw.

Notes

Section 6.4 Wet Labs SeaOwl Sensor

MMP firmware release version 5.28 and higher supports the Wet Labs SeaOwl sensor, a transmissometer that measures oil-in water. The WetLabs documentation provided with the SeaOwl includes a calibration sheet. Refer to this sheet for information specific to your SeaOwl.



Although the SeaOwl is not a self logging sensor, it can be enabled and disabled using the REQACT control command as well as queued with sensor data transmission using the REQUE control command. See Appendix A ‘Inductive File Transmission Protocol’ in this User Manual for details on these commands.

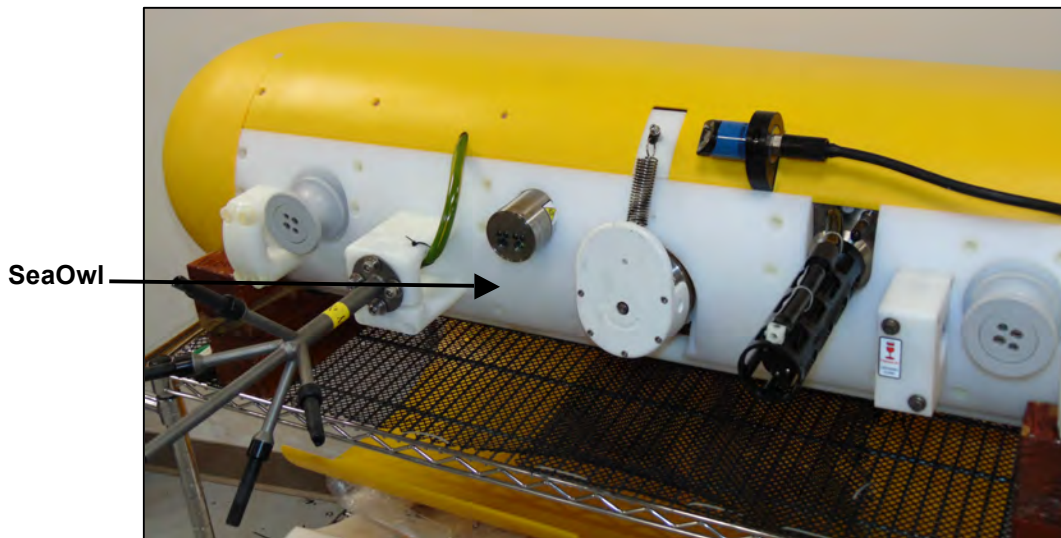


Figure 6.4-1: MMP with SeaOwl Installed

During system initialization the firmware makes three attempts to confirm that the SeaOwl is connected. If the third attempt to confirm connection fails, the deployment continues without logging SeaOwl files.

SeaOwl Data Details

SeaOwl data is logged in a “W” file for each profile.

```

Profile 4, SEAOWLA2K-021
-----
mm/dd/yyyy hh:mm:ss ChLed ChLoG ChHiG ChRep bbLed bbLoG bbHiG bbRep FDLe1 FDLe2 FDL0G FDHiG FDRep
04/19/2017 15:03:19 3779 690 6530 6530 2705 209 -263 -263 3762 3762 317 2696 2696
04/19/2017 15:03:22 3760 689 6518 6518 2695 137 -146 -146 3759 3759 316 2691 2691
04/19/2017 15:03:26 3757 688 6510 6510 2693 164 -145 -145 3756 3756 316 2688 2688
04/19/2017 15:03:30 3753 686 6500 6500 2689 189 -143 -143 3756 3756 316 2686 2686
04/19/2017 15:03:33 3745 685 6489 6489 2684 211 -139 -139 3754 3754 316 2683 2683
04/19/2017 15:03:37 3741 684 6477 6477 2683 229 -136 -136 3754 3754 316 2685 2685
04/19/2017 15:03:40 3742 683 6466 6466 2682 246 -133 -133 3752 3752 315 2681 2681
04/19/2017 15:03:44 3740 682 6460 6460 2681 262 -127 -127 3751 3751 315 2677 2677
04/19/2017 15:03:48 3737 680 6447 6447 2679 275 -125 -125 3748 3748 314 2674 2674
04/19/2017 15:03:54 3738 680 6447 6447 2681 240 -107 -107 3748 3748 314 2675 2675

Profile 4

SEAOWL turned on at 04/19/2017 15:01:16
SEAOWL turned off at 04/19/2017 15:05:59
    
```

Figure 6.4-2: ‘W’ File Sea-Owl Data



Although SeaOwl manufacturer documentation notes that output columns can be changed, the output columns required for MMP integration are predefined as recommended by WetLabs. These columns will be reset at Profiler initialization.

Using SeaOwl Bench Test Options

The main Bench Tests and Wet Labs SeaOwl Bench Tests menus provide options to verify and change sensor settings before deployment. The main Bench Tests Menu displays only options that are available to installed sensors. Type *G* to display the Wet Labs SeaOwl Bench Tests menu.

```
Config: MPP_IM_CM_CT_OP_SC                               CF2 V5.28
-----
                Pattern Profiler
                Bench Tests
-----
                Wed May 31 09:27:16 2017
CTD & ACM utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
<5> Falmouth Scientific 3d ACM+ communication
<6> Falmouth Scientific 3d ACM+ tilt & compass

System evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<D> Detailed schedule
<S> Recover schedule

Sensor & Option tests:
<G> Wetlabs SeaOwl
<I> Seabird Inductive Modem
<#> Aanderaa Optode

Exit:
<X> Main Menu

Selection [] ? g
```

Figure 6.4-3: Profiler Bench Tests Menu

```
Config: MPP_IM_CM_CT_OP_SC                               CF2 V5.28
-----
                Pattern Profiler
                Wetlabs SeaOwl Bench Test Menu
-----
                Wed May 31 09:27:24 2017

<1> Direct communications (19200 Baud)
<2> restore McLane parameters
<4> Report parameter settings
<5> Perform a profile test loop

<M> return to previous Menu

Selection [] ?
```

Figure 6.4-4: Wet Labs SeaOwl Bench Test Menu

Direct Sensor Connection

Typing *I* from the WetLabs SeaOwl Bench Test Menu connects directly with the SeaOwl sensor. The Profiler communicates with the Wet Labs Sensors at 19200 baud. Once direct connection is established, typing commands at the command prompt provides additional sensor information. Figure 6.4-5 shows direct communication with the SeaOwl.

```
Selection [] ? 1
05/31/2017 09:27:30 WlSeaOwl Enter "!!!!!" (w/o quotes) to get sensor's attention.
05/31/2017 09:27:30 WlSeaOwl Press ^C to terminate COMM session.
05/31/2017 09:27:30 SYSTEM Press ^B to change or confirm Baud rate.
05/31/2017 09:27:31 WlSeaOwl 19.2 kBaud communication channel opened.
05/31/2017 09:27:31 WlSeaOwl Powered on.
*****
Name Mod-Ser ChLed ChLoG ChHiG ChRep bbLed bbLoG bbHiG bbRep FDLe1 FDLe2 FDL0G FDHiG FDRep
SEAOWLA2K-021 3778 631 5937 5937 2674 9918 9684 9684 3744 3744 227 1793 1793
SEAOWLA2K-021 3777 630 5925 5925 2660 9927 9689 9689 4142 4142 227 1793 1793
SEAOWLA2K-021 3751 631 5939 5939 2662 9932 9657 9657 4141 4141 227 1793 1793
SEAOWLA2K-021 3762 630 5922 5922 2653 9931 9595 9595 4139 4139 227 1796 1796
SEAOWLA2K-021 3739 630 5921 5921 2656 9927 9524 9524 4137 4137 226 1793 1793
SEAOWLA2K-021 3753 629 5914 5914 2648 9923 9448 9448 4134 4134 226 1791 1791
!SEAOWLA2K-021 3732 628 5912 5912 2652 9918 9374 9374 4133 4133 226 1791
 1791
!!!!
Ser SEAOWLA2K-021
Ver AOS 5.45
Ave 12
Pkt 0
Seq 3

Rat 19200

! [^C]
*****
05/31/2017 09:27:44 WlSeaOwl Powered off.
05/31/2017 09:27:44 WlSeaOwl 19.2 kBaud communication channel closed.
.
```

Figure 6.4-5: <I> SeaOwl Direct Communications

Restore McLane Parameters

Option 2 restores the SeaOwl settings required by McLane for integration to the Profiler. This option requires the password *mcl*.

```
Config: MPP_IM_CM_CT_OP_SC                                CF2 V5.28
-----
                Pattern Profiler
                Wetlabs SeaOwl Bench Test Menu
-----
                Wed May 31 09:27:24 2017

<1> Direct communications (19200 Baud)
<2> restore McLane parameters
<4> Report parameter settings
<5> Perform a profile test loop

<M> return to previous Menu

Selection [] ?
```

Figure 6.4-6: <2> Restore McLane Parameters

Report Parameter Settings

Option 3 reports the SeaOwl settings.

```
Selection [] ? 3

05/31/2017 09:28:06 WlSeaOwl 19.2 kBaud communication channel opened.
05/31/2017 09:28:06 WlSeaOwl Powered on. .
05/31/2017 09:28:08 WlSeaOwl Sending command [!!!!]. ...
05/31/2017 09:28:09 WlSeaOwl Sending command [$mnu]. ...

05/31/2017 09:28:09 WlSeaOwl

Ser SEAOWLA2K-021
Ver AOS 5.45
Ave 12
Pkt 0
Seq 3

Rat 19200.

05/31/2017 09:28:09 WlSeaOwl Powered off.
05/31/2017 09:28:09 WlSeaOwl 19.2 kBaud communication channel closed.
```

Figure 6.4-7: <3> Report Parameter Settings

Perform Profile Test Loop

Option 4 performs a profile test loop as shown in Figure 6.4-8. The test simulates an automated sensor verification and a 5 minute profile.

```
Selection [ ] ? 4
05/31/2017 09:28:18 WlSeaOwl 5854 Ch1, 9360 bb, 1778 FDOM.
05/31/2017 09:28:18  SYSTEM Suspended until 05/31/2017 09:28:25 ... Awake
05/31/2017 09:28:28 WlSeaOwl 5849 Ch1, 9630 bb, 1779 FDOM.
05/31/2017 09:28:28  SYSTEM Suspended until 05/31/2017 09:28:35 ... Awake
05/31/2017 09:28:39 WlSeaOwl 5864 Ch1, 9656 bb, 1778 FDOM.
05/31/2017 09:28:39  SYSTEM Suspended until 05/31/2017 09:28:45 ... Awake
05/31/2017 09:28:49 WlSeaOwl 5856 Ch1, 9644 bb, 1778 FDOM.
05/31/2017 09:28:49  SYSTEM Suspended until 05/31/2017 09:28:55 ... Awake
05/31/2017 09:28:59 WlSeaOwl 5854 Ch1, 9639 bb, 1777 FDOM.
05/31/2017 09:28:59  SYSTEM Suspended until 05/31/2017 09:29:05 ... Awake
05/31/2017 09:29:09 WlSeaOwl 5848 Ch1, 9631 bb, 1776 FDOM.
05/31/2017 09:29:09  SYSTEM Suspended until 05/31/2017 09:29:15 ... Awake
[^C]
```

Figure 6.4-8: <4> SeaOwl Profile Test Loop

Removing the SeaOwl for Calibration

The SeaOwl sensor can be removed for calibration if necessary, using the following steps:

1. Place the MMP on a stable cart or surface and remove the side of the MMP skin closest to the sensor.
2. With the SeaOwl still connected to the sensor cable, use a 5/32" hex driver (provided in the toolkit), to loosen the two mounting screws behind the SeaOwl.
3. Gently pull the SeaOwl through the mounting space.
4. Unplug the SeaOwl sensor cable

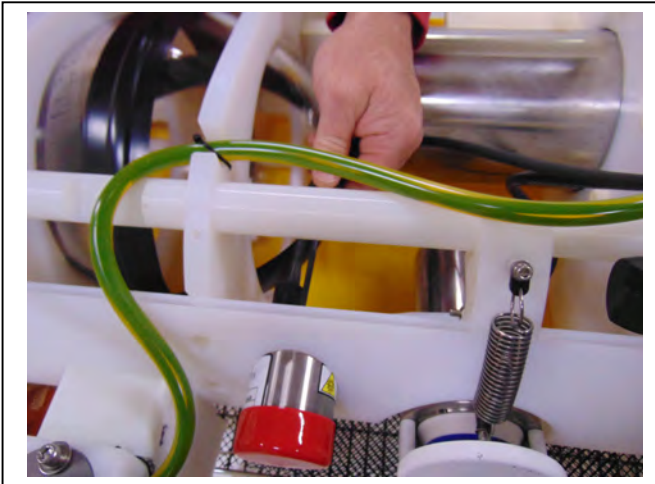


Figure 6.4-9: Locate Mounting Screws



Figure 6.4-10: Loosen Mounting Screws



Figure 6.4-11: Remove the Sensor Cable

Notes

Chapter 7

Ostar OceanServer MotionPack Sensor

MMP Release v5.00 firmware and higher supports the Ostar OceanServer5000. The OceanServer 5000 sensor board is installed on the controller electronics stack. The OceanServer samples heading, pitch and roll position with acceleration in the X, Y, and Z axes. Pressure recorded by the installed CTD is also reported. For additional information about the OceanServer5000 MotionPack sensor, refer to the Ocean Server Technology web site (www.ocean-server.com) or contact OceanServer.

Motion Pack
Sensor Board →

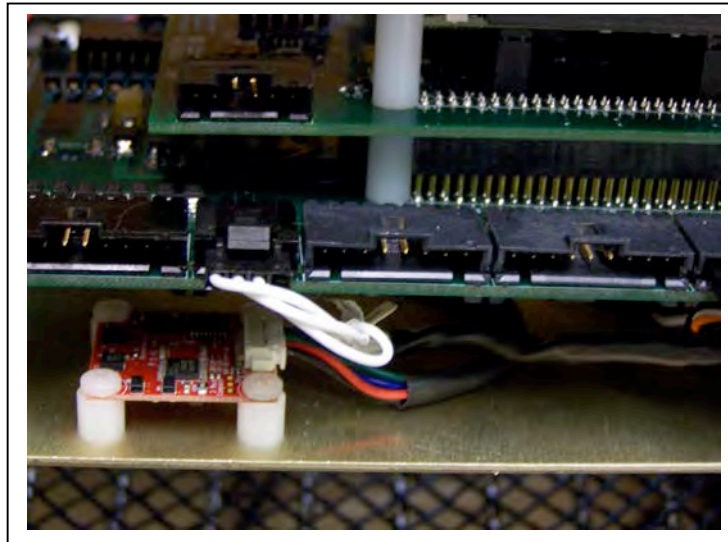


Figure 7-1: Motion Sensor on MMP Electronics Stack

Collecting Data with the OceanServer MotionPack

MotionPack Data is logged in an 'M' file for each profile. During warm-up and ramp, 2 samples/second are collected. During the rest of the profile, including warm-down, 1 sample/sec is collected. The Profile Unpacker unpacks the 'M' file with the CTD, ENG, ACM and other data files.

The MotionPack collects 3 axis Magnetic Field and 3 axis Acceleration readings (X, Y, Z) and the Magnetic Vector and Accelerated Vector Lengths. The Pressure column records the depth for each measurement as reported by the CTD. Azimuth heading, pitch and roll readings are in degrees. The Temperature is the internal board temperature in degrees Celsius.

```
Profile 2
Time,          Pres, Azim, Pitch, Roll, Temp,Vmag,  Xmag,  Ymag,  Zmag,  Vacc, Xacc, Yacc,  Zaac
12/07/2012 16:30:19,0.80, 310.2,1.1,  -0.3,  7.6, 303.00,-135.54,138.06,233.18,1.003,0.019,-0.006,1.003
12/07/2012 16:30:20,0.80, 306.9,1.2,  -0.6,  7.7, 302.88,-135.38,138.05,233.14,1.004,0.021,-0.010,1.004
12/07/2012 16:30:20,0.80, 306.9,1.2,  -0.6,  7.7, 303.07,-135.69,138.07,233.19,1.006,0.020,-0.011,1.006
12/07/2012 16:30:21,0.80, 310.0,1.2,  -0.4,  7.8, 302.96,-135.70,138.01,233.07,1.006,0.020,-0.007,1.006
. . .
```

Figure 7-2: 'M' File Motion Pack Data

Configuring the Firmware to Use the OceanServer MotionPack

The Profiler System Configuration menu specifies the active sensors. To enable an OS5000 MotionPack, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*. Select <M> OceanServer5000 MotionPack and then type *Y* to enable the sensor.
2. Select <M> OceanServer5000 MotionPack and then type *Y* to enable the sensor.

```
Config: MPP_IM_CT_CM_PA_SC_MP          CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                System Configuration
-----
                Tue Mar 11 15:37:44 2014
System Parameters:
<0> Battery capacity                240 Ah
Sensor Suite:
  Port J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
<2> Nortek AquaDopp DVS ----- ENABLED AquaDopp-2
  Port J6:IMM
<I> Telemetry ----- ENABLED IMM @ 1200 baud
  Port J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA Nitrate
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2 ----- ENABLED
Port J10:SPR
<L> Wetlabs ECO FLBB(RT)/D
<P> Biospherical PAR ----- ENABLED @ 5 samp/avg
  Port J7:TRB
<T> Seapoint IR Turbidity
  Port J8:FLR
<E> Seapoint CHL Fluorometer
<F> Wetlabs CDOM Fluorometer
  Port J4i:SER
<H> ProOceanus CH4
<M> OceanServer5000 MotionPack ---- ENABLED ← OS5000 MotionPack
  Port J5i:SER
<K> ProOceanus CO2
Exit:
<X> Save changes    <^C> Cancel changes
Selection [] ? [^C]

Enable the "Nortek AquaDopp DVS" [Y] ?
Select 1 = AquaDopp-HR, 2 = AquaDopp-II (1-2) [0] ? 2
```

Figure 7-3: System Configuration Menu with Sensor Selections

Using Bench Test Options

The main Bench Tests and OceanServer Bench Tests menus provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu, type '5' at the prompt to display the Profiler Bench Tests Menu.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013
      McLane Research Laboratories, USA
      Pattern Profiler
      S/N: ML12345-01D
-----
      Pattern Profiler
      Main Menu
-----
      Wed Nov 13 10:00:55 2013
<1> Set Time           <5> Bench Test
<2> Diagnostics       <6> Deploy Profiler
<3> Flash Card Ops    <7> Offload Deployment Data
<4> Sleep             <8> Contacting McLane
<C> Configure
```

Figure 7-4: Profiler Main Menu

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013
-----
      Pattern Profiler
      Bench Tests
-----
      Wed Dec 19 13:44:33 2012
Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record
System Evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<0> Battery endurance
<D> Detailed schedule
<S> Recover schedule
System Sensor & Option Tests:
<M> OceanServer5000 MotionPack
Exit:
```

Figure 7-5: Profiler Bench Tests Menu

2. From the Profiler Bench Tests menu, type *M* at the prompt to display the OceanServer Bench Test menu.
3. Type '1' to connect directly with the OceanServer MotionPack.

```
Configuration: MPP_CT                                CF2 V5.00 of Dec 19 2012
-----
                Pattern Profiler
OceanServer5000 MotionPack Bench Test Menu
-----
                Wed Dec 19 13:44:36 2012

<1> Direct communications (19200 Baud)
<2> Restore McLane parameters
<3> Restore factory parameters
<4> Report parameter settings
<5> Perform a profile test loop

<M> return to previous Menu

Selection  [] ? 1

12/19/12 13:44:53 OST/5kMP Press ^C to terminate COMM session.
12/19/12 13:44:53 OST/5kMP SYSTEM Press ^B to change or confirm Baud rate.
```

← **Direct Communications**

Figure 7-6: OceanServer MotionPack Bench Tests Menu



The Profiler communicates with the OceanServer at 19200 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 7-7). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****  
  
-Êûx-òÄ-fûx-` ,ò6x-Ê#-ò-ûfx6òx`Ü6ò-òÄ-Ê`  
  
04/23/14 12:50:37 AAND OPT ERROR! Didn't receive prompt after [wake-up]  
command finished.
```

Figure 7-7: Baud Rate Communications Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu displays the Baud Rate menu (Figure 7-7). Use this menu option to temporarily connect at the sensor’s current baud rate. Once connected to the sensor, change to the Profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013  
  
-----  
                Pattern Profiler  
                Select new Baud rate  
-----  
                Fri Jan 11 13:48:30 2013  
  
<1> 1200  
<2> 2400  
<3> 4800  
<4> 9600  
<5> 19200  
<6> 38400  
<7> 57600  
  
<G> Go to COMM session  
      Selection [ ] ? g
```

Figure 7-8: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the OceanServer, typing commands at the command prompt provides additional sensor information. Figure 7-9 shows direct connection with the OceanServer.

```
12/19/12 13:46:29 OST/5kMP 19.2 kBaud communication channel opened.
12/19/12 13:46:30 OST/5kMP Powered on.
*****
173.7,-88.4,0.0,16.5,364.11,-310.20,19.77,189.64,1.023,-1.023,0.027,-0.002
173.7,-88.4,0.0,16.5,364.12,-310.15,19.84,189.71,1.022,-1.022,0.026,-0.002
173.7,-88.4,0.0,16.6,364.08,-310.14,19.82,189.66,1.022,-1.022,0.028,-0.002
173.7,-88.4,0.0,16.7,364.00,-310.08,19.80,189.62,1.022,-1.022,0.026,0.000
173.7,-88.4,0.0,16.8,364.03,-310.11,19.81,189.62,1.022,-1.021,0.027,-0.001
...
73.7,-88.4,0.0,17.4,363.75,-309.76,19.86,189.64,1.021,-1.021,0.027,-0.002
173.7,-88.4,0.0,17.3,363.71,-309.74,19.86,189.61,1.021,-1.021,0.027,-0.002
[^C]
*****
12/19/12 13:46:48 OST/5kMP Powered off.
12/19/12 13:46:48 OST/5kMP 19.2 kBaud communication channel closed.
```

Figure 7-9: Option <I> OceanServer Direct Communications

Restore McLane and Factory Settings

Option <2> and <3> from the MotionPack Bench Tests menu restore the McLane or OceanServer factory settings on the MotionPack sensor. Using option <2> requires the password *mclane*. Using option <3> (not shown) also requires a password. Contact McLane before resetting to the factory parameters.

```
Selection [] ? 2 Password: ***

12/19/12 13:52:46 OST/5kMP 19.2 kBaud communication channel opened.
12/19/12 13:52:46 OST/5kMP Powered on. .
12/19/12 13:52:49 OST/5kMP Sending command [V]. . . .
12/19/12 13:52:49 OST/5kMP Identified as V2.6, S#25828. ..
12/19/12 13:52:49 OST/5kMP Sending command [R]. . . .
12/19/12 13:52:49 OST/5kMP Sending command [1]. . . .
12/19/12 13:52:49 OST/5kMP Sending command [*]. . . .
12/19/12 13:52:49 OST/5kMP Sending command [8]. . . .
12/19/12 13:52:50 OST/5kMP Sending command [X]. . . .
12/19/12 13:52:50 OST/5kMP Sending command [495]. . . .
12/19/12 13:52:50 OST/5kMP Sending command [E]. . . . . . .
12/19/12 13:52:50 OST/5kMP Sending command [3]. . .
12/19/12 13:52:50 OST/5kMP Was able to restore McLane parameters.
12/19/12 13:52:50 OST/5kMP Powered off.
12/19/12 13:52:50 OST/5kMP Power-down delay . . . . .
12/19/12 13:52:52 OST/5kMP 19.2 kBaud communication channel closed.
```

Figure 7-10: Option <2> Restore McLane Parameters



The firmware requires settings configured by McLane. Changing settings, or resetting to the factory settings prevents the MotionPack sensor from working correctly with the profiler.

Display Current Settings

Option <4> displays the current MotionPack parameters.

```
Selection  [] ? 4

12/19/12 13:53:41 OST/5kMP Identified as V2.6, S#25828.
12/19/12 13:53:41 OST/5kMP Parameter settings.
-----
FW_Version=V2.6-4

FW_Date=3-Nov-10

Serial_number=000025828

Test_date=08 Aug 11

Output_Format=8

Acclerometer=2

Display_Fields=495

HW_Mounting_Pos=3

Baud_Rate=3
Set-Reset_Rate=200

Output_Rate=1

Averaging=4

AD_Update_Rate=3

lifeskip=8

Euler=4

MaxG=2
-----
Press any key to continue.
```

Figure 7-11: Option <4> Report Parameter Settings

Perform Profile Test Loop

Option <5> performs a profile test loop. This test simulates an automated sensor verification which begins with a display of the parameters and 5 minute profile.

```
Config: MPP_IM_CT_CM_PA_SC_MP                CF2 V5.17 of Sep 16 2014
-----
                        Pattern Profiler
OceanServer5000 MotionPack Bench Test Menu
-----
                        Thu Sep 18 10:39:34 2014
<1> Direct communications (19200 Baud)
<2> restore McLane parameters
<3> restore Factory parameters
<4> Report parameter settings
<5> Perform a profile test loop

<M> return to previous Menu

Selection [ ] ? 5

09/18/14 10:39:37 OST/5kMP Automated verification of sensor settings.
09/18/14 10:39:41 OST/5kMP Identified as V2.6, S#24112.
09/18/14 10:39:41 OST/5kMP Parameter settings.

-----
FW_Version=V2.6-4
FW_Date=3-Nov-10
Serial_number=000024112
Test_date=06 Feb 13
Output_Format=8
Acclerometer=2
Display_Fields=495
HW_Mounting_Pos=5
Baud_Rate=3
Set-Reset_Rate=100
Output_Rate=2
Averaging=4
AD_Update_Rate=3
lifeskip=8
Euler=4
MaxG=2
-----

09/18/14 10:39:43   SYSTEM Next profile scheduled for 09/18/14 10:40:00.
09/18/14 10:39:43   SYSTEM Suspended until 09/18/14 10:40:00 ... Awake
```

Figure 7-12: Option <5> Perform Profile Test Loop screen 1 of 2

```

10/09/12 13:12:02  SYSTEM Awake at 10/09/12 13:12:02. Press ^C to exit the loop
10/09/12 13:12:02  SYSTEM Prepping for profile 0.

10/09/12 13:12:02  SYSTEM Initializing OST/5kMP logging pointers.
10/09/12 13:12:06  OST/5kMP Identified as V2.6, S#25828.

10/09/12 13:12:06  OST/5kMP Opening M0000000.DAT for profile 0.
10/09/12 13:12:06  OST/5kMP Writing 2 byte header for profile 0.
10/09/12 13:12:06  OST/5kMP Closing M0000000.DAT for profile 0.
10/09/12 13:12:06  OST/5kMP Acquiring to 30 dbar, with a 15 second stop-check interval.
10/09/12 13:12:06  SYSTEM 1 minute warmup.
10/09/12 13:12:07  SYSTEM Waiting until 10/09/12 13:13:06. ... Continuing

10/09/12 13:13:10  SYSTEM "Diving" ...

10/09/12 13:13:29  OST/5kMP C27.3, P6.5, R-0.1, T19.6, Vm179.9, Val.0, 3.75 dbar.
10/09/12 13:13:44  OST/5kMP C27.3, P6.5, R-0.1, T19.9, Vm179.8, Val.0, 7.50 dbar.
10/09/12 13:13:59  OST/5kMP C27.4, P6.5, R-0.1, T20.1, Vm179.6, Val.0, 11.25 dbar.
10/09/12 13:14:14  OST/5kMP C27.5, P6.4, R-0.1, T20.3, Vm179.6, Val.0, 15.00 dbar.
10/09/12 13:14:29  OST/5kMP C27.4, P6.4, R-0.1, T20.5, Vm179.2, Val.0, 18.75 dbar.
10/09/12 13:14:44  OST/5kMP C27.4, P6.4, R-0.1, T20.6, Vm179.2, Val.0, 22.50 dbar.
10/09/12 13:14:59  OST/5kMP C27.4, P6.4, R-0.1, T20.7, Vm179.2, Val.0, 26.25 dbar.
10/09/12 13:15:14  OST/5kMP C27.4, P6.4, R-0.1, T20.8, Vm179.1, Val.0, 30.00 dbar.

10/09/12 13:15:14  SYSTEM Found stop at 30 dbar.
10/09/12 13:15:14  SYSTEM 1 minute warmdown.
10/09/12 13:15:14  SYSTEM Waiting until 10/09/12 13:16:14. ... Continuing

10/09/12 13:16:17  OST/5kMP Opening M0000000.DAT for profile 0.
10/09/12 13:16:17  OST/5kMP Writing 64 byte trailer for profile 0.
10/09/12 13:16:17  OST/5kMP Closing M0000000.DAT for profile 0.

10/09/12 13:16:18  OST/5kMP test profile 0 succeeded

```

Figure 7-13:Option <5> Perform Profile Test Loop screen 2 of 2

Notes

Chapter 8

Satlantic SUNA Sensor

MMP Release v4.15 and higher supports the Satlantic SUNA sensor. The SUNA collects nitrate data which is recorded in an 'S' file (*SNNNNNNN.DAT* for each profile). For additional information, refer to the Satlantic web site (www.satlantic.com/suna) or contact Satlantic.

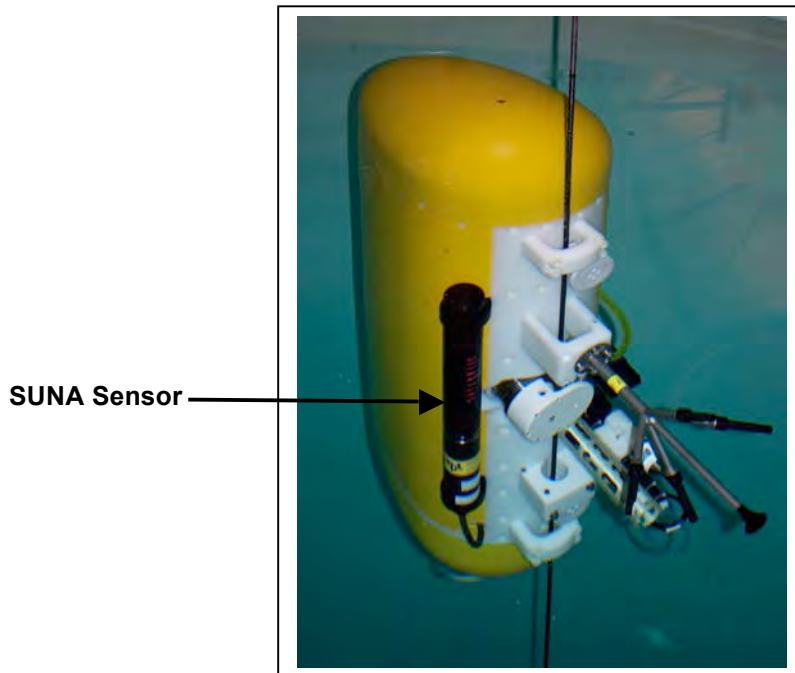


Figure 8-1: MMP with SUNA Sensor

Collecting Data with the SUNA

SUNA data is logged in the 'S' file. ('*SNNNNNNN.DAT*' where 'N' is the profile number). Five nitrate measurements are collected during each stop check. One 'dark' frame is recorded for reference. Four 'light' frames of nitrate data are then recorded. The stop check data displays only the last 'light' frame (the nitrate sample), measured as milligrams per liter.

Unpacked SUNA data is shown next in Figure 8-2.

Profile 6

Instrument	Timefield	NitrateUM	NitrateMG	FitError	LampT	SpecT	LampTime	Hum	Vlt12	VltRg	VltMn	SpecAv	DarkAv	Ch001	Ch002	
Ch003	Ch004	Ch005	Ch006	Ch007	Ch008	Ch009	Ch010	Ch011	Ch012	Ch013	Ch014	Ch015	Ch016	Ch017	Ch018	Ch019
Ch020	Ch021	Ch022	Ch023	Ch024	Ch025	Ch026	Ch027	Ch028	Ch029	Ch030	Ch031	Ch032	Ch033	Ch034	Ch035	Ch036
Ch037	Ch038	Ch039	Ch040	Ch041	Ch042	Ch043	Ch044	Ch045	Ch046	Ch047	Ch048	Ch049	Ch050	Ch051	Ch052	Ch053
Ch054	Ch055	Ch056	Ch057	Ch058	Ch059	Ch060	Ch061	Ch062	Ch063	Ch064	Ch065	Ch066	Ch067	Ch068	Ch069	Ch070
Ch071	Ch072	Ch073	Ch074	Ch075	Ch076	Ch077	Ch078	Ch079	Ch080	Ch081	Ch082	Ch083	Ch084	Ch085	Ch086	Ch087
Ch088	Ch089	Ch090	Ch091	Ch092	Ch093	Ch094	Ch095	Ch096	Ch097	Ch098	Ch099	Ch100	Ch101	Ch102	Ch103	Ch104
Ch105	Ch106	Ch107	Ch108	Ch109	Ch110	Ch111	Ch112	Ch113	Ch114	Ch115	Ch116	Ch117	Ch118	Ch119	Ch120	Ch121
Ch122	Ch123	Ch124	Ch125	Ch126	Ch127	Ch128	Ch129	Ch130	Ch131	Ch132	Ch133	Ch134	Ch135	Ch136	Ch137	Ch138
Ch139	Ch140	Ch141	Ch142	Ch143	Ch144	Ch145	Ch146	Ch147	Ch148	Ch149	Ch150	Ch151	Ch152	Ch153	Ch154	Ch155
Ch156	Ch157	Ch158	Ch159	Ch160	Ch161	Ch162	Ch163	Ch164	Ch165	Ch166	Ch167	Ch168	Ch169	Ch170	Ch171	Ch172
Ch173	Ch174	Ch175	Ch176	Ch177	Ch178	Ch179	Ch180	Ch181	Ch182	Ch183	Ch184	Ch185	Ch186	Ch187	Ch188	Ch189
Ch190	Ch191	Ch192	Ch193	Ch194	Ch195	Ch196	Ch197	Ch198	Ch199	Ch200	Ch201	Ch202	Ch203	Ch204	Ch205	Ch206
Ch207	Ch208	Ch209	Ch210	Ch211	Ch212	Ch213	Ch214	Ch215	Ch216	Ch217	Ch218	Ch219	Ch220	Ch221	Ch222	Ch223
Ch224	Ch225	Ch226	Ch227	Ch228	Ch229	Ch230	Ch231	Ch232	Ch233	Ch234	Ch235	Ch236	Ch237	Ch238	Ch239	Ch240

SATSDB0052	148.723	0.000000	0.000000	0.000000	27.1	25.0	436212	4.9	0.00	5.46	11.59	849	849	851	872
855	825	843	835	858	869	834	860	837	858	880	871	863	844	839	
878	873	841	840	877	859	861	852	850	835	886	876	864	859	845	
827	825	830	876	871	823	842	868	870	865	815	787	859	853	850	
867	851	832	857	855	830	826	823	839	871	883	848	834	827	831	
859	849	839	872	839	866	827	869	849	837	842	839	857	863	865	
866	852	841	844	859	861	840	843	861	870	867	877	889	877	842	
826	842	837	836	869	864	865	834	849	844	850	875	847	827	861	
846	842	877	863	833	849	853	857	839	833	852	832	841	873	864	
832	840	842	853	836	817	843	843	828	833	861	858	850	867	837	
835	843	847	833	841	839	869	871	873	861	876	854	843	853	863	
824	851	857	851	849	839	828	844	855	869	849	865	843	843	880	
879	820	831	835	845	865	862	826	838	827	865	861	856	843	861	
846	857	824	867	841	831	819	864	853	832	875	861	833	843	851	
841	849	852	0x60												

SATSIB0052	152.035	2.152976	0.030156	0.000004	26.3	25.1	436213	6.0	12.06	5.52	10.99	21308	843	858	887
859	855	873	893	867	913	897	893	962	1279	1999	3386	5477	7861	9913	
11413	12382	13016	13490	13970	14507	15219	18255	19540	20883	22333	23716	24907	25930	26716	
27135	27203	26909	26368	25681	24873	24069	22776	22683	22881	23280	23851	24631	25709	27004	
28445	30041	31817	33645	35530	37306	39037	42584	42967	42996	42485	41590	40348	38827	37181	
35567	33842	32283	30840	29569	28476	27576	25736	25436	25267	25226	25297	25495	25771	26218	
26747	27350	27939	28633	29372	30142	30901	32464	32711	32668	32465	31991	31350	30450	29425	
28401	27261	26115	25039	24044	23122	22301	20438	19998	19680	19443	19234	19188	19175	19211	
19389	19621	19952	20325	20799	21316	21900	23270	24012	24737	25527	26326	27090	27835	28557	29236
29741	30275	30692	30999	31173	31232	31133	30602	30144	29603	28972	28307	27598	26899	26132	25416
24614	23811	23097	22452	21819	21217	20679	19703	19265	18862	18496	18120	17739	17394	17107	16788
16528	16300	16096	15905	15785	15635	15565	15466	15467	15483	15505	15614	15626	15649	15655	15697
15707	15652	15646	15600	15575	15605	15591	15584	15545	15492	15479	15450	15402	15337	15256	15034
14884	14749	14578	14377	14158	13885	13675	13423	13143	12890	12599	12331	12052	11786	11518	10854
10559	10285	10053	0x2C												

SATSIB0052	153.332	1.813990	0.025408	0.000002	26.3	25.1	436215	5.7	12.12	5.49	10.99	21265	843	900	915	
913	905	899	873	875	886	876	868	972	1278	1998	3386	5455	7842	9921		
11406	12373	12986	13443	13939	14471	15187	16022	17037	18189	19519	20868	22273	23625	24871	25927	26678

Figure 8-2: 'S' File SUNA Data

Configuring the Firmware to Use the SUNA

The Profiler System Configuration menu specifies the active sensors. The number of light sample frames captured per Stop Check can be changed from this menu. The sampling time varies based on how many frames are captured. To enable the SUNA, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select <N> for the Satlantic SUNA and then type *Y* to enable the sensor.
3. The setting for Frames per stop check displays next to the SUNA option.

```
Config: MPP_IM_CT_CM_PA_SC_MP_NI                CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                System Configuration
-----
                Tue Mar 11 15:37:44 2014
System Parameters:
<0> Battery capacity                240 Ah
Sensor Suite:
  Port J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
<2> Nortek AquaDopp DVS ----- ENABLED AquaDopp-2
  Port J6:IMM
<I> Telemetry ----- ENABLED IMM @ 1200 baud
  Port J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA  1 Dk, 3 Lt Enabled ←
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2 ----- ENABLED
Port J10:SPR
<L> Wetlabs ECO FLBB (RT)/D
<P> Biospherical PAR ----- ENABLED @ 5 samp/avg
  Port J7:TRB
<T> Seapoint IR Turbidity
  Port J8:FLR
<E> Seapoint CHL Fluorometer
<F> Wetlabs CDOM Fluorometer
  Port J4i:SER
<H> ProOceanus CH4
<M> OceanServer5000 MotionPack ---- ENABLED
  Port J5i:SER
<K> ProOceanus CO2
Exit:
<X> Save changes    <^C> Cancel changes
Selection [X] ? N
Enable the Satlantic SUNA Nitrate (Yes/No) [N] ? y
Number of frames per stop-check (1 to 4) ? 3
```

Figure 8-3: System Configuration Menu



Conducting pre-deployment *in-situ* SUNA timing tests is recommended to check response time. Collecting more data frames at stop check requires a longer SUNA response time and increases the length of each check stop interval. The desired stop check interval time must be balanced with the number of SUNA frames recorded for each stop check. SUNA response time also varies according to nitrate concentration. Example: to record 3 frames, the SUNA response time is approximately 15 seconds ($5 + (3 * \text{frames})$)

4. Specify the number of data frames to capture (from 1 to 4) at each stop check interval and type *X* to exit and save the entry.

```
Port J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA 1 Dk, 3 Lt Enabled ← Frames per stop check is 3
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2 ----- ENABLED
```

Figure 8-4: Frames per Stop Check



The Dark frame is a SUNA reference frame. This number is 1 and cannot be changed.

Using Bench Test Options

The main Bench Tests and SUNA Bench Tests menu provide options to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options available to the installed sensors.

1. From the Profiler Main Menu, type '5' to display the Profiler Bench Tests Menu.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013
      McLane Research Laboratories, USA
      Pattern Profiler
      S/N: ML12345-01D

-----
      Pattern Profiler
      Main Menu

-----
      Wed Nov 13 10:00:55 2013
<1> Set Time          <5> Bench Test ←
<2> Diagnostics      <6> Deploy Profiler
<3> Flash Card Ops   <7> Offload Deployment Data
<4> Sleep            <8> Contacting McLane
<C> Configure
```

Figure 8-5: Profiler Main Menu

```
Configuration: MMP_IM_CT_CM_PA_SC          CF2 V5_00 of Dec 7 2012

-----
      Bench Tests

-----
      Fri Dec 7 13:30:20 2012

Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record

<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass

System evaluation:
<7> Motor operation
<8> Release Brake
<9> Independent Watchdog
<0> Estimate deployment endurance

System Sensor & Option Tests:
<I> Seabird Inductive Modem
<M> OceanServer5000 MotionPack
<N> Satlantic SUNA ←

Exit:
<X> Main Menu
Selection [] ?
```

Figure 8-6: Profiler Bench Tests Menu

2. From the main Bench Tests menu, type *N* at the prompt to display the SAT/SUNA Bench Test menu.

```
Configuration: MPP_CT_NI                                CF2 V5.00 of Dec 19 2012
-----
SAT/SUNA Bench Test Menu
-----
Tue Feb 22 11:34:44 2011

<1> Direct communications (9600 Baud)
<2> Restore McLane parameters
<3> Restore factory parameters
<4> Report parameter settings
<5> Perform a profile test loop
<6> Perform a sensor self-test
<7> Set number of frames/stopcheck (2)

<M> Return to previous Menu

Selection [M] ? 7
Number of frames per stop-check (1 to 4) ? 3

12/19/12 13:44:53 Sat/SUNA Press ^C to terminate COMM session.
12/19/12 13:44:53 Sat/SUNA SYSTEM Press ^B to change or confirm Baud rate.
```

← **Direct Communications**

Figure 8-7: SUNA Bench Test Menu



The Profiler communicates with the SUNA at 9600 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 8-8). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` , ò8x-Ê+-ò-ûfx8òx-Û8ò-òÄ-Ê
04/23/14 12:50:37 AAND OPT ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 8-8: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu displays the Baud Rate menu (Figure 8-9). Use this menu option to temporarily connect at the sensor’s current baud rate. Once connected to the sensor, change to the profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
          Pattern Profiler
          Select new Baud rate
-----
          Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600
<G> Go to COMM session
      Selection [] ? g
```

Figure 8-9: Baud Rate Menu

Direct Sensor Connection

Once connected to the SUNA, typing commands at the command prompt provides additional sensor information.

1. Type *1* to connect directly with the SUNA.

```
Selection ? 1

Press ^C to terminate Sat/SUNA session

14:40:43 Sat/SUNA communication channels opened..
14:40:43 Sat/SUNA powered ON.
*****

SUNA v1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1      (Aug 28 2009, 14:46:06)

Reset source: BROWNOUT
Temperature sensors:
    Lamp housing: FOUND
    Spectrometer: FOUND
RS-232 POLLED MODE
CMD?
```

Figure 8-10: Option <1> Direct Communications with SUNA

Restore McLane and Factory Settings

Option <2> and Option <3> from the SUNA Bench Test menu provide a way to restore the McLane or Satlantic factory settings on the SUNA. Using option <2> requires typing the password *mclane*. Using option <3> (not shown) also requires a password. Contact McLane before resetting factory parameters.

```
Selection ? 2 Password: *****
14:41:03 Sat/SUNA communication channels opened..
14:41:03 Sat/SUNA powered ON. . . . .

14:41:10 Sat/SUNA sending [$] command. . . . .
14:41:11 Sat/SUNA sending [$Conf SetOpMode POLLED] command. . . . .
14:41:12 Sat/SUNA sending [$Conf SetTFMode FULL_BINARY] command. . . . .
14:41:13 Sat/SUNA sending [$Conf SetWaterType salt] command. . . . .

14:41:14 Sat/SUNA was able to restore McLane parameters.

14:41:14 Sat/SUNA powered OFF.
14:41:14 Sat/SUNA power-down delay . . . . .
14:41:19 Sat/SUNA communication channels closed..

Exit:
  <M> Main Menu
```

Figure 8-11: Option <2> Restore McLane Parameters



The profiler firmware requires the SUNA parameters configured by McLane. Changing these settings, including resetting to the factory settings will prevent the SUNA from working correctly with the profiler.

Display Current Settings

Option <4> displays the current SUNA settings.

```
Selection ? 4

14:41:21 Sat/SUNA communication channels opened..
14:41:21 Sat/SUNA powered ON. . . . .

14:41:28 Sat/SUNA current parameter settings.

FirmwareVersion:  1.7.1

Identify Pkg:      61835
Identify Cal:      21054
LampTime:          134828
GetSNum:           0052
GetBaud:           38400
GetOpMode:         POLLED
GetTFMode:         FULL_BINARY
GetFMTime:         60
GetIntPeriod:      400
GetBLOrder:        Linear
GetFitMin:         217.0
GetFitMax:         240.0
GetNtrDACMin:      -5.000000
GetNtrDACMax:      100.000000
GetLFrames:        1790
GetDFrames:        10
GetWaterType:      salt

14:41:39 Sat/SUNA powered OFF.
14:41:39 Sat/SUNA power-down delay . . . . .
14:41:44 Sat/SUNA communication channels closed..

Exit:
  <M> Main Menu
```

Figure 8-12: Option <4> Report Parameter Settings

Perform Profile Test Loop

Option <5> performs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile. The predefined 5 minute test time allows 2 minutes for sensor warm up, 1 minute for simulated profiling and 2 minutes for sensor warm down.

```
Selection ? 5
14:45:29 Sat/SUNA Automated verification of sensor settings.
14:45:29 Sat/SUNA communication channels opened..
14:45:29 Sat/SUNA powered ON. . . . .
14:45:36 Sat/SUNA powered OFF.
14:45:36 Sat/SUNA power-down delay . . . . .
14:45:41 Sat/SUNA communication channels closed..
Press ^C to exit the loop
14:45:42 Sat/SUNA prepping for profile.
14:45:42 Sat/SUNA communication channels opened..
14:45:42 Sat/SUNA powered ON. . . . .
14:45:49 Sat/SUNA opening file S0000000.DAT for profile 0.
14:45:49 Sat/SUNA writing 4 byte header for profile 0.
14:45:50 Sat/SUNA communication channels closed..
14:45:50 Sat/SUNA performing 20 "stop-checks" at 15 second intervals (5
minutes).
Sat/SUNA profile 0, "stop-check" 1:
14:45:50 Sat/SUNA communication channels opened..
14:45:50 Sat/SUNA acquiring 1 reference sample.
14:45:50 Sat/SUNA sending [DATA] command. . .
14:45:51 Sat/SUNA writing 511 byte block for profile 0. .
14:45:51 Sat/SUNA sending [LON] command. . .
14:45:53 Sat/SUNA acquiring 4 nitrate samples.
14:45:54 Sat/SUNA sending [DATA] command. . .
14:45:54 Sat/SUNA writing 511 byte block for profile 0. .
14:45:55 Sat/SUNA sending [DATA] command. . .
14:45:56 Sat/SUNA writing 511 byte block for profile 0. .
14:45:56 Sat/SUNA sending [DATA] command. . .
14:45:57 Sat/SUNA writing 511 byte block for profile 0. .
14:45:57 Sat/SUNA sending [DATA] command. . .
14:45:58 Sat/SUNA writing 511 byte block for profile 0. .
14:45:58 Sat/SUNA sending [LOFF] command. . .
14:45:58 Sat/SUNA communication channels closed..0.009866 mg/L nitrate
. . .
14:50:51 Sat/SUNA halting profile.
14:50:51 Sat/SUNA writing 519 byte trailer for profile 0.
14:50:52 Sat/SUNA closing file S0000000.DAT for profile 0.
14:50:52 Sat/SUNA communication channels opened..
14:50:52 Sat/SUNA powered OFF.
14:50:52 Sat/SUNA power-down delay . . . . .
14:50:58 Sat/SUNA communication channels closed..

Sat/SUNA test profile 0 succeeded
Press ^C to exit the loop
```

Figure 8-13: Option <5> Perform a profile test loop

Perform Sensor Self Test

Option <6> performs a SUNA self test to verify SUNA operation.

```
Selection ? 6

Press ^C to terminate Sat/SUNA session
14:44:43 Sat/SUNA communication channels opened..
14:44:44 Sat/SUNA powered ON.
*****
SUNA V1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1 (Aug 28 2009, 14:46:06)

Reset source: BROWNOUT
Temperature sensors:
    Lamp housing: FOUND
    Spectrometer: FOUND
RS-232 POLLED MODE
CMD? $
SUNA V1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1 (Aug 28 2009, 14:46:06)
Type '$Help' for a list of available commands.
Note:commands are case insensitive.

SUNA> $SelfTest ← Profiler firmware executes scripted command for SUNA self test to run
*** SUNA DIAGNOSTICS ***
Erasing LOG file, if present...OK
TEST 1 (7.695 s): Memory ... wrote: 19345 read: 19345 OK
TEST 2 (8.008 s): External SRAM ..... Bytes: 32768 Errors: 0 OK
TEST 3 (9.117 s): Temperature Sensor (Lamp Housing)... 25.813 C OK
TEST 4 (9.965 s): Temperature Sensor (Spectrometer)... 25.563 C OK
TEST 5 (10.816 s): Input voltage (VMAIN) ... 11.71 V OK
. . .
$Ok
SUNA> $reboot
$Ok
SUNA V1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1 (Aug 28 2009, 14:46:06)
Reset source: WATCHDOG
Temperature sensors:
    Lamp housing: FOUND
    Spectrometer: FOUND
RS-232 POLLED MODE
CMD? [^C] ← User types [CTRL]-[C] to terminate session
*****
14:45:21 Sat/SUNA powered OFF.
14:45:21 Sat/SUNA power-down delay .....
14:45:27 Sat/SUNA communication channels closed..
```

Figure 8-14: Option <6> SUNA Self Test

Option <7> (not shown) provides the option to change the Frames per Stop check as on the System Configuration menu,

Installing the SUNA in the Sensor Mounting Brackets

The SUNA sensor is removed from the MMP for shipment and must be re-installed prior to deployment. To install the SUNA, complete the following steps:

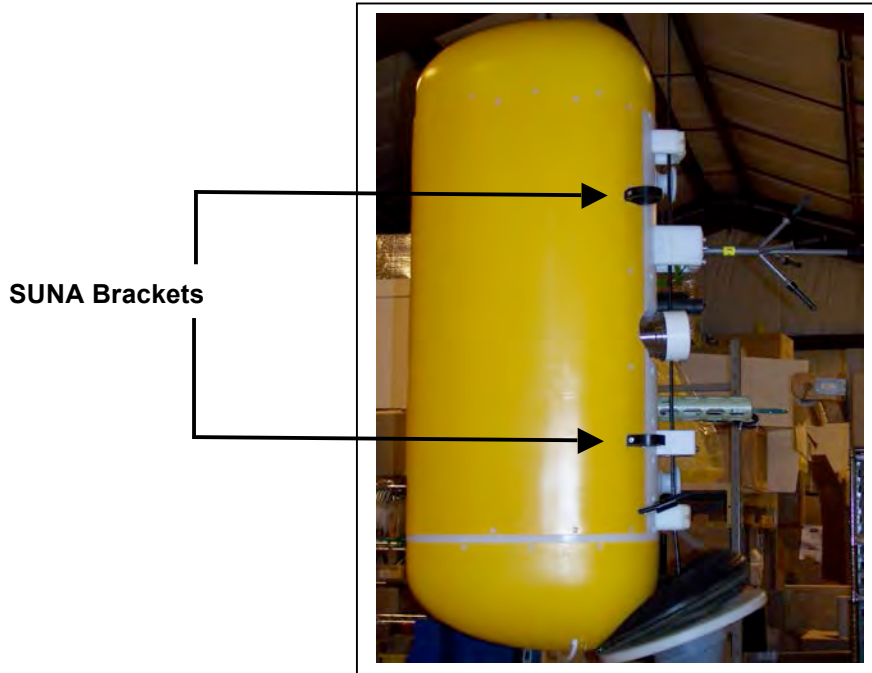


Figure 8-15: MMP with SUNA Sensor

1. Slide the SUNA into the top and bottom mounting brackets on the MMP.



Figure 8-16: Sliding the SUNA into the Sensor Brackets

- Using the provided hex driver, tighten the bottom and top mounting bracket screws (Figure 8-17 and 8-18). Connect the 5-pin connector (Figure 8-19 and 8-20).

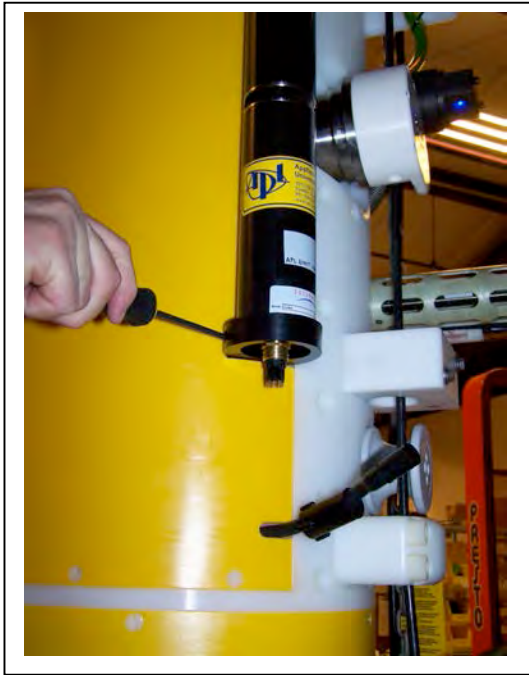


Figure 8-17 and Figure 8-18: Tightening Bottom and Top Mounting Screws

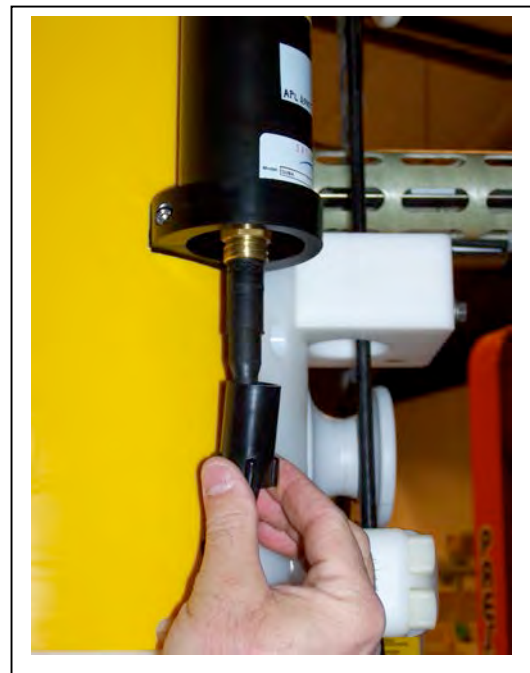


Figure 8-19 and Figure 8-20: Connect the 5-pin connector

3. Connect the opposite end of the cable (not shown) to the 8-pin connector on the controller housing marked SUNA.

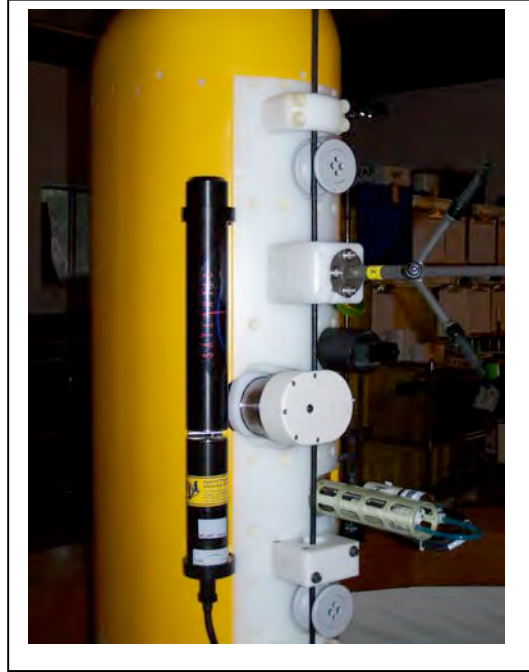


Figure 8-21: Completed SUNA Installation

Figure 8-21 shows the completed SUNA installation.



The SUNA also has a test cable for direct connection to the sensor. This cable is included in the Profiler shipment.

Chapter 9

Biospherical Par Sensor

The Biospherical PAR is a single-channel (analog) sensor that measures Irradiance (Photosynthetically Active Radiation). Calculating irradiance with PAR data requires using the Calibration sheet provided with the sensor. This section provides information common to both the QSP-2200, QSP-2300, QCP-2200 and QSP-2300 Par sensors. The PAR Q-series sensors are mechanically integrated with the MMP in the same manner. The MMP may not be shipped with the PAR sensor installed. See the instructions in this section for connecting and installing the PAR sensor. For more information about these sensors, refer to the Biospherical Instruments, Inc. website (www.biospherical.com) or contact Biospherical Instruments, Inc.

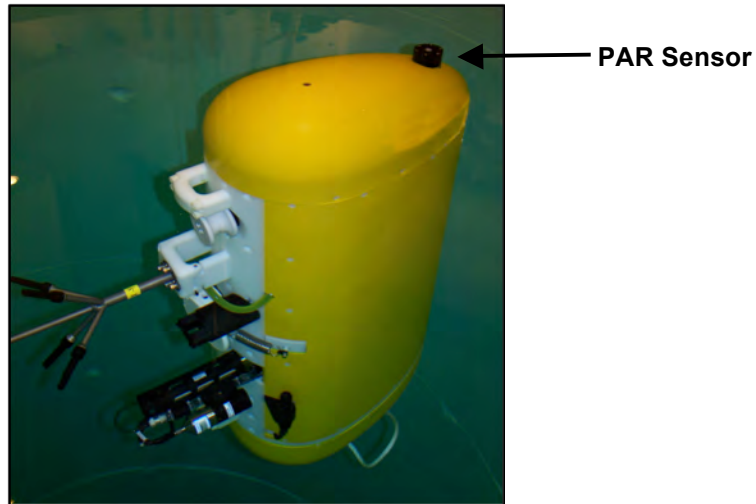


Figure 9-1: MMP with PAR Sensor

Collecting Data with the PAR

PAR data is logged as voltage and displayed in the Engineering File as Par mV, as shown next.

```
Profile 1
Sensors were turned on at 12/07/2012 15:30:01
Vehicle began profiling at 12/07/2012 15:32:01
Date, [mA], [V], [dbar], Par[mV], scatSig, chlSig, CDOMSig
12/07/2012 15:32:01, -2, 12.1, 0.000, 0.00, 66, 54, 98
12/07/2012 15:32:07, 55, 12.0, 0.000, 0.00, 68, 54, 100
12/07/2012 15:32:12, 166, 11.9, 0.000, 0.60, 67, 52, 101
12/07/2012 15:32:17, 193, 11.9, 0.000, 2.20, 71, 53, 100
12/07/2012 15:32:22, 185, 11.9, 0.000, 0.00, 69, 53, 99
12/07/2012 15:32:28, 175, 11.9, 0.000, 3.80, 67, 52, 100
12/07/2012 15:32:34, 217, 11.9, 5.760, 0.00, 67, 52, 99
12/07/2012 15:32:40, 159, 11.9, 4.030, 4.00, 65, 55, 101
12/07/2012 15:32:46, 141, 11.9, 2.290, 0.00, 70, 52, 99
12/07/2012 15:32:52, 129, 11.9, 0.670, 6.20, 68, 53, 102

Ramp exit: SMOOTH RUNNING
Profile exit: TOP PRESSURE

Vehicle motion stopped at 12/07/2012 15:33:00
Sensor logging stopped at 12/07/2012 15:35:09
```

Figure 9-2: ENG File with PAR Data

PAR Calibration Sheet Example

The PAR output is voltage that is proportional. Models QCP-2200 and QSP-2200 are linearly proportional to the log of incident irradiance. Models QCP-2300 and QCP-2300 are proportional to the log of incident irradiance. The documentation from the sensor manufacturer includes a Calibration Sheet to calculate irradiance from PAR mV readings.



A sample Calibration sheet for the QCP-2300 is shown on the next page only for reference. Refer to the Calibration sheet specific to the installed PAR for calculating irradiance.

Job No.: L10177

Calibration Date: 02/09/09
Model Number: QCP2300
Serial Number: 70219
Operator: TPC
Standard Lamp: 91537(10/25/2006)

Operating Voltage Range: 6 to 15 VDC (+)

Note: The QCP2300 output is a voltage that is proportional to the log of the incident irradiance.

To calculate irradiance, use this formula:

$$\text{Irradiance} = \text{Calibration factor} * (10^{\wedge}\text{Light Signal Voltage} - 10^{\wedge}\text{Dark Voltage})$$

Dry Calibration Factor: 3.04E+12 quanta/cm²-sec per volt 5.04E-06 μ Einsteins/cm²-sec per volt

Wet Calibration Factor: 3.20E+12 quanta/cm²-sec per volt 5.31E-06 μ Einsteins/cm²-sec per volt

Sensor Test Data and Results²⁾

Sensor Supply Current (Dark): 3.4 mA
Supply Voltage: 6 Volts
Lamp Integrated PAR Irradiance: 8.83E+15 quanta/cm²-sec 0.01467 μ Einsteins/cm²-sec
Immersion Coefficient: 0.95

Nominal Filter OD	Expected Transmission	Calibrated Trans.	Sensor Voltage	Expected Voltage	Measured Trans.	Transmission Error (%)	Test Irrad. (quanta/cm ² -sec)
No Filter	100%	100.00%	3.464	3.464	100.00%	0.0	8.84E+15
0.3	50%	36.10%	3.023	3.022	36.16%	-0.2	3.19E+15
0.5	32%	27.60%	2.910	2.905	27.89%	-1.1	2.46E+15
1	10%	9.27%	2.448	2.431	9.61%	-3.5	8.49E+14
2	1%	1.11%	1.546	1.509	1.17%	-5.3	1.04E+14
3	0.10%	0.05%	0.421	0.192	0.05%	-2.8	4.97E+12
RG780	0.00%	0.00%	0.016	0.016	0.00%	-100.0	1.15E+11

Dark Before: 0.016 Volts
Light - No Filter Hidr.: 3.465 Volts
Dark After - NFH: 0.016 Volts
Average Dark 0.0161 Volts

Notes:

- 1. Annual calibration is recommended.
- 2) This section is for internal use and for more advanced analysis.

Configuring the Firmware to Use the PAR

The Profiler System Configuration Menu specifies the active sensors. Samples/average for the PAR can also be changed. To enable the PAR sensor, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select <P> Biospherical Par and then type *Y* to enable the sensor. Type <1> or <2> to select the PAR sensor model. Optionally enter a new 'samples to average' measurement between 1 and 100 and type *X* to exit and save.

```
Config: MPP_IM_CT_CM_MP                               CF2 V5.16 of Aug 22 2014
-----
                          Pattern Profiler
                          System Configuration
-----
                          Mon Aug 25 15:00:43 2014
System Parameters:
<0> Battery capacity                               240 Ah
Sensor Suite:
  Port J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
<2> Falmouth Scientific 2d ACM ---- ENABLED
  Port J6:IMM
<I> Telemetry ----- ENABLED IMM @ 1200 Baud
  Port J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA Nitrate
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2
  Port J10:SPR
<L> Wetlabs ECO FLBB(RT)/D
<P> Biospherical PAR
  Port J7:TRB
<T> Seapoint IR Turbidity
  Port J8:FLR
<E> Seapoint CHL Fluorometer
<F> Wetlabs CDOM Fluorometer
  Port J4i:SER
<H> ProOceanus CH4
<M> OceanServer5000 MotionPack ---- ENABLED
  Port J5i:SER
<K> ProOceanus CO2
Exit:
  <X> Save changes      <^C> Cancel changes
Selection [ ] ? p
Enable the "Biospherical PAR" [Y] ? y
Select 1 = QSP/QCP-2200, 2 = QSP/QCP-2300 (1-2) [1] ? 2
Enter number of measurements to average (1-100) [5] ? 10
```

Example: Averaging '10' causes the firmware to calculate a voltage average from 10 samples

Figure 9-3: System Configuration Menu

Using Bench Test Options

The Bench Tests menu provides an option to verify and change sensor settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the Profiler Main Menu, type 5 to display the Profiler Bench Tests Menu.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013
      McLane Research Laboratories, USA
      Pattern Profiler
      S/N: ML12345-01D

      Pattern Profiler
      Main Menu

      Wed Nov 13 10:00:55 2013
<1> Set Time          <5> Bench Test
<2> Diagnostics      <6> Deploy Profiler
<3> Flash Card Ops   <7> Offload Deployment Data
<4> Sleep            <8> Contacting McLane
<C> Configure
```

Figure 9-4: Profiler Main Menu

```
Configuration: MMP_IM_CT_CM_PA_SC          CF2 V5_00 of Dec 7 2012

      Bench Tests

      Fri Dec 7 13:30:20 2012

Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record

<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass

System evaluation:
<7> Motor operation
<8> Release Brake
<9> Independent Watchdog
<0> Estimate deployment endurance

System Sensor & Option Tests:
<I> Seabird Inductive Modem
<M> OceanServer5000 MotionPack
<P> Biospherical PAR

Exit:
<X> Main Menu
Selection [ ] ?
```

Figure 9-5: Profiler Bench Tests Menu

Direct Sensor Connection

1. From the main Profiler Bench Tests menu, type *P* Biospherical PAR.
2. Optionally change PAR samples to average for testing purposes.
3. Press [CTRL]-[C] to exit.

```
-----  
                          Bench Tests  
-----  
  
                          Thu Dec  6 16:17:44 2012  
Sensor Utilities:  
  
<1> Seabird 52MP CTD communication  
<2> Seabird 52MP CTD pressure  
<3> Seabird 52MP CTD average pressure  
<4> Seabird 52MP CTD temperature record  
<5> Nortek AquaDopp DVS communication  
<6> Nortek AquaDopp DVS tilt & compass  
  
System Evaluation:  
<7> Motor operation  
<8> Set Brake  
<9> Independent Watchdog  
<0> Battery endurance  
  
System Sensor & Option Tests:  
<I> Seabird Inductive Modem  
<M> OceanServer5000 MotionPack  
<P> Biospherical PAR  
<W> Wetlabs ECO BBFL2  
  
Exit:  
  
<X> Main Menu  
  
Selection [ ] ? p  
  
Enter number of PAR samples to average (1-100) [5] ?  
  
Press ^C to exit, or any other key to pause|continue.  
  
12/06/12 16:31:48 BII/PAR Powered on.  
12/06/12 16:31:48 BII/PAR 0.0 mV, 12.6Vb.  
12/06/12 16:31:49 BII/PAR 0.0 mV, 12.6Vb.  
12/06/12 16:31:50 BII/PAR 1.2 mV, 12.7Vb.  
12/06/12 16:31:51 BII/PAR 0.0 mV, 12.6Vb. ← PAR Analog Voltage  
12/06/12 16:31:52 BII/PAR 0.0 mV, 12.6Vb.  
12/06/12 16:31:53 BII/PAR 0.8 mV, 12.6Vb.  
12/06/12 16:31:54 BII/PAR 1.4 mV, 12.6Vb.  
12/06/12 16:31:55 BII/PAR 0.0 mV, 12.6Vb.
```

Figure 9-6: PAR Direct Communications

Connecting the PAR Sensor

To connect and install the PAR Q series sensors, complete the following steps (the QCP-2300 sensor is illustrated):

1. Connect the PAR sensor to the 4 pin bulkhead connector.
2. Gently slide the PAR sensor into the hole at the top of the MMP.



Figure 9-7: Connecting to the Bulkhead



Figure 9-8: Sliding in the PAR

3. Slide the white sensor clamp over the PAR and tighten the 8-32 socket cap screws.
4. Gently push the sensor clamp back into place.



Figure 9-9: Securing the Sensor Clamp



Figure 9-10: Re-inserting the Clamp

5. Using a hex screwdriver, tighten the 3/16 x 1" long nylon socket cap screws.
6. Replace the MMP Skin.



Figure 9-11: Tightening the Socket Cap Screws



Figure 9-12: PAR Sensor Installed

Removing the PAR Sensor

To disconnect and remove the PAR, complete the following steps:

1. Lay the MMP on its side on a stable surface and remove the Top skin.
2. Using a Hex driver (included in the toolkit), remove the 3/8-16 x 1" long nylon socket cap screws from the white PAR sensor clamp.
3. Loosen the sensor clamp.

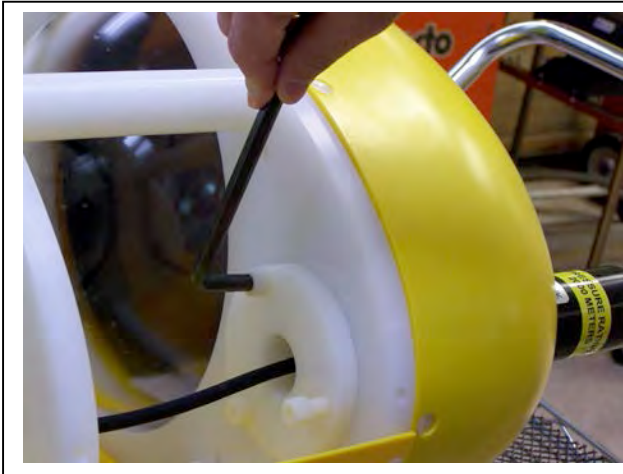


Figure 9-13: Unscrewing the Socket Cap Screws

Figure 9-14: Loosening the Sensor Clamp

4. Pull the sensor clamp out to expose the two 8-32 socket cap screws.
5. Using a screwdriver, loosen the 8-32 socket cap screws that hold the sensor in the clamp.



Figure 9-15: Pulling Out the Sensor Clamp

Figure 9-16: Loosening the Clamp Screws

6. While holding the PAR securely, gently pull the sensor out from the top of the MMP.
7. Remove the PAR from the bulkhead connector.



Figure 9-17: Pulling Out Sensor Clamp



Figure 9-18: Removing Bulkhead Connector

8. Cap the PAR sensor when not in use.



Figure 9-19: Placing the Cap on the PAR

Notes

Section 9.1

PAR QSP-2200 Sensor

MMP firmware release versions 5.00 and above support the Biospherical Instruments Inc QSP-2200 PAR. This irradiance sensor is depth-rated to 2000 meters. The QSP-2200 is a scalar irradiance sensor which produces an analog voltage output that is directly proportional to the incident irradiance upon the sensing plane of the collector.

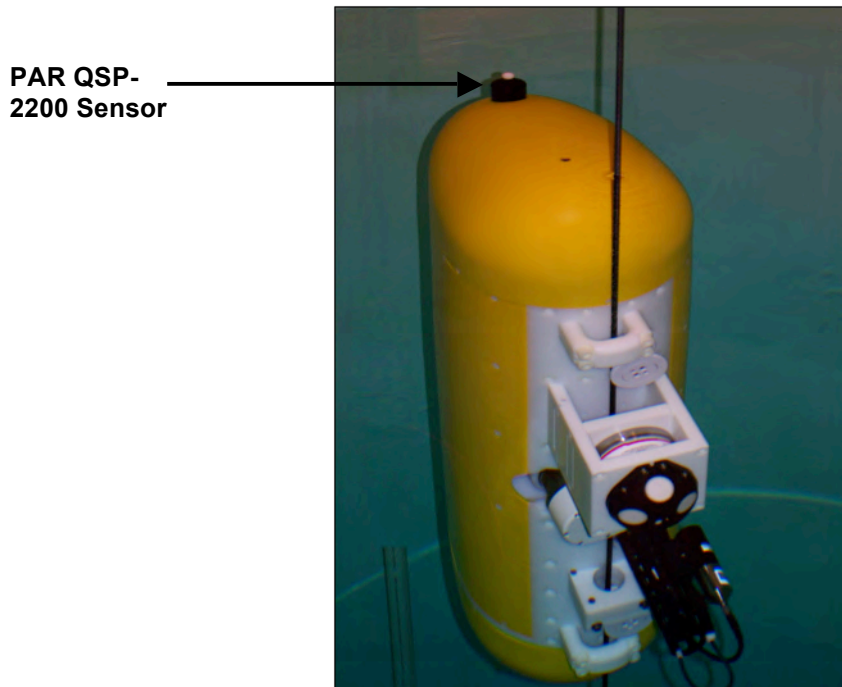


Figure 9.1-1: PAR QSP-2200 Sensor



Calculating irradiance with PAR data requires using the Calibration sheet provided with the sensor.

Notes

Section 9.2

PAR QCP-2300 Sensor

MMP Release versions 4.09 or 4.20 and above support the Biospherical Instruments Inc QCP-2300 PAR. This irradiance sensor is depth-rated to 2000 meters. The model QCP-2300 is designed for use with commercially available CTD's and dataloggers that require an analog voltage as signal input.

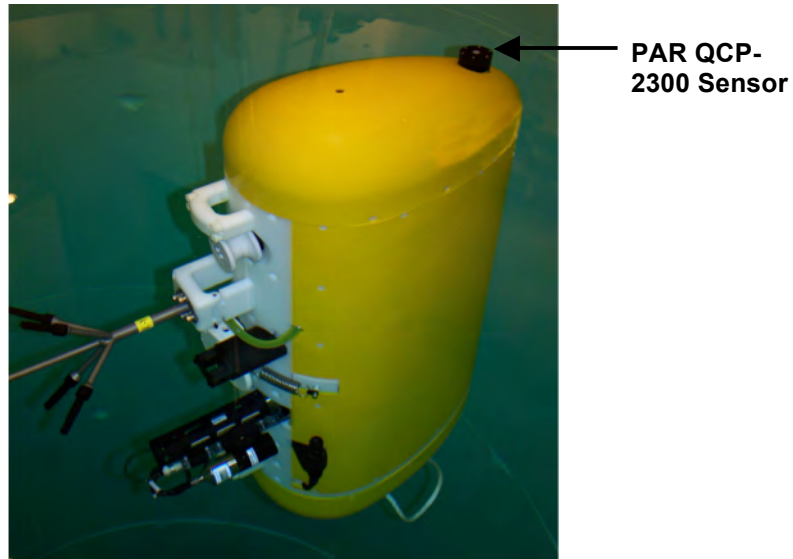


Figure 9.2-1: MMP with PAR QCP-2300 Sensor



Calculating irradiance with PAR data requires using the Calibration sheet provided with the sensor.

Notes

Chapter 10

Seapoint Turbidity/Fluorometer – General Info

The Seapoint Turbidity Meter detects light scattered by particles suspended in water. The Seapoint Chlorophyll Fluorometer (SCF) is a high-performance, low power instrument for in situ measurements of chlorophyll.

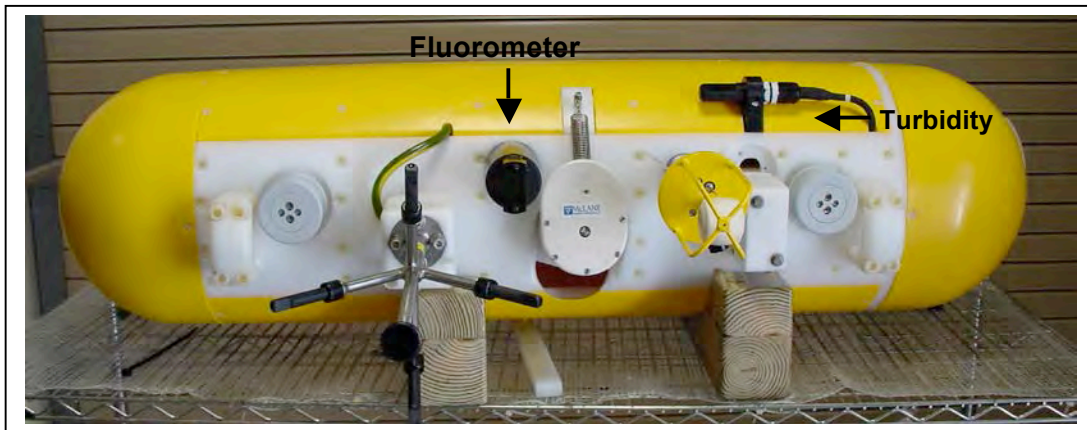


Figure 10-1: MMP with Turbidity and Fluorometer Sensors

Collecting Data with the Turbidity Sensor

Seapoint Turbidity data is logged as voltage and displayed in the Engineering File, as shown next.

Date	Time	[mA]	[V]	[dbar]	Turb[mV]	Gain	Oxygen[uM]	Optode
Profile 2								
Sensors were turned on at 05/21/2014 08:43:25								
Vehicle began profiling at 05/21/2014 08:45:02								
Temp[C]								
05/21/2014	08:45:02	-19	11.5	0.000	1338.60	1	16014.64	0.00
05/21/2014	08:45:17	40	11.5	0.000	1338.80	1	16014.64	0.00
05/21/2014	08:45:31	40	11.5	0.010	1339.40	1	259.20	21.93
05/21/2014	08:45:46	39	11.5	0.010	1339.80	1	259.33	21.93
05/21/2014	08:46:01	39	11.5	0.000	1340.20	1	259.41	21.93
Ramp exit: SMOOTH RUNNING								
Profile exit: TIMER EXPIRED								
Vehicle motion stopped at 05/21/2014 08:46:05								
Sensor logging stopped at 05/21/2014 08:48:08								

Figure 10-2: ENG File with Turbidity Data

Configuring the Firmware to Use Turbidity/Fluorometer Sensors

The Profiler System Configuration Menu specifies the active sensors.. To enable the Turbidity or Fluorometer sensors, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select <T> Seapoint Turbidity or <E> Seapoint CHL Fluorometer and then type *Y* to enable the sensor.

```
Config: MPP_IM_CT_CM_PA_SC_MP_NI                CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                System Configuration
-----
                Tue Mar 11 15:37:44 2014
System Parameters:
<0> Battery capacity                240 Ah
Sensor Suite:
  Port J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
<2> Nortek AquaDopp DVS ----- ENABLED AquaDopp-2
  Port J6:IMM
<I> Telemetry ----- ENABLED IMM @ 1200 baud
  Port J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA 1 Dk, 3 Lt ----- ENABLED
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2 ----- ENABLED
Port J10:SPR
<L> Wetlabs ECO FLBB(RT)/D
<P> Biospherical PAR -----
  Port J7:TRB
<T> Seapoint IR Turbidity ----- ENABLED @ 3 samp/avg ←
  Port J8:FLR
<E> Seapoint CHL Fluorometer ----- ENABLED ←
<F> Wetlabs CDOM Fluorometer
  Port J4i:SER
<H> ProOceanus CH4
<M> OceanServer5000 MotionPack ---- ENABLED
  Port J5i:SER
<K> ProOceanus CO2
Exit:
<X> Save changes    <^C> Cancel changes
      Selection [ ] ? t
Enter number of measurements to average (1-100) [10] ? 3
```

Figure 10-3: System Configuration Menu

Using Bench Test Options

The Bench Tests menu provides an option to verify and change sensor settings prior to deployment. The main Bench Tests menu displays only options that are available to installed sensors.

1. From the Profiler Main Menu, type 5 to display the Profiler Bench Tests Menu.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.09 of Oct 19 2013
      McLane Research Laboratories, USA
      Pattern Profiler
      S/N: ML12345-01D

-----
      Pattern Profiler
      Main Menu

-----
      Wed Nov 13 10:00:55 2013
<1> Set Time          <5> Bench Test
<2> Diagnostics      <6> Deploy Profiler
<3> Flash Card Ops   <7> Offload Deployment Data
<4> Sleep            <8> Contacting McLane
<C> Configure
```

Figure 10-4: Profiler Bench Tests Menu

```
Configuration: MMP_IM_CT_CM_PA_SC          CF2 V5_00 of Dec 7 2012

-----
      Bench Tests

-----
      Fri Dec 7 13:30:20 2012

Sensor Utilities:
<1> Seabird 52MP CTD communication
<2> Seabird 52MP CTD pressure
<3> Seabird 52MP CTD average pressure
<4> Seabird 52MP CTD temperature record

<5> Nortek AquaDopp DVS communication
<6> Nortek AquaDopp DVS tilt & compass

System evaluation:
<7> Motor operation
<8> Release Brake
<9> Independent Watchdog
<0> Estimate deployment endurance

System Sensor & Option Tests:
<I> Seabird Inductive Modem
<E> Seapoint CHL Fluorometer
<T> Seapoint IR Turbidity

Exit:
<X> Main Menu
Selection [] ?
```

Figure 10-5: Profiler Main Menu

Direct Sensor Connection

1. From the main Profiler Bench Tests menu, type *T* Seapoint Turbidity.
2. Optionally change samples to average for testing purposes.
3. Press [CTRL]-[C] to exit.

```
-----  
Bench Tests  
-----  
  
Thu Dec 6 16:17:44 2012  
Sensor Utilities:  
  
<1> Seabird 52MP CTD communication  
<2> Seabird 52MP CTD pressure  
<3> Seabird 52MP CTD average pressure  
<4> Seabird 52MP CTD temperature record  
<5> Nortek AquaDopp DVS communication  
<6> Nortek AquaDopp DVS tilt & compass  
  
System Evaluation:  
<7> Motor operation  
<8> Set Brake  
<9> Independent Watchdog  
<0> Battery endurance  
  
System Sensor & Option Tests:  
<I> Seabird Inductive Modem  
<E> Seapoint CHL Fluorometer  
<T> Seapoint IR Turbidity  
  
Exit:  
  
<X> Main Menu  
  
Selection [] ? t  
  
Set Turbidity Sensor Gain:  
  
  <A> Automatic  
  <1> Fixed 1X  
  <2> Fixed 5X  
  <3> Fixed 20X  
  <4> Fixed 100X  
  
Selection [A] ? a  
  
Enter number of measurements to average (1 to 100) ? 3  
Press ^C to exit, or any other key to pause|continue.
```

Figure 10-6: Set Turbidity Gain

05/21/2014 13:51:54	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:51:56	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:51:57	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:51:58	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:51:59	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:00	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:01	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:02	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:03	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:04	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:05	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:06	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:07	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:08	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:09	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:10	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:11	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:12	Turbidity:	100.37 FTU	4015 mV, 20X	Battery: 11.1 V
05/21/2014 13:52:14	Turbidity:	114.47 FTU	1145 mV, 05X	Battery: 11.1 V
05/21/2014 13:52:15	Turbidity:	114.43 FTU	1144 mV, 05X	Battery: 11.1 V
05/21/2014 13:52:16	Turbidity:	112.47 FTU	1125 mV, 05X	Battery: 11.1 V
. . .	← Display shortened for brevity			
05/21/2014 13:52:30	Turbidity:	349.67 FTU	699 mV, 01X	Battery: 11.1 V
05/21/2014 13:52:31	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:33	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:34	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:35	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:36	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:37	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:38	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:39	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V
05/21/2014 13:52:40	Turbidity:	0.00 FTU	0 mV, 100X	Battery: 11.1 V

Figure 10-7: Turbidity Direct Communications

Turbidity/Fluorometer Shared Bulkhead Implementation

If both of these sensors are installed on the Profiler, the implementation may share a single bulkhead. As shown in Figures 10-8 the MMP End Cap with a 12-pin center MCBH bulkhead connector is wired to both the Fluorometer and Turbidity Sensors.

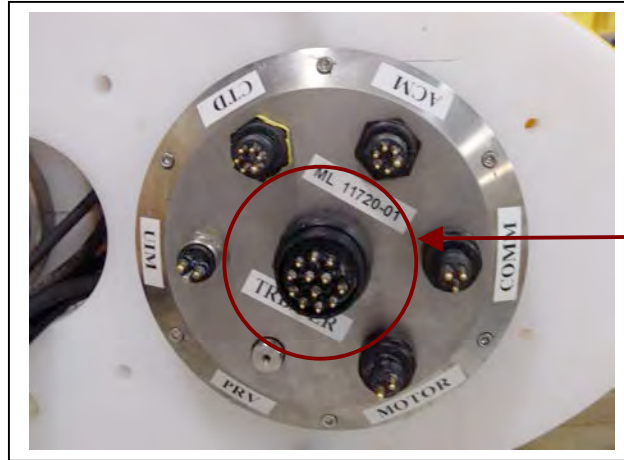


Figure 10-8: MMP with Turbidity and Fluorometer MCBH Connector

Notes

Chapter 11

Inductive Communications

The inductive communications option can transmit deployment files near real-time. This option requires a customer-supplied surface controller package. The following inductive communications coils are integrated with the Profiler firmware and hardware:

- Sea-Bird IMM (1200 baud rate inductive telemetry)
- RBR MLM (4800 baud rate inductive telemetry)

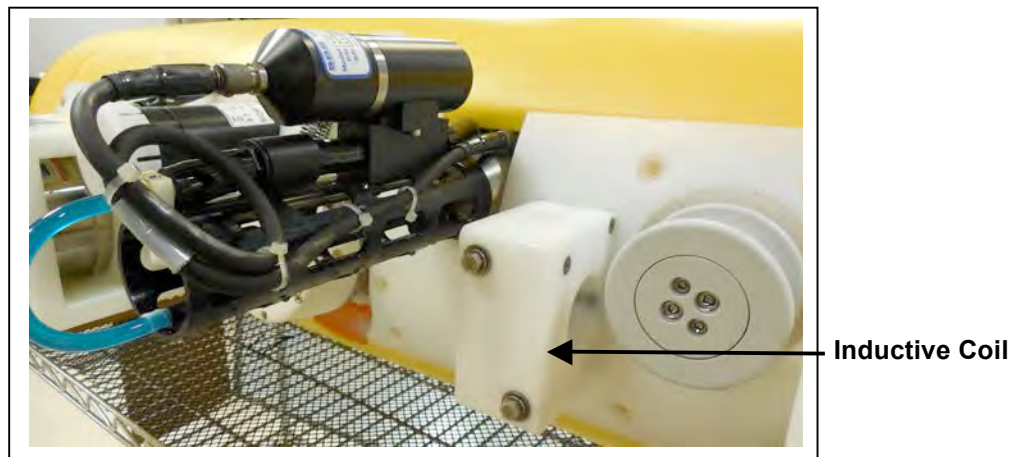


Figure 11-1: Inductive Coil



Regardless of Inductive Modem model, the Profiler firmware use the same Transmission Protocol. Refer to Appendix A in this User Manual, ‘Inductive File Transmission Protocol’ for details about inductive commands. The Sea-Bird UIM is an obsolete inductive modem. This inductive option is documented in Appendix B in this User Manual ‘Sea-Bird UIM’.

This chapter describes the inductive options in the order below.

Inductive Communications Chapter Contents	
Section	Topic
11.1	Sea-Bird Inductive Model Module (IMM)
11.2	RBR Mooring Line Modem (MLM)



Patterned profiling is a deployment programming method available through a McLane application called Deployment Planner. This programming method also has inductive settings. Refer to the section on Deployment Planner in the MMP User Manual for more detailed information about inductive profiles and the Deployment Planner.

Configuring the Firmware to Use Inductive Communications

The Profiler System Configuration menu specifies the active sensors. To enable Inductive Telemetry, complete the following steps:

1. From the Main Menu type *c* and enter the password *configure*.
2. Select <I>. An option to select the type of inductive telemetry displays.

```
Config: MPP_IM_CT_CM_PA_SC_MP_NI                CF2 V5.12 of Feb 11 2014
-----
                Pattern Profiler
                System Configuration
-----
                Tue Mar 11 15:37:44 2014
System Parameters:
<0> Battery capacity                240 Ah
Sensor Suite:
  Port J9:CTD
<1> Seabird 52MP CTD ----- ENABLED
  Port J5:ACM
<2> Nortek AquaDopp DVS ----- ENABLED AquaDopp-2
  Port J6:IMM
<I> Telemetry ----- ENABLED IMM @ 1200 baud
  Port J4:SSP
<B> BioSuite Triplet/PAR
<N> Satlantic SUNA 1 Dk, 3 Lt Enabled
<O> Aanderaa Optode
<U> bbe FluoroProbe
<W> Wetlabs ECO BBFL2 ----- ENABLED
Port J10:SPR
<L> Wetlabs ECO FLBB(RT)/D
<P> Biospherical PAR ----- ENABLED @ 5 samp/avg
  Port J7:TRB
<T> Seapoint IR Turbidity
  Port J8:FLR
<E> Seapoint CHL Fluorometer
<F> Wetlabs CDOM Fluorometer
  Port J4i:SER
<H> ProOceanus CH4
<M> OceanServer5000 MotionPack ---- ENABLED
  Port J5i:SER
<K> ProOceanus CO2
Exit:
<X> Save changes    <^C> Cancel changes

Selection [X] ? i
Enable the "Inductive Telemetry" [Y] ?

Select 1 = UIM, 2 = IMM, 3 = MLM (1-3) [0] ? 2 ← Inductive Settings
```

Figure 11-2: Select Telemetry Type

Notes

Section 11.1

Sea-Bird Inductive Model Modem (IMM)

Profiler firmware versions 4.16/4.26 and higher support the Sea-Bird IMM board (with an inductive coupler around the mooring wire. A surface controller with a Sea-Bird IMM board (the SIMM) is also required for this option. This section describes SIMM/UIMM functions.



Regardless of Inductive Modem, the Profiler Firmware uses the same Transmission Protocol. Refer to Appendix A in this User Manual, ‘Inductive File Transmission Protocol’ for details about inductive commands.



Figure 11.1-1: Sea-Bird IMM Modem

Advanced Interface Options – Inductive Communications

The options that display on the Advanced Interface menu are sensor-dependent. When Inductive Communications are active, several options display for Inductive Communications settings. Advanced Interface settings are critical controls for inductive communications performance. Carefully review the option definitions provided in this section or contact McLane (www.mclanelabs.com) for more information.



Menu commands with “IMM” refer specifically to the Seabird IMM (Inductive Modem Module) and are only available if the Seabird IMM is attached and enabled. Command descriptions with “IM” refer generically to all Profiler inductive modem hardware variations.

```
Configuration: MPP_IM_CT                CF2 V5.00 of Jan  3 2013

-----
                Pattern Profiler
                Advanced Interface
-----
                Fri Jan  4 11:07:35 2013
<0> FullSpeed                0.250 dbar/sec
<1> PR Threshold              0.045 dbar/sec
<2> PR TimeThreshold          180 seconds
<3> Sensor warmup            120 seconds
<4> Sensor warmdown          120 seconds

<5> FSI/CTD Bytes/Second     17 bytes/sec
<6> SBE/41CP Bytes/Second    9 bytes/sec
<7> SBE/52MP Bytes/Second    11 bytes/sec
<8> FSI/ACM Bytes/Second     33 bytes/sec

<D> Display verbose messages  YES
<H> History reset
<M> profiling Mode            PATTERN
<N> adjust profile couNter    -1
<P> caPture file enabled      NO

<F> IMM use Force capture line  YES
<K> IM ACK/NAK reply timer    100 seconds
<L> IM Listening loop timer     40 seconds
<S> IMM configure Surface modem  NO
<W> IMM send Wakeup tone      YES
<X> Save any changes          <^C> Discard changes
```

← IMM and Inductive Options

Figure 11.1-2: Inductive Telemetry Settings on the Advanced Interface Menu

IMM Use Force Capture Line

Option <F> issues a forced capture line to the modem. If set to 'Yes', the modem will use the line regardless of whether noise is present. If this is 'No', the modem will not use the line until it detects the line is free.

```
Selection [X] ? f
IMM use Force capture line (Yes/No) [N] Yes
```

Figure 11.1-3: IMM use Force Capture Line

IM ACK/NAK Reply Timer

Option <K> sets the number of seconds the profiler firmware waits for a reply/response from the modem after each data packet is sent. If the maximum number of seconds are exceeded, the firmware goes to the next reply/response attempt. After a total of three attempts, the firmware moves to the next data packet. The default is 100 seconds. The timer can be changed to between 30 and 300 seconds.

IM Listening Loop Timer

Option <L> sets the number of seconds the profiler listens for the inductive modem command from the surface controller. The profiler waits the number of specified seconds for three separate attempts. After a third attempt where no surface command is detected the profiler advances to the next profile. The default is 40 seconds. The timer can be changed to between 30 and 300 seconds.

IMM Configure Surface Modem

Option <S> displays for inductive communications only if Patterned Profiling is the profiling mode. If the entry is 'Yes' the Profiler firmware automatically configures the surface controller modem. If the value is 'No' the Profiler will not configure the surface controller modem. This option requires the password *surface*.

IMM Send Wakeup Tone

Option <W> controls whether or not the Profiler sends a wakeup signal to the surface controller. Some surface packages may not require a wakeup tone.

Using Bench Test Options

The main Bench Test and Inductive Modem Bench Test menus provide options to verify and change inductive settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu, type 5 at the prompt to display the main Bench Tests Menu.

```
Config: MPP_CT                               CF2 V5.00 of Jan 11 2013
                                           _____
                                           McLane Research Laboratories, USA
                                           Pattern Profiler
                                           S/N: ML12345-001
                                           _____
                                           Main Menu
                                           _____
                                           Tue Feb 19 07:16:21 2013
<1> Set Time                               <5> Bench Test ←
<2> Diagnostics                            <6> Deploy Profiler
<3> Flash Card Ops                         <7> Offload Deployment Data
<4> Sleep                                  <8> Contacting McLane
<C> Configure
```

Figure 11.1-4: Profiler Main Menu

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP           CF2 V5.13 of May 05 2014
                                           _____
                                           Pattern Profiler
                                           Bench Tests
                                           _____
                                           Tue May 6 09:01:52 2014

CTD utilities:
<1> Seabird 41CP CTD communication
<2> Seabird 41CP CTD pressure
<3> Seabird 41CP CTD average pressure
<4> Seabird 41CP CTD temperature record

System evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<D> Detailed schedule
<S> Recover schedule

Sensor & Option tests:
<I> Seabird Inductive Modem

Exit:
Selection [ ] ? m
```

Figure 11.1-5: Profiler Bench Tests Menu

2. From the main Bench Tests menu, type **I** at the prompt to display the Seabird IMM Bench Test Menu (Figure 11.1-6).
3. Type **I** to connect directly with the IMM.

```
-----  
Config: MPP_IM_CT                               CF2 V5.13 of May 15 2014  
  
-----  
                Pattern Profiler  
Seabird Inductive Modem Bench Test Menu  
-----  
  
                Tue May 27 11:30:32 2014  
  
<1> Direct communications (9600 Baud) ← Direct Communications  
<2> restore McLane parameters  
<3> restore Factory parameters  
<4> Report parameter settings  
<5> Single transaction  
<6> Telemetry session  
  
<M> return to previous Menu  
  
Selection [] ? 1  
  
05/27/14 11:31:19 SBE/IMM   Press ^C to terminate COMM session.  
05/27/14 11:31:19 SYSTEM   Press ^B to change or confirm Baud rate.  
  
05/27/14 11:31:20 SBE/IMM   9.6 kBaud communication channel opened.  
05/27/14 11:31:20 SBE/IMM   Powered on.
```

Figure 11.1-6: IMM Bench Test Menu



The Profiler communicates with the Sea-Bird IMM at 9600 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 11.1-7). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` ,ò10x-Ê‡-ò-ûfxf10òx-Û10ò-òÄ-Ê
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 11.1-7: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu (Figure 11.1-6) displays the Baud Rate menu (Figure 11.1-8). Use this menu option to temporarily connect at the sensor's current baud rate. Once connected to the sensor, change to the Profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Select new Baud rate
-----
                Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600
<G> Go to COMM session
      Selection  [] ? g
```

Figure 11.1-8: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the IMM, typing commands at the command prompt provides additional sensor information.

```
Selection [] ? 1

05/27/14 11:31:19 SBE/IMM Press ^C to terminate COMM session.
05/27/14 11:31:19 SYSTEM Press ^B to change or confirm Baud rate.

05/27/14 11:31:20 SBE/IMM 9.6 kBaud communication channel opened.
05/27/14 11:31:20 SBE/IMM Powered on.

*****
<PowerOn/>
IMM>getsd
<StatusData DeviceType='SBE90554 IMM' SerialNumber='70002367'>
<HostID>Host ID not set</HostID>
<EventSummary numEvents='7'/>
<Power><TransmitVoltage>9.1</TransmitVoltage></Power>
<SampleDataSummary NumSamples='0' TotalLen='0' FreeMem='16384'/>
<HostFileSummary Len='0' CRC='0xFFFFFFFF'/>
<LineStatus>BUSY</LineStatus>
</StatusData>
<Executed/>
IMM>getcd
<ConfigurationData DeviceType='SBE90554 IMM' SerialNumber='70002367'>
<Settings ConfigType='2'
DebugLevel='2'
BaudRate='9600'
HostID='Host ID not set'
GdataStr='GDATA'
HostPrompt='x'
ModemPrompt='IMM>'
DeviceID='1'
EnableHostFlagWakeup='0'
EnableHostFlagConfirm='0'
EnableHostFlagTerm='0'
EnableSerialIMMWakeup='1'
EnableHostPromptConfirm='1'
EnableHostServeOnPwrup='0'
EnableAutoIMFlag='1'
EnablePrompt='1'
EnableHostWakeupCR='1'
EnableHostWakeupBreak='0'
EnableEcho='0'
EnableSignalDetector='1'
EnableToneDetect='0'
EnableFullPwrTX='0'
EnableBackSpace='1'
EnableGDataToSample='0'
EnableStripHostEcho='0'
EnableBinaryData='1'
```

Figure 11.1-9: IMM Direct Communications (screen 1 of 2)

```

SerialType='1'
TermToHost='254'
TermFromHost='255'
SerialBreakLen='5'
MaxNumSamples='40'
GroupNumber='0'
THOST0='0'
THOST1='5'
THOST2='3000'
THOST3='12000'
THOST4='100'
THOST5='5'
TMODEM2='3000'
TMODEM3='18000'
TMODEM4='100'
/>
</ConfigurationData>
<Executed/>
IMM>gethd
<HardwareData DeviceType='SBE90554 IMM' SerialNumber='70002367'>
<Manufacturer>Sea-Bird Electronics, Inc</Manufacturer>
<HardwareVersion>41420H</HardwareVersion>
<HardwareVersion>PCB Type 3, 10345B</HardwareVersion>
<MfgDate>2014-03-05</MfgDate>
<FirmwareVersion>1.14 Jan 13 2012 16:32:44</FirmwareVersion>
<FirmwareLoader>MSP LOADER RS232 57.6K 2007-02-08</FirmwareLoader>
</HardwareData>
<Executed/>
IMM> [^C]
*****

05/27/14 11:31:36 SBE/IMM Powered off.
05/27/14 11:31:36 SBE/IMM 9.6 kBaud communication channel closed.

```

Figure 11.1-10: IMM Direct Communications (screen 2 of 2)

Restore McLane and Factory Settings

Option <2> and <3> from the Seabird Inductive Modem Bench Test menu restores the McLane or Sea-Bird factory settings. Figure 11.1-11 shows a reset of the McLane-defined parameters. Using option <2> requires typing the password *mcl*.

```
Selection [] ? 2 Password: ***

06/03/14 09:45:04 SBE/IMM 9.6 kBaud communication channel opened.

06/03/14 09:45:04 SBE/IMM Powered on.
06/03/14 09:45:04 SBE/IMM Sending command [\r\n].
06/03/14 09:45:19 SBE/IMM Sending command [SETDEBUGLEVEL=2]. .

06/03/14 09:45:20 SBE/IMM Sending command [SETTERMFROMHOST=255].
06/03/14 09:45:20 SBE/IMM Sending command []. . .
06/03/14 09:45:20 SBE/IMM Sending command []. . .
06/03/14 09:45:20 SBE/IMM Sending command [SETModemPrompt=IMM>]. . .
06/03/14 09:45:21 SBE/IMM Sending command [SETDebugLevel=2]. . .
06/03/14 09:45:22 SBE/IMM Sending command [SETDeviceID=1]. . .
06/03/14 09:45:22 SBE/IMM Sending command [SETEnableAutoIMFlag=1]. . .
06/03/14 09:45:23 SBE/IMM Sending command [SETEnableBackSpace=1]. . .
06/03/14 09:45:23 SBE/IMM Sending command [SETEnableBinaryData=1]. . .
06/03/14 09:45:24 SBE/IMM Sending command [SETEnableEcho=0]. . .
06/03/14 09:45:25 SBE/IMM Sending command [SETEnableFullPwrTX=0]. . .
06/03/14 09:45:25 SBE/IMM Sending command [SETEnableGDataToSample=0].
. .
. . .

06/03/14 09:45:43 SBE/IMM Sending command [SETTMODEM4=100]. . .
06/03/14 09:45:44 SBE/IMM Sending command [SETSerialType=1]. . . . .
06/03/14 09:45:44 SBE/IMM Sending command [SETSerialType=1]. . .
06/03/14 09:45:46 SBE/IMM Sending command [].
06/03/14 09:45:46 SBE/IMM Sending command []. .
06/03/14 09:45:46 SBE/IMM Sending command [SETBaudRate=9600]. . . . .
06/03/14 09:45:47 SBE/IMM Sending command [SETBaudRate=9600]. . .
06/03/14 09:45:48 SBE/IMM Sending command [].
06/03/14 09:45:49 SBE/IMM Sending command [].
06/03/14 09:45:49 SBE/IMM Was able to restore McLane parameters.
06/03/14 09:45:49 SBE/IMM Powered off.
06/03/14 09:45:49 SBE/IMM Power-down delay . . . . .
06/03/14 09:45:51 SBE/IMM 9.6 kBaud communication channel closed.
```

Figure 11.1-11: Option <2> Restore McLane Settings

Option <3> 'Restore factory parameters' (not shown) restores the configuration parameters delivered with the SBE Inductive Modem. Option <3> requires the password factory.



The firmware requires the Sea-Bird parameters configured by McLane. Changing settings, or resetting to the factory settings prevents the IMM from working correctly with the Profiler.

Display Current Settings

Option <4> 'Report Parameter Settings' is active only for the RBR MLM inductive modem. See Section 11.2 in this User Manual for more information about the RBR Inductive Modem.

```
Config: MMP_IM_CT_CM                      CF2 V5.15 of Jun 17 2014
-----
                Standard Profiler
      Seabird Inductive Modem Bench Test Menu
-----
                Mon Jun 23 12:54:53 2014

<1> Direct communications (9600 Baud)
<2> restore McLane parameters
<3> restore Factory parameters
<4> Report parameter settings
<5> Single transaction
<6> Telemetry session

<M> return to previous Menu

Selection [] ? 4

06/23/14 12:54:56 SBE/IMM NOTICE! ReportParameterSettings() has not been
implemented.
```

Figure 11.1-12: Option <4> Report Parameter Settings

Single Transaction

Option <5> displays a single inductive file transmission.

```
Selection [ ] ? 5

06/03/14 09:45:57 SBE/IMM 9.6 kBaud communication channel opened.
06/03/14 09:45:57 SBE/IMM Powered on.
06/03/14 09:45:57 SBE/IMM Sending command [\r\n].
06/03/14 09:46:12 SBE/IMM Sending command [SETDEBUGLEVEL=2]. .
06/03/14 09:46:13 SBE/IMM Sending command [SETTERMFROMHOST=255]. .
06/03/14 09:46:13 SBE/IMM Sending command []. .
06/03/14 09:46:13 SBE/IMM Sending command []. .
06/03/14 09:46:13 SBE/IMM Sending command [GETCD].
.....
06/03/14 09:46:17 SBE/IMM Sending command [FORCECAPTURELINE]. .
06/03/14 09:46:18 SBE/IMM Sending command [SENDWAKEUPTONE]. ...
06/03/14 09:46:22 SBE/IMM Sending command [#G0:@@MMP/ML13198-07/001/01]. .
06/03/14 09:46:23 SBE/IMM Sending command [RELEASELINE]. .
06/03/14 09:46:24 SBE/IMM Sending command [PWROFF]. .
06/03/14 09:46:25 SBE/IMM Listening attempt 1 of 3.
06/03/14 09:46:32 SBE/IMM Received [REQNEW] command.
06/03/14 09:46:33 SYSTEM Sending PROFILES.DAT.
06/03/14 09:46:33 SYSTEM Sending 52 bytes of packet 0 (metadata) ...
06/03/14 09:46:33 SYSTEM Waiting for ACK|NAK . . . Received ACK
06/03/14 09:46:35 SYSTEM Sending 4 bytes of file data.
06/03/14 09:46:35 SYSTEM Sending 12 bytes of packet 1 (hdr+data) ...
06/03/14 09:46:35 SYSTEM Waiting for ACK|NAK . . . Received ACK
06/03/14 09:46:37 SYSTEM Sending 8 bytes of packet 2 (crc) ...
06/03/14 09:46:38 SYSTEM Uploaded 4 bytes in 3 seconds. ~1 CPS.
06/03/14 09:46:38 SBE/IMM Processed [REQNEW] command.
06/03/14 09:46:43 SBE/IMM Received [REQNEW] command.
06/03/14 09:46:44 SYSTEM Sending ENDOFDAT.DAT.
06/03/14 09:46:45 SBE/IMM Processed [REQNEW] command.
06/03/14 09:46:49 SBE/IMM Received [REQEOD] command.
06/03/14 09:46:49 SYSTEM Sending ENDOFDAT.DAT.
06/03/14 09:46:50 SBE/IMM Processed [REQEOD] command.
06/03/14 09:46:51 SBE/IMM Powered off.
06/03/14 09:46:51 SBE/IMM Power-down delay .....
06/03/14 09:46:53 SBE/IMM 9.6 kBaud communication channel closed.
```

Figure 11.1-13: Option <5>Single Transaction

Telemetry Session

Option <6> provides a test telemetry session.

```
Selection [ ] ? 6

Enter session interval in seconds [5] (0-86400) [0] ?
Enter the first profile to send [0] (0-9999) [0] ? 0
Enter the starting value of ProfileCounter [0] (0-9999) [0] ? 0

05/27/14 11:31:51 SYSTEM Creating PROFILES.DAT ... done.
05/27/14 11:31:52 SYSTEM Creating LASTSENT.DAT ... done.
05/27/14 11:31:52 SYSTEM Renaming E????????.DAX .... done.
05/27/14 11:31:52 SYSTEM Renaming S????????.DAX .... done.
05/27/14 11:31:52 SYSTEM Updating PROFILES.DAT ... done.
05/27/14 11:31:53 SYSTEM E0000000.DAT exists.
05/27/14 11:31:53 SYSTEM Creating E0000001.DAT from E0000000.DAT.
05/27/14 11:31:53 SYSTEM Copying E0000000.DAT to E0000001.DAT.

E0000000.DAT

    1 file(s) copied
05/27/14 11:31:53 SYSTEM C0000000.DAT exists.
05/27/14 11:31:53 SYSTEM Creating C0000001.DAT from C0000000.DAT.
05/27/14 11:31:53 SYSTEM Copying C0000000.DAT to C0000001.DAT.

C0000000.DAT

    1 file(s) copied

05/27/14 11:31:54 SYSTEM IM session 1 will begin at 05/27/14 11:31:52.Awake
05/27/14 11:31:54 SYSTEM Waking and proceeding.
05/27/14 11:31:54 SYSTEM Starting IM session 1.
05/27/14 11:31:55 SBE/IMM 9.6 kBaud communication channel opened.
05/27/14 11:31:55 SBE/IMM Powered on.
05/27/14 11:31:55 SBE/IMM Sending command [\r\n].

. . . ← Display shortened for brevity

05/27/14 11:37:19 SBE/IMM Sending command [SETDEBUGLEVEL=2]. . .
05/27/14 11:37:20 SBE/IMM Sending command [SETTERMFROMHOST=255]. . .
05/27/14 11:37:20 SBE/IMM Sending command []. . .
05/27/14 11:37:20 SBE/IMM Sending command []. . .
05/27/14 11:37:20 SBE/IMM Sending command [GETCD].
..... [^C]
05/27/14 11:37:24 SYSTEM Command attempt 2 of 3.
05/27/14 11:37:24 SBE/IMM Powered off. [^C]
05/27/14 11:37:24 SBE/IMM 9.6 kBaud communication channel closed.
```

Figure 11.1-14: Option <6> Telemetry Session

Offloading Last Sent Data

Offload Logging Files is a screen display of files that the Profiler records during the deployment. Option <5> 'Last sent' displays the last Inductive file transmitted to the Profiler firmware.

```
-----  
Config: MPP_IM_CT_CM                               CF2 V5.10 of Nov  4 2013  
  
-----  
                Pattern Profiler  
            Offload Logging Files Menu  
-----  
                Tue Jan  7 09:47:09 2014  
  
Select log to offload:  
<1> PROFILES.DAT  
<2> DEPLOY.DAT  
<3> IRQ_XCPT.LOG  
<4> Profile Termination Log  
<5> Last sent  
<6> Deployment Termination Condition  
  
<M> previous Menu  
  
Selection [] ? 5  
  
01/07/14 09:47:10  SYSTEM Reading LASTSENT.DAT ... done.  
  
Oldest profile transmitted is -1  
  
Press any key to continue.
```

Figure 11.1-15: Option <5> Last Sent

Sea-Bird SIMM/UIMM Communication Session Overview

Below is an overview of a communication session between the SIMM, the UIMM, and the Profiler.

1. The sequence begins with the SIMM powered off.
2. At the completion of a profile, the Profiler powers on the UIMM.
3. The UIMM takes control of the inductive line
4. The UIMM sends a Wakeup tone to wake the SIMM
5. The Profiler sends an identification string to the SIMM via the UIMM.
6. The SIMM takes control of the inductive line.
7. The Profiler listens to the UIMM for commands transmitted by the SIMM.
8. If a command is received within the allowed time period:
 - a. If the command is to terminate the session, go to step 9.
 - b. If no command is received within the allowed time period, go to step 9.
 - c. Otherwise, process the command and go to step 7.
9. The Profiler terminates the session and continues its programmed deployment.
10. The SIMM releases the inductive line.

Sea-Bird IMM Communication Session Command Sequence

The next section describes technical details of the telemetry session including sample command transmission sequences, and data formats. The file transmission protocol is listed in Appendix A ‘Inductive File Transmission Protocol’ in this User Manual.

The Wakeup/Identification/Listen pattern repeats three times. If no commands are received after the third attempt, the Profiler terminates the session and continues the programmed deployment.

- Step 1 – Wakeup–Profile completion Profiler powers on the UIMM. Sends Wakeup tone and identification through the UIM to the SIMM (see table shown next).
- Step 2 – Identification–IMM receives the Wakeup/Identification messages.
- Step 3 – Listen–Profiler begins the transmission session by listening for commands for three 40 second cycles. If no commands are received after the third attempt, the Profiler terminates the session and continues the programmed deployment.
- Step 4 – Begin Transmission Session – Profiler receives an inductive file transmission protocol command (see Appendix A in this User Manual).

Identification Messages: Wakeup/Identification	
SIMM Received messages	Description
WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED	Generated by Profiler’s UIMM for ~5 seconds if 'send wakeup tone' is enabled.
@@@MMP/ML12345-67/001/01	ID generated by Profiler contains: @@@MMP/SerialNumber/MooringID/UIMM-DeviceID

Sea-Bird IMM Sample Transmission Session

During the three 40 second listening attempts, the SIMM can respond by capturing the inductive line (CAPTURELINE or FORCECAPTURELINE) and then sending commands to the UIMM. If addressed correctly, the UIMM passes the commands to the Profiler. For example, if the SIMM wants to request the latest un-transmitted file the following would occur.



Options on the Advanced Interface Menu (Figure 11.1-2) set the number of seconds the Profiler listens for the inductive modem command and for the ACK/NAK reply from the surface controller. The Listening Loop default is 40 seconds. The ACK/NAK Reply Timer default is 100 seconds. The timer can be changed to between 30 and 300 seconds.

1. The SIMM sends a `#ddREQNEW` command to the MMP (where `dd` is the UIMM's DeviceID.) The command REQNEW is passed to the Profiler by the UIMM.
2. The Profiler responds by sending the next file available from the files collected since the last successful transmission. The data is sent in packets and the transaction process requires the surface to acknowledge receipt of each packet. If no new file exists, an End-of-Data packet is sent. The Profiler waits for another command.
3. The SIMM responds to each packet with a REQACK or a REQNAK, depending on whether the packet was received correctly.
4. After the last packet has been sent and acknowledged, the Profiler sends a Cyclical Redundancy Check (CRC) packet that contains only a packet header (no data content). This packet does not expect an acknowledgement.
5. If the SIMM wants to request the next un-transmitted file, the process begins again at step 1.
6. When the SIMM is finished requesting files, a `#nnREQEOD` command transmits, causing the Profiler to immediately terminate the session and continue its programmed deployment. Alternatively, not issuing any further commands causes the Profiler to eventually time-out at the end of three listening loops and continue its programmed deployment.

Data Format for File Transmission

When a file is requested, the Profiler first sends a metadata packet for the file. The packet is structured as follows:

```
typedef struct
{
    char fileName[13];           // 12.3 filespec, plus a space
    char profileEndTime[20];    // "mm dd yyyy hh mm ss", plus a space
    char mooringID[4];          // %03d, plus a space
    char byteCount[12];         // %11ld, plus a space
    char term[2];               // ">"
} metaDataStruct;
```

Figure 11.1-16: File Metadata Packet

Except for the term field, which is a NULL terminated string, the other fields in the structure are all terminated by a trailing white space.

An example of a metadata packet: E0000000.DAT 07 28 2011 08 50 48 001 88 >

The metadata packet for a particular file is followed by one or more data packets and a final CRC packet. Each of these packets is prefaced with a packet header structured as follows:

```
typedef struct
{
    char dataHdr[4];           // "DAT" or "CRC", plus a space
    short byteCount;          // 2 bytes. Bytes in the whole packet;
                                // these 8 bytes, plus the packet size
    short CRC;                // A 16bit CCITT standard CRC.
} packetHeader;
```

Figure 11.1-17: Packet Header Structure

The dataHdr field is terminated by a white space.

For data packets:

- dataHdr will contain "DAT " <- note trailing space
- bytecount will be less than or equal to 4096
- CRC will be for this packet's data

For CRC packets:

- dataHdr will contain "CRC " <- note trailing space
- bytecount will be 0
- CRC will be cumulative for all the file's data packets

Auxiliary Files

The following files are present during a Profiler deployment, and can be requested with REQFIL. Their contents can provide information about the deployment's progress and status:

PROFILES.DAT	a 4 byte index of the current profile
LASTSENT.DAT	a 4 byte index of the last profile successfully sent via REQNEW
DEPLOY.DAT	a complete definition of the current Profiler configuration
SCHEDULE.TXT	(for Pattern Profilers only) a complete listing of the current profile schedule

Sea-Bird Inductive Modem Module Configuration

Following are the McLane recommended configuration settings for the SIMM:

```
S>gethd
<HardwareData
DeviceType='SBE90554 IMM' SerialNumber='70001230'>
<Manufacturer>Sea-Bird Electronics, Inc</Manufacturer>
<HardwareVersion>41420H.1</HardwareVersion>
<HardwareVersion>PCB Type 3, 10345B</HardwareVersion>
<MfgDate>2011-04-01</MfgDate>
<FirmwareVersion>IMM Ver 1.12</FirmwareVersion>
<FirmwareDate>Jun 15 2009</FirmwareDate>
<FirmwareLoader>MSP LOADER RS232 57.6K 2007-02-08</FirmwareLoader>
</HardwareData>
<Executed/>
```

```
S>getsd
<StatusData DeviceType='SBE90554 IMM' SerialNumber='70001230'>
<HostID>Host ID not set</HostID>
<EventSummary numEvents='718'/>
<Power><TransmitVoltage>9.0</TransmitVoltage></Power>
<SampleDataSummary NumSamples='0' TotalLen='0' FreeMem='16384'/>
<HostFileSummary Len='0' CRC='0xFFFFFFFF'/>
<LineStatus>IDLE</LineStatus>
</StatusData>
<Executed/>
```

```
S>getcd
<ConfigurationData DeviceType='SBE90554 IMM' SerialNumber='70001230'>
<Settings ConfigType='2'
DebugLevel='2'
BaudRate='9600'
HostID='Host ID not set'
GdataStr='GDATA'
HostPrompt='x'
ModemPrompt='S>'
DeviceID='0'
EnableHostFlagWakeup='0'
EnableHostFlagConfirm='0'
EnableHostFlagTerm='0'
EnableSerialIMMWakeup='1'
```

```
EnableHostPromptConfirm='1'  
EnableHostServeOnPwrup='0'  
EnableAutoIMFlag='1'  
EnablePrompt='1'  
EnableHostWakeupCR='1'  
EnableHostWakeupBreak='0'  
EnableEcho='1'  
EnableSignalDetector='1'  
EnableToneDetect='1'  
EnableFullPwrTX='0'  
EnableBackSpace='1'  
EnableGDataToSample='0'  
EnableStripHostEcho='0'  
EnableBinaryData='1'  
SerialType='1'  
TermToHost='254'  
TermFromHost='254'  
SerialBreakLen='5'  
MaxNumSamples='40'  
GroupNumber='0'  
THOST0='0'  
THOST1='5'  
THOST2='3000'  
THOST3='12000'  
THOST4='500'  
THOST5='5'  
TMODEM2='3000'  
TMODEM3='18000'  
TMODEM4='100'  
/>  
</ConfigurationData>  
<Executed/>
```

S>

UIMM Configuration Settings

Following are the McLane recommended configuration settings for the UIMM:

```
IMM>gethd
<HardwareData
DeviceType='SBE90554 IMM' SerialNumber='70001231'>
<Manufacturer>Sea-Bird Electronics, Inc</Manufacturer>
<HardwareVersion>41420H.1</HardwareVersion>
<HardwareVersion>PCB Type 3, 10345B</HardwareVersion>
<MfgDate>2011-04-01</MfgDate>
<FirmwareVersion>IMM Ver 1.12</FirmwareVersion>
<FirmwareDate>Jun 15 2009</FirmwareDate>
<FirmwareLoader>MSP LOADER RS232 57.6K 2007-02-08</FirmwareLoader>
</HardwareData>
<Executed/>
```

```
IMM>getsd
<StatusData DeviceType='SBE90554 IMM' SerialNumber='70001231'>
<HostID>Host ID not set</HostID>
<EventSummary numEvents='827'/>
<Power><TransmitVoltage>9.2</TransmitVoltage></Power>
<SampleDataSummary NumSamples='0' TotalLen='0' FreeMem='16384'/>
<HostFileSummary Len='0' CRC='0xFFFFFFFF'/>
<LineStatus>IDLE</LineStatus>
</StatusData>
<Executed/>
```

```
IMM>getcd
<ConfigurationData DeviceType='SBE90554 IMM' SerialNumber='70001231'>
<Settings ConfigType='2'
DebugLevel='2'
BaudRate='9600'
HostID='Host ID not set'
GdataStr='GDATA'
HostPrompt='x'
ModemPrompt='IMM>'
DeviceID='1'
EnableHostFlagWakeup='0'
EnableHostFlagConfirm='0'
EnableHostFlagTerm='0'
EnableSerialIMMWakeup='1'
EnableHostPromptConfirm='1'
EnableHostServeOnPwrup='0'
EnableAutoIMFlag='1'
EnablePrompt='1'
EnableHostWakeupCR='1'
EnableHostWakeupBreak='0'
```

```
EnableEcho='0'  
EnableSignalDetector='1'  
EnableToneDetect='0'  
EnableFullPwrTX='0'  
EnableBackSpace='1'  
EnableGDataToSample='0'  
EnableStripHostEcho='0'  
EnableBinaryData='1'  
SerialType='1'  
TermToHost='254'  
TermFromHost='255'  
SerialBreakLen='5'  
MaxNumSamples='40'  
GroupNumber='0'  
THOST0='0'  
THOST1='5'  
THOST2='3000'  
THOST3='12000'  
THOST4='100'  
THOST5='5'  
TMODEM2='3000'  
TMODEM3='18000'  
TMODEM4='100'  
/>  
</ConfigurationData>  
<Executed/>
```

IMM>

Notes

Section 11.2

RBR Mooring Line Modem (MLM)

Version 4.35/4.45 and higher of the Profiler firmware supports RBR Mooring Line Modem (MLM) communication between the Profiler and a surface controller with an RBR Sub-Surface Modem board (the SSM). The surface controller connects to the SSM. For this inductive communications option, the Profiler integrates with an RBR Head End Modem (HEM) with an inductive coupler around the mooring wire.



Regardless of Inductive Modem, the Profiler Firmware uses the same Transmission Protocol. Refer to Appendix A 'Inductive File Transmission Protocol' for details about inductive commands.



Figure 11.2-1: MLM Modem Electronics Board and Inductive Coil

Advanced Interface Options – Inductive Communications

The options that display on the Advanced Interface menu are sensor-dependent. When Inductive Communications are active, several options display for Inductive Communications settings. Advanced Interface settings are critical controls for inductive communications performance. Carefully review the option definitions provided in this section or contact McLane (www.mclanelabs.com) for more information.



Menu commands with “IMM” refer specifically to the Seabird IMM (Inductive Modem Module) and are only available if the Seabird IMM is attached and enabled. Command descriptions with “IM” refer generically to all Profiler inductive modem hardware variations.

```
Configuration: MPP_IM_CT                               CF2 V5.00 of Jan  3 2013
-----
                Pattern Profiler
                Advanced Interface
-----
                Fri Jan  4 11:07:35 2013
<0> FullSpeed                0.250 dbar/sec
<1> PR Threshold              0.045 dbar/sec
<2> PR TimeThreshold          180 seconds
<3> Sensor warmup            120 seconds
<4> Sensor warmdown          120 seconds

<5> FSI/CTD Bytes/Second     17 bytes/sec
<6> SBE/41CP Bytes/Second    9 bytes/sec
<7> SBE/52MP Bytes/Second    11 bytes/sec
<8> FSI/ACM Bytes/Second     33 bytes/sec

<D> Display verbose messages  YES
<H> History reset
<M> profiling Mode           PATTERN
<N> adjust profile couNter   -1
<P> caPture file enabled     NO

<F> IMM use Force capture line  YES
<K> IM ACK/NAK reply timer    100 seconds
<L> IM Listening loop timer     40 seconds
<S> IMM configure Surface modem NO
<W> IMM send Wakeup tone      YES
<X> Save any changes         <^C> Discard changes
```

← Inductive Options

Figure 11.2-2: Inductive Telemetry Settings on the Advanced Interface Menu

Using Bench Test Options

The main Bench Test and Inductive Modem Bench Tests menus provide options to verify and change inductive settings prior to deployment. The main Bench Tests Menu displays only options that are available to installed sensors.

1. From the main Profiler Menu, type 5 at the prompt to display the Bench Tests Menu.

```
Config: MPP_CT                               CF2 V5.00 of Jan 11 2013
-----
McLane Research Laboratories, USA
Pattern Profiler
S/N: ML12345-001
-----
Main Menu
-----
Tue Feb 19 07:16:21 2013
<1> Set Time           <5> Bench Test ←
<2> Diagnostics       <6> Deploy Profiler
<3> Flash Card Ops    <7> Offload Deployment Data
<4> Sleep             <8> Contacting McLane
<C> Configure
```

Figure 11.2-3: Profiler Main Menu

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP           CF2 V5.13 of May 05 2014
-----
Pattern Profiler
Bench Tests
-----
Tue May 6 09:01:52 2014

CTD utilities:
<1> Seabird 41CP CTD communication
<2> Seabird 41CP CTD pressure
<3> Seabird 41CP CTD average pressure
<4> Seabird 41CP CTD temperature record

System evaluation:
<7> Motor operation
<8> Set Brake
<9> Independent Watchdog
<D> Detailed schedule
<S> Recover schedule

Sensor & Option tests:
<I> Seabird Inductive Modem

Exit:
Selection [] ? m
```

Figure 11.2-4: Profiler Bench Tests Menu

2. From the main Bench Tests menu, type *I* at the prompt to display the RBR MLM Bench Test Menu (Figure 11.2-5).
3. Type *I* to connect directly with the MLM.

```
-----  
Config: MPP_IM_CT_CM_MP                               CF2 V5.07 of Sep  5 2013  
  
-----  
                Pattern Profiler  
RBR Mooring Line Modem Bench Test Menu  
-----  
                Thu Sep 12 07:10:24 2013  
  
<1> Direct communications (19200 Baud) ← Direct Communications  
<2> Restore McLane parameters  
<3> Restore factory parameters  
<4> Report parameter settings  
<5> Single transaction  
<6> Telemetry session  
  
<M> return to previous Menu  
  
Selection  [] ?  [^C]  
  
09/12/13 07:14:15 RBR/LGR2 Press ^C to terminate COMM session.  
09/12/13 07:14:15  SYSTEM Press ^B to change or confirm Baud rate.  
  
09/12/13 07:14:16 RBR/LGR2 9.6 kBaud communication channel opened.  
09/12/13 07:14:16 RBR/LGR2 Powered on.
```

Figure 11.2-5: MLM Bench Test Menu



The Profiler communicates with the RBR MLM at 19200 baud. If this rate is changed (for example after sensor manufacturer servicing) communicating directly with the sensor displays unrelated characters or a communication error (Figure 11.2-6). Fix the error by changing the sensor to the baud rate the Profiler requires.

```
*****
-Êûx-òÄ-fûx-` ,ò31x-Ê‡-ò-ûfxf31òx`Ü31ò-òÄ-Ê
04/23/14 12:50:37 SBE/52MP ERROR! Didn't receive prompt after [wake-up]
command finished.
```

Figure 11.2-6: Baud Rate Communication Error Examples

Typing [CTRL]-[B] from the sensor-specific Bench Tests menu (Figure 11.2-5) displays the Baud Rate menu (Figure 11.2-7). Use this menu option to temporarily connect at the sensor's current baud rate. Once connected to the sensor, change to the Profiler-required baud rate. Finally, exit the Baud Rate Menu to resume the communications session.

```
Config: MPP_IM_CT_CM_FL_TU_OP_MP          CF2 V5.00 of Jan 10 2013
-----
                Pattern Profiler
                Select new Baud rate
-----
                Fri Jan 11 13:48:30 2013
<1> 1200
<2> 2400
<3> 4800
<4> 9600
<5> 19200
<6> 38400
<7> 57600
<G> Go to COMM session
      Selection  [] ? g
```

Figure 11.2-7: Baud Rate Menu

Direct Sensor Connection

Once connected directly to the MLM, typing commands at the command prompt provides additional sensor information.

```
Selection [] ? 1

Expecting RBR/LGR2 at 9600 baud. Change [N] ? [^C]

08/28/13 14:29:50 RBR/LGR2 Press ^C to terminate COMM session.
08/28/13 14:29:50 SYSTEM Press ^B to change or confirm Baud rate.

08/28/13 14:29:51 RBR/LGR2 9.6 kBaud communication channel opened.
08/28/13 14:29:51 RBR/LGR2 Powered on.

*****

[^C]

*****
08/28/13 14:30:34 RBR/LGR2 Powered off.

08/28/13 14:30:34 RBR/LGR2 9.6 kBaud communication channel closed.
```

Figure 11.2-8: MLM Direct Communications

Restore McLane and Factory Settings

Option <2> and <3> (not shown) from the RBR MLM Bench Test menu restores the McLane or RBR factory settings. Using option <2> requires typing the password *mcl*.

Option <3> (not shown) 'Restore factory parameters' restores the configuration parameters delivered with the RBR Inductive Modem. Option <3> requires the password factory.



The firmware requires the RBR parameters configured by McLane. Changing settings, or resetting to the factory settings prevents the MLM from working correctly with the Profiler.

Display Current Settings

Option <4> 'Report Parameter Settings' displays the RBR MLM inductive modem settings.

```
Selection  [] ? 4
09/12/13 07:29:00 RBR/MLM 19.2 kBaud communication channel opened.
09/12/13 07:29:01 RBR/MLM Powered on.
09/12/13 07:29:02 RBR/MLM Sending command [].
09/12/13 07:29:02 RBR/MLM Sending command [A]. .
09/12/13 07:29:02 RBR/MLM Identified as V1.300, S#052538.
09/12/13 07:29:02 RBR/MLM Sending command [EE TPESCTO 10]. ..
09/12/13 07:29:03 RBR/MLM baud rate BAUD: 19200.
09/12/13 07:29:03 RBR/MLM sleep timeout (10ms) ZTO: 6000.
09/12/13 07:29:03 RBR/MLM transparent max chars before send TPMXC: 512.
09/12/13 07:29:04 RBR/MLM transparent send char enable TPSNDEN: 0.
09/12/13 07:29:04 RBR/MLM transparent char timeout (10ms) TPCTO: 25.
09/12/13 07:29:04 RBR/MLM transparent char timeout enable TPCTOEN: 1.
09/12/13 07:29:05 RBR/MLM transparent escape sequence TPESC:
x01,x02,x03,x04,x05,x06,x07,x08,x08,x07,x06,x05,x04,x03,x02,x01.
09/12/13 07:29:05 RBR/MLM transparent escape timeout (10ms) TPESCTO: 10.
09/12/13 07:29:06 RBR/MLM transparent escape timeout enable TPESCTOEN: 1.
09/12/13 07:29:06 RBR/MLM transparent request ack enable TPACK: 1.
09/12/13 07:29:06 RBR/MLM transparent display ack enable TPACKDSP: 1.
09/12/13 07:29:07 RBR/MLM transparent display nak enable TPNAKDSP: 1.
09/12/13 07:29:07 RBR/MLM modem open channel timeout (10ms) MDOCDUR:
6000.
09/12/13 07:29:07 RBR/MLM modem maximum retry count MDRTRY: 3.
09/12/13 07:29:08 RBR/MLM Powered off.
09/12/13 07:29:08 RBR/MLM Power-down delay .....
09/12/13 07:29:10 RBR/MLM 19.2 kBaud communication channel closed.
```

Figure 11.2-9: Option <4> Report Parameter Settings

Single Transaction

Option <5> (not shown) displays a single inductive file transmission.

Telemetry Session

Option <6> runs a test telemetry session.

```
Selection  [] ? 6

Enter session interval in seconds [5] (0-86400) [0] ?
Enter the first profile to send [0] (0-9999) [0] ?
Enter the starting value of ProfileCounter [0] (0-9999) [0] ?

09/12/13 08:12:45  SYSTEM Creating PROFILES.DAT ... done.
09/12/13 08:12:45  SYSTEM Creating LASTSENT.DAT ... done.
09/12/13 08:12:46  SYSTEM Renaming E????????.DAX .... done.
09/12/13 08:12:46  SYSTEM Renaming M????????.DAX .... done.
09/12/13 08:12:46  SYSTEM Renaming S????????.DAX .... done.
09/12/13 08:12:46  SYSTEM Updating PROFILES.DAT ... done.
09/12/13 08:12:46  SYSTEM E0000000.DAT exists.
09/12/13 08:12:46  SYSTEM E0000001.DAT exists.
09/12/13 08:12:46  SYSTEM C0000000.DAT exists.
09/12/13 08:12:46  SYSTEM C0000001.DAT exists.
09/12/13 08:12:47  SYSTEM A0000000.DAT exists.
09/12/13 08:12:47  SYSTEM Creating A0000001.DAT from A0000000.DAT.
09/12/13 08:12:47  SYSTEM Copying A0000000.DAT to A0000001.DAT.

A0000000.DAT

1 file(s) copied

09/12/13 08:12:47  SYSTEM M0000000.DAT exists.
09/12/13 08:12:48  SYSTEM M0000001.DAT exists.
09/12/13 08:12:48  SYSTEM IM session 1 will begin at 09/12/13 08:12:46.
09/12/13 08:12:48  SYSTEM Waking and proceeding.

. . . ← Display shortened for brevity

09/12/13 08:23:39  RBR/MLM Listening attempt 1 of 3.
09/12/13 08:23:39  RBR/MLM Sending command [].
09/12/13 08:23:39  RBR/MLM Sending command [X 052571]. ..
09/12/13 08:23:43  RBR/MLM Sending command [.ee reset]. .
09/12/13 08:23:43  RBR/MLM Sending command [.ee tpsnden 0]. ..
09/12/13 08:23:44  RBR/MLM Sending command [.ee tpcto 25]. [^C]
09/12/13 08:23:44  SYSTEM Attempt 2 of 3.
09/12/13 08:23:44  RBR/MLM Sending command [].
09/12/13 08:23:45  RBR/MLM Sending command [SSM R]. [^C]
09/12/13 08:23:45  SYSTEM Attempt 2 of 3.
09/12/13 08:23:45  RBR/MLM ERROR! Didn't receive surface response - listening
attempt 1 of 3 failed.
09/12/13 08:23:45  RBR/MLM Listening attempt 2 of 3.
09/12/13 08:23:45  RBR/MLM ERROR! Didn't receive surface response - listening
attempt 2 of 3 failed.
09/12/13 08:23:45  RBR/MLM Listening attempt 3 of 3.
09/12/13 08:23:45  RBR/MLM ERROR! Didn't receive surface response - listening
attempt 3 of 3 failed.
09/12/13 08:23:45  RBR/MLM Powered off. [^C]
09/12/13 08:23:45  RBR/MLM 19.2 kBaud communication channel closed.
```

Figure 11.2-10: Option <6> Telemetry Session

Offloading Last Sent Data

Offload Logging Files is a screen display of files that the Profiler records during the deployment. Option <5> 'Last sent' displays the last Inductive file transmitted to the Profiler firmware.

```
-----  
Config: MPP_IM_CT_CM                               CF2 V5.10 of Nov  4 2013  
  
-----  
                Pattern Profiler  
            Offload Logging Files Menu  
-----  
                Tue Jan  7 09:47:09 2014  
  
Select log to offload:  
<1> PROFILES.DAT  
<2> DEPLOY.DAT  
<3> IRQ_XCPT.LOG  
<4> Profile Termination Log  
<5> Last sent  
<6> Deployment Termination Condition  
  
<M> previous Menu  
  
Selection [] ? 5  
  
01/07/14 09:47:10  SYSTEM Reading LASTSENT.DAT ... done.  
  
Oldest profile transmitted is -1  
  
Press any key to continue.
```

Figure 11.2-11: Option <5> Last sent

RBR MLM Communication Session Overview

Below is an overview of a communication session between the Sub-Surface Modem (SSM), the Head End Modem (HEM), and the Profiler.

1. The sequence begins with the SSM sleeping.
2. At the completion of a profile, the Profiler powers on the HEM.
3. The HEM commands the paired SSM to enter transparent mode.
4. The Profiler sends an identification string to the SSM via the HEM.
5. The SSM can now send commands to the Profiler via the HEM.
6. The Profiler listens to the HEM for commands transmitted by the SSM for a specified amount of time. This amount is configurable in the Profiler's "Advanced Interface" from 30 to 300 seconds. The default is 40 seconds.
7. If a command is received within the allowed time period, process the command and go to step 6. If a command to terminate the session is received or no command is received within the allowed time period, go to step 8.
8. The Profiler terminates the session and continues its programmed deployment.
9. The SSM ends its session.

RBR MLM Communication Session Command Sequence

The next section describes technical details of the telemetry session including sample command transmission sequences, and data formats. The file transmission protocol is listed on Appendix A ‘Inductive File Transmission Protocol’ in this User Manual.

The Wakeup/Identification/Listen pattern repeats three times. If no commands are received after the third attempt, the Profiler terminates the session and continues the programmed deployment.

- Step 1 – Wakeup–Profile completion. Profiler powers on the MLM. Sends Wakeup tone/identification through the HEM to the SSM (see table shown next).
- Step 2 – Identification–SSM receives the Wakeup/Identification messages below.
- Step 3 – Listen–listens for commands for three 40 second cycles. Commands sent through the SSM/HEM system take the form COMMAND<RETURN>, where the entire command string is relayed to the Profiler. If no commands are received after the third attempt, the Profiler terminates the session and continues the programmed deployment.
- Step 4 – Begin Transmission Session– Profiler receives an inductive file transmission protocol command (see Appendix A in this User Manual).

Identification Messages: Wakeup/Identification	
SSM Received messages	Description
WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED WAKE-UP TONE DETECTED	Generated by Profiler’s HEM for ~5 seconds if ‘send wakeup tone’ is enabled.
@@@MMP/ML12345-67/001/01	ID generated by Profiler contains: @@@MMP/SerialNumber/MooringID/HEM-DeviceID The identification string is sent, and the HEM remains on until Profile 0 (Dive Zero, the initial MMP dive) begins. The HEM then powers off and remains off until the next scheduled transmission session

To confirm the communications link, the HEM also powers on when the user commits to a deployment through the Profiler Deployment menu (Proceed with the deployment (Yes/No) [N]? Y).

The power on at Profile 0 is a verification feature only. During this period, the SSM communicates only with the HEM to confirm a proper link – for example, issuing commands to modify or retrieve certain HEM configuration settings. The Profiler firmware itself remains in Suspend Mode while waiting for Dive Zero, and does not listen, or respond, to the HEM until the deployment starts and a scheduled transmission session begins.

RBR MLM Sample Transmission Session

During the three 40 second listening attempts, the SSM can respond by sending various commands through the HEM to the Profiler. In the transparent mode established by the HEM when the session is initiated, everything the SSM transmits is passed verbatim to the Profiler, including any arguments for commands that require them, such as “REQFIL filename.ext”.

The SSM can respond by capturing the inductive line (CAPTURELINE or FORCECAPTURELINE) and then sending various commands to the MLM. If addressed correctly, the MLM passes the commands to the Profiler. For example, if the SSM wants to request the latest un-transmitted file the following would occur.



Options on the Advanced Interface Menu set the number of seconds the Profiler listens for the inductive modem command and for the ACK/NAK reply from the surface controller. The Listening Loop default is 40 seconds. The ACK/NAK Reply Timer default is 100 seconds. The timer can be changed to between 30 and 300 seconds.

For example, if the SSM wants to request the latest un-transmitted file:

1. The SSM sends a REQNEW command to the Profiler. The command REQNEW is passed to the Profiler by the HEM.
2. The Profiler responds by sending the next file available from the files collected since the last successful transmission. The data is sent in packets and the transaction process requires the surface to acknowledge receipt of each packet. The length of time the Profiler will wait for a REQACK or REQNAK is configurable in the Profiler’s “Advanced Interface” from 30 to 300 seconds. The default is 100 seconds. If the MMP has no new file to offer, it will reply with an End-of-Data packet and wait for another command.
3. The SSM responds to each packet with a REQACK or a REQNAK, depending on whether the packet was received correctly.
4. After the last packet has been sent and acknowledged, the Profiler sends a CRC packet that contains only a packet header (no data content). This packet does not expect an acknowledgement.

5. If the SSM wants to request the next un-transmitted file, the process begins again at step 1.
6. Otherwise, when the SSM is finished requesting files, it should send a REQEOD command. This causes the Profiler to immediately terminate the session and continue its programmed deployment. Alternatively, simply not issuing any further commands will cause the Profiler to eventually time-out at the end of three listening loops and continue its programmed deployment.

Example MLM Inductive Telemetry Session

ID generated by Profiler contains:

```

@@@MMP/ML12672-01/001/01      @@@MMP / SerialNumber / MooringID / IMM DeviceID
SSM command                  HEM reply
REQNEW                        E0000000.DAT 12 23 2010 08 00 42 001    1024 >

REQACK                        DAT [binary file contents transmitted here]

REQACK                        CRC [binary CRC transmitted here]

REQNEW                        ... etc as above ...

```

Data Format for File Transmission

When a file is requested, the Profiler first sends a metadata packet for the file. The packet is structured as follows:

```

typedef struct
{
char fileName[13];           // 12.3 filespec, plus a space
char profileEndTime[20];    // "mm dd yyyy hh mm ss", plus a space
char mooringID[4];         // %03d, plus a space
char byteCount[12];        // %11ld, plus a space
char term[2];              // ">"
} metaDataStruct;

```

Figure 11.2-1: File Metadata Packet

Except for the term field, which is a NULL terminated string, the other fields in the structure are all terminated by a trailing white space.

An example of a metadata packet: “E0000000.DAT 07 28 2011 08 50 48 001 88 >” (not including the quotes) The metadata packet for a particular file is followed by one or more data packets and a final CRC packet. Each of these packets is prefaced with a packet header structured as follows:

```
typedef struct
{
char dataHdr[4]; // "DAT" or "CRC", plus a space
short byteCount; // 2 bytes. Bytes in the whole packet;
// these 8 bytes, plus the packet size
short CRC; // A 16bit CCITT standard CRC.
} packetHeader;
```

Figure 11.2-2: Packet Header Structure

The dataHdr field is terminated by a white space.

For data packets:

dataHdr will contain “DAT ” <- note trailing space bytecount will be less than or equal to 4096
CRC will be for this packet’s data.

For CRC packets:

dataHdr will contain “CRC ” <- note trailing space bytecount will be 0 CRC will be cumulative for
all the file’s data packets

Auxiliary Files

The following files are present during a Profiler deployment, and can be requested with REQFIL. Their contents can provide information about the deployment's progress and status:

PROFILES.DAT	a 4 byte index of the current profile
LASTSENT.DA	a 4 byte index of the last profile successfully sent via REQNEW
DEPLOY.DAT	a complete definition of the current Profiler configuration
SCHEDULE.T	(for Pattern Profilers only) a complete listing of the current profile schedule

Appendix A

Inductive File Transmission Protocol

Inductive Telemetry commands transmit deployment files and execute various other functions between the Profiler and a surface controller near real-time. These commands can be grouped into three types: File Commands, Control Commands, and Profiling Commands. Some sensors support File Decimation and/or Data File Reduction commands which can reduce the size of files.

File Decimation

The Profiler supports Data File Decimation for sensors with this function. Decimation determines how many data records the surface controller retrieves upon request. For example, a decimation value of 2 causes the Profiler firmware to retrieve one record then skip the next record. For a decimation value of 1, the Profiler firmware retrieves every record.

Data File Reduction

The Profiler supports data file reduction for sensors with this function, such as the Nortek Aquadopp II. The Aquadopp II allows the user to select which columns of data to include in a transmitted file. Profiler firmware v5.13 and higher supports both data reduction and file decimation for the Aquadopp II to select the decimation setting, and the columns of data for inductive transmissions.

Inductive Telemetry Commands

Regardless of inductive modem type, the Profiler commands have the same protocol. For Control commands, the request can display and/or change settings.

File Commands	
Command	Profiler Action
REQNEW	<p>Send next available file in the list of files collected since the last successful transmission:</p> <ol style="list-style-type: none"> 1. Profiler responds with a metadata packet and waits for acknowledgement. 2. SIMM acknowledges with REQACK. 3. Profiler responds with first data packet. 4. SIMM (Surface Inductive Modem Module) acknowledges with REQACK or REQNAK. <ol style="list-style-type: none"> a. If REQACK, Profiler possibly responds with next packet. b. If REQNAK, Profiler responds with the same packet again. 5. Any additional packets are sent and acknowledged similarly. 6. When data is exhausted, Profiler responds with a CRC packet. 7. Profiler does not expect, or wait for, acknowledgement. 8. Profiler returns to listening loop. <p>During REQNEW: If 3 consecutive REQNAK replies are received, or if the Profiler hears nothing from the SIMM while waiting for acknowledgement, the Profiler abandons the requested file and returns to the listening loop.</p> <p>For 3 failed REQNEW attempts for a specific file: The file is renamed from DAT to DAX (for example, C0000XXX.DAT to C0000XXX.DAX) and taken out of the transmission queue. Further attempts to retrieve the file can be made at any time by specifically requesting it with REQFIL C0000123.DAX</p>
REQDCN	<p><i>(Only for Decimation - Not supported by all sensors)</i></p> <p>Send a decimated version of the next available file in the list of files collected since the last successful transmission using the same protocol as REQNEW.</p>
REQFIL <i>filename.ext</i>	<p>Send a specific file, if filename.ext exists on the flash card, using the same protocol as REQNEW. Failed attempts, however, do not provoke file renaming.</p>
REQDCF <i>filename.ext nnn</i>	<p><i>(Only for Decimation - Not supported by all sensors)</i></p> <p>Send an nnn-th decimated version of the requested file, if filename.ext exists on the flash card, using the same protocol as REQNEW. Failed attempts, however, do not provoke file renaming.</p>

File Commands	
Command	Profiler Action
REQDIR	Send a file containing a listing of all files on the flash card using the same protocol as REQNEW. The filename reported in the metadata packet comprises a current timestamp of the form YYMMDDHH.PDR (Year Month Day Hour). This can include ~ 1,100 files. The most recent REQDIR listing is saved in <i>filename.DIR</i> for possible offload via REQFIL [<i>filename</i>].dir
REQFDR <i>filename.ext</i>	Send a listing of the first file found on the flash card that matches <i>filename.ext</i> . The listing is in the format “FILENAME.EXT bbbbbbbbbb>”, where bbbbbbbbbb is the file size displayed in ten digits. The Profiler does not expect, or wait for, acknowledgement.
REQACK	Acknowledge receipt of the current file packet and requests the next packet in the file.
REQNAK	Request retransmission of the current file packet.
REQETK	Request “end transmission” for current file transfer and continue telemetry session.

If control commands are issued with no argument, the firmware returns the current parameter setting. Adding an argument to a control command changes the parameter. Examples of commands with and without arguments are provided below. The firmware terminates telemetry messages with the > character.

Control Commands	
Command	Profiler Action
<p>REQCLK Example of parameter request: REQCLK Reply: ACKCLK <i>ClockTime</i>></p> <p>Example with argument: Command: REQCLK 1433760561 Reply: ACKCLK 1433760561></p>	<p>Request or set the Profiler's Real Time Clock in seconds. The argument for time is represented as seconds since 01/01/1970.</p>
<p>REQNUM Example of parameter request: REQNUM Reply: ACKNUM <i>ProfileNumber</i>></p> <p>Example with argument: Command: REQNUM 0 Reply: ACKNUM 0></p>	<p>Request or set the Profiler's current profile number. Minimum = 0, Maximum = 9999</p>
<p>REQACM Example of parameter request: REQACM Reply: ACKACM <i>SamplingRate</i>></p> <p>Example with argument: Command: REQACM 02 Reply: ACKACM 02></p>	<p><i>(Only for Profilers with an enabled ACM that supports a variable sampling rate and firmware release version 5.0 or higher)</i></p> <p><i>For example, the FSI ACM + supports integer rates from 1 to 10, and the Norktek Aquadopp II supports integer rates of 1, 2, 4, 8, 10.</i></p> <p>Allows a surface controller to request or reconfigure the sampling rate of an enabled ACM that supports a variable sampling rate in the middle of a deployment. After reconfiguring, following profiles in the deployment will be sampled at the new rate.</p> <p>Profiler accepts a new ACM sampling rate between 1 Hz and 10 Hz and responds with "ACMACM ss".</p> <p>Minimum = 1, Maximum = 10 (ACM model dependent) If the commanded rate is less than 1 or greater than 10, the Profiler continues to use the previous rate.</p>

Control Commands	
Command	Profiler Action
<p>REQDSP Example of parameter request: REQDSP Reply: ACKDSP <i>VerboseMode</i>></p> <p>Example with argument: Command: REQDSP 1 Reply: ACKDSP 1></p>	<p>Request or set the main UART verbose mode VerboseMode: 0=disable, 1=enable</p>
<p>REQWRM Example of parameter request: REQWRM Reply: ACKWRM <i>WarmUpSeconds</i> <i>WarmDownSeconds</i>></p> <p>Example with argument: Command: REQWRM 30 30 Reply: ACKWRM 30 30></p>	<p>Request or set the sensor warm-up and warm-down. Minimum =0, Maximum = 300. Default = 120</p>
<p>REQBAK Example of parameter request: REQBAK Reply: ACKBAK <i>Iterations Rate Time</i>></p> <p>Example with argument: Command: REQBAK 2 45 60 Reply: ACKBAK 2 45 60></p>	<p>Request or set the BackTrack Variables Iteration: Minimum = 1, Maximum = 5, Default = 3 Rate: Minimum =0, Maximum = 1000, Default = 45 (in dbar/second * 1000) Time: Minimum = 5, Maximum = 300, Default = 60 (in seconds)</p>
<p>REQRMP Example of parameter request: REQRMP Reply: ACKRMP <i>RampDuration</i>></p> <p>Example with argument: Command: REQRMP 45 Reply: ACKRMP 45></p>	<p>Request or set the ramp duration in seconds. Minimum = 2, Maximum = 90 Default = 30.</p>
<p>REQRST Example: Command: REQRST Reply: ACKRST> Command: REQRST Reply: ACKRST></p>	<p>Reset the Profiler, if issued two times in a row with no other commands between.</p>

Control Commands	
Command	Profiler Action
<p>REQACT Example: Command: REQACT Reply: ACKACT ACM:1 CTD:1 FLR:0 CH4:0 CO2:1 TRA:0></p> <p>Example: Command: REQACT CH4 1 activates CH4 sensor</p> <p>Example: Command: REQACT ALL 1 activates all self logging sensors</p> <p>Example: Command: REQACT ALL 0 deactivates all self logging sensors</p>	<p>Request or set a self-logging sensor's data acquisition state</p> <p>Reply to request at left indicates that the currently installed sensors, ACM, CTD, and CO2 sensors are active, and FLR, CH4 and TRA sensors are not.</p>
<p>REQQUE Example: Command: REQQUE Reply: ACKACT ACM:1 CTD:1 FLR:1 CH4:1 CO2:1 TRA:1></p> <p>Example: Command: REQQUE CO2 0 excludes CO2 sensor from file transmission queue.</p> <p>Example: Command: REQQUE ALL 1 includes all self logging sensors in file transmission queue.</p>	<p>Request or set whether or not a self-logging sensor is in the data offload queue for REQNEW and REQDCN commands.</p> <p>Reply to request at left indicates ACM, CTD, FLR, CH4, CO2 and TRA sensor data is included in the file transmission queue.</p>

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Profiling Commands	
Command	Profiler Action
REQEOD	<p>Terminate the telemetry session and power off the UIMM.</p> <p>The response to this command is a single metadata packet where the filename field contains "ENDOFDAT.DAT ". The timestamp field reflects the Profiler's clock when the command was received. The bytecount field is 0.</p> <p>The Profiler does not expect, or wait for, acknowledgement of this packet.</p>
REQUND Reply: ACKUND	<p><i>Only for Profilers with inductive charging option.</i></p> <p>Clear the docking flag. Continue telemetry session.</p>
REQPRF Example: REQPRF <i>Direction StartTime Shallow Deep StopCheck TimeLimit ShallowErr DeepErr</i>	<p><i>Only for Adaptive Profilers with inductive charging option (not available in Standard or Pattern Profilers). See Adaptive Profiling documentation for details of this command.</i></p> <p>Command profile setting.</p>
REQSUS Example: REQSUS <i>SuspendUntil</i> Reply: ACKSUS <i>SuspendUntil</i> >	<p><i>Only for Adaptive (not available in Standard or Pattern Profilers). See Adaptive Profiling documentation for details of this command.</i></p> <p>Suspend until some future clock time, then resume telemetry session.</p>
REQCHG	<p><i>Only for Profilers with inductive charging option.</i></p> <p>Go to charging dock</p>

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Profiling Commands	
REQCNT	<p><i>Only for Adaptive Profilers with inductive charging option (not available in Standard or Pattern Profilers). See Adaptive Profiling documentation for details of this command.</i></p> <p>If in charging mode, leave the dock. Continue with deployment.</p>
XMTSCH dd	<p><i>(Only for Pattern-Profilers. Not available in Standard or Adaptive profiling mode).</i></p> <p>Prepare to receive a new schedule from a SIMM that has a DeviceID of dd. If the optional dd is not specified, the Profiler assumes the SIMM has a DeviceID of 00 (zero):</p> <ol style="list-style-type: none"> 1. Profiler responds with XMTACK. 2. Profiler waits 30 seconds for the SIMM to release the inductive line. 3. Profiler configures the SIMM & UIMM for Xmodem use. 4. Profiler idles for 5 seconds to allow SIMM time to start an Xmodem1k-CRC send process. 5. Profiler starts an Xmodem1k-CRC receive process expecting to receive a new schedule file from a SIMM whose DeviceID is dd. 6. If successful, the new schedule is installed in the Profiler. 7. Profiler idles for 5 seconds to allow SIMM time to stop its Xmodem1k-CRC send process. 8. Profiler resets SIMM & UIMM for normal use. 9. Profiler goes back to listening loop.

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Other Command Replies	
Command	Profiler Action
MMPERR < <i>invalidcommand</i> >	Response to an invalid command.
MMPRDY ClockTime>	<i>Only for MLM and DPC telemetry, not available for IMM surface controller.</i> Ready for a command.

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Appendix B

Sea-Bird Underwater Inductive Modem (UIM)

Profiler firmware versions 3.10 and higher supports Sea-Bird UIM board (with an inductive coupler around the mooring wire). A surface controller with a Sea-Bird inductive modem link is required. For the inductive modem interface, the Profiler electronics stack contains a Sea-Bird UIM (Underwater Inductive Modem) board (SBE44 V1.8) with an inductive coupler around the mooring wire (a surface inductive modem and surface controller are also required for this option).

This section describes the communications sequence between the Profiler and the UIM. A detailed description of SIM/UIM protocols is also provided.



Regardless of Inductive Modem, the Profiler Firmware uses the same Transmission Protocol. Refer to Appendix A in this User Manual ‘Inductive File Transmission Protocol’ for details about inductive commands.



Figure B-1: Sea-Bird UIM Modem Electronics Board

Sea-Bird UIM Communication Session Overview

Below is a process overview of the communication session between the Surface Inductive Modem (SIM), the Underwater Inductive Modem (UIM) and the Profiler.

1. The sequence begins with the SIM powered off.
2. At the completion of a profile, the Profiler powers on the UIM.
3. The UIM sends a tone detect to wake the SIM.
4. The Profiler listens for commands transmitted by the SIM as the SIM performs a Cyclic Redundancy Check (CRC) to ensure that data transmitted is valid. If the CRC confirms valid data, the SIM sends the Profiler a command to ‘send the next piece of data’. If the CRC detects invalid data, the SIM sends the Profiler a ‘resend data’ command.



The CRC calculated is a 16bit CCITT standard CRC.

5. The Profiler sends a null record after the last group of data to tell the SIM that the ‘end of the data’ has been reached.
6. The Profiler powers off the UIM and waits to perform the next profile.



When data transmission is complete, the SIM must be powered off before the next tone detect is sent or both the surface modem and the inductive modem will be in ‘listening mode’ simultaneously and cannot perform the communication sequence.

Sea-Bird UIM Communication Session Command Sequence

The next section describes technical details of the telemetry session including sample command transmission sequences, and data formats. The file transmission protocol is listed in Appendix A 'Inductive File Transmission Protocol' in this User Manual.

Commands sent through the SIM/UIM system always take one of two forms: #nnCOMMAND or bnnCOMMAND.

The nn is the UIM identification and is used by the UIM to identify whether a command is directed toward it. If the command is meant to be handled by the UIM, the COMMAND portion is relayed to the serial instrument (in this case the Profiler).

- The '#', indicates that the SIM and UIM are awaiting ASCII data terminated with a pre-defined termination character.
- The 'b', indicates that the SIM and UIM are awaiting binary data terminated by a transmission gap.

The timeouts are different for the two cases and are explained in the Sea-Bird documentation.

UIM Sample Transmission Session

This section provides a sample transmission session. To confirm the communications link, the UIM initially powers 'on' after 'V' (Verify and Proceed) is selected from the Profiler Deployment menu. The UIM remains on until Profile 0 (the initial Profiler dive) begins, then powers off and remains off until the next scheduled transmission session. This is a verification feature only. The Profiler firmware itself remains in Suspend Mode and does not listen or respond to the UIM until the scheduled transmission session.

1. The 'Tone detect' board attached to the SIM receives a tone and responds by setting its detect line (JP4 pin 2) low. The Profiler allows 40 seconds to receive a response from the surface. If no tone is received, the tone will be sent again a maximum of two more times (spaced 40 seconds apart). . The UIM should automatically generate a 4800 Hz tone for 2.5 seconds detectable by the Tone Detect board on the SIM. If the UIM tone is not sent (this occurs because the SBE44 was not specifically designed for the Profiler Inductive Modem interface), the Profiler initiates the wake-up tone to ensure that the SIM detect line is properly set.
2. The surface controller (SC) monitors the 'Tone detect' board tone detect line. Receipt of a tone indicates that the Profiler is ready to transmit data. The SC powers on the SIM and sends the necessary commands to upload the data.
3. The Profiler listens for 3 intervals of 40 seconds each for one of the recognized data upload commands.
4. When power is applied to the SIM board, the board sends a wake-up signal down the mooring wire (if the UIM is up and running the wake-up signal is ignored). If the UIM is not ready, this wake-up activates the UIM.

5. A transmit-receive-acknowledge sequence proceeds as follows until the Profiler has sent the entire file:
 - If the SC requires the newest data it relays a #nnREQNEW command to the Profiler (eg. #01REQNEW). The '#' defines the request to the UIM to transmit ASCII data with a termination character, configured as '>'; nn is the ID of the UIM attached to the Profiler; REQNEW is the command relayed by the UIM to the Profiler. Everything after the nn ID is relayed verbatim to the UIM, including the filename in the case of REQFIL.
 - The Profiler responds by sending the next file available from the files collected since the last successful transmission. If a limited number of files are stored and there is trouble transmitting, the oldest files may be deleted before they are transmitted. This risks the loss of the oldest data, but does not interfere with the algorithm which sends the next available data. The data is sent in packets (defined in the 'Data Format for File Transmission' section of this chapter) and the transaction process requires the surface to acknowledge receipt of each packet.
6. After the Profiler sends the entire data file, a CRC packet is sent that contains only a packet header (no data content).



If required, the SC can request transmission of a particular file by sending #nnREQFIL filename.ext (where filename.ext conforms to the 8.3 format). The Profiler will send the requested file (DOS) with the same protocol used to answer REQNEW.

7. If the SC requests a full directory listing of files on the flash card, (by sending a #nnREQDIR command) the Profiler responds by sending a listing of file names and file sizes as described in the 'File Transmission Protocol' section of this document.
8. If the Profiler has no data to offer it will reply with an EOD packet and wait for a command. The Profiler will terminate communications if a termination command is sent by the surface. The SC maintains primary control of the communication. Time-out thresholds are used as a backup. If no command is received the Profiler will time out after the third 40 second session.
9. If the SC is finished requesting data, and sends a #nnREQEOD command, the Profiler powers off the UIM and continues with the programmed deployment.

Control of Communication Session

Noise on the mooring cable could falsely trigger the Tone Detect board attached to the SIM (however, the UIM is powered on only during the communication transaction period at the end of a profile). The Profiler/UIM pair exclusively initiate a communication session. Once the session starts, the SC controls data transmission and the end of the communication session. The communication session will timeout in the absence of surface controller response.

Data Format for File Transmission

When a file or combination of files is requested, the Profiler first sends the metadata for the next file to be transmitted.



Mooring ID (a three position numeric identifier) is defined from the Deployment Menu and embedded in the metadata to identify files from multiple Profilers on the same mooring line.

The metadata structure is as follows:

```
typedef struct
{
  char  fileName[13]; // filename.ext - followed by white space
  char  profileEndTime[20]; // mm dd yyyy hh mm ss - followed "
  char  mooringID[4]; // ### - followed by "
  char  byteCount[12]; // ##### - followed by "
  char  term[2];
} metaDataStruct;
```

Figure B-2: File Metadata Packet

Each character field is terminated by a white space, rather than a null. The metadata for a single file is followed by a series of data packets and ends with an EOD packet. Each packet is prefaced with the packet header.

```
typedef struct
{
  char  dataHdr[4]; // "DAT", "CRC"
  short byteCount; // of whole pkt 8 + pktdatasize
  short CRC; // CRC
} packetHeader;
```

Figure B-3: Packet Header Structure

The character field dataHdr is terminated by a white space. Immediately after the packet header, the packet content is transmitted. A "DAT" packet will contain up to 4KB of data; a

“CRC” packet will indicate that there are no more packets to be sent. There is no content for the CRC packet. The CRC value reported in this packet is the value for the entire file.

Sea-Bird Firmware and Settings for 4K Packets

SIM V2.8 (or later) and the UIM, SBE44 V1.9 (or later) support binary relay commands. The binary relay command works like the standard relay command except that all characters received by the SBE44 are relayed to the SIM and the relay termination character is ignored.

Settings for 4K Packets

The SIM and UIM settings in the transmission sequence scenario described in this Appendix are shown next. These settings were designed to effectively coordinate the communications relay and data packet transmission between the MMP, SIM and UIM. Guidelines for these settings are below.

- The UIM terminates Relay when the time since the last character the SBE44 receives exceeds the time specified by the RTERM MAX command (5500 msec default) or the time specified by the RTOTAL MAX command (600 sec default).
- Relay is terminated by the SIM when the time since the last character received by the SIM is greater than the time specified by the BINARY GAP command (5000MSEC default) or the total time specified by the RELAY MAX command (600 SEC default) is exceeded.
- UIM command RTERM MAX must be greater than SIM command BINARY GAP.
- Setting the PONTONE command to ‘Yes’ should cause the UIM to send a wake up tone to the SIM upon power-up. If the wake-up tone is not sent, the MMP forces a tone detect that wakes up the SIM after 40 seconds.

SIM Settings

SBE 37 SURFACE MODEM V 2.8
wait time for dataNN response = 1000 msec
wait time for relay command response = 600 seconds
binary relay character timeout = 5000 msec
echo = yes
execute pwr on command on powerup = no

← RELAYMAX=600
← BINARYGAP=5000

UIM Settings

SBE 44 UNDERWATER MODEM V 1.9
sensor baud rate = 9600
break character length = 1000 milliseconds
time out after 30 seconds without receiving a valid command
termination character is 62, char = >
Relay Command Settings:
 relay termination characters = <CR><LF>
 total time for response = 600 seconds
 wait 0 milliseconds before sending the command
 halt relay after a gap of 5500 milliseconds between characters
GDATA Command Settings:
 total time for response = 30 seconds
 wait 0 milliseconds before sending the command
 halt acquisition after a gap of 1000 milliseconds between characters
 GDATA command string = NO STRING
include gdata reply delay in datann reply
do not enable control line on power up
disable control line logic for relayed commands
disable control line logic for GDATA command
do not switch power to sensor on power up
disable switch power logic for relayed commands
disable switch power logic for GDATA command
 send tone on powerup

← !01TIMEOUT=30

← !01RTOTALMAX=600

← !01RTERMMAX=5500

← !01GTERMMAX=1000

← !01PONTONE=Y