Profilers   Samplers   Flotation

mclanelabs.com

Sediment Trap
User Manual

2017 McLane Research Laboratories, Inc., Rev.17.F.28

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Chapter 1
Introduction and System Description

McLane Sediment Trap

The McLane Sediment Trap is a time-series sampler that uses 21 or 13 individual sample bottles of 250mL or 500mL to collect the flux of settling particles in-situ. Several Sediment Trap models are available to fit different sampling needs.

Figure 1-1: Standard and Mark 8 Size Sediment Traps

Sediment Trap Models

Available Sediment Trap models are listed below.

Model	Description
Mark 78H-21	Collects 21 individual samples in 250mL or 500mL bottles.
Mark 78HW-13	Collects 13 individual samples in 250mL 0r 500mL wider bottles.
Mark 8	Collects 13 individual samples in 250mL or 500mL bottles. This Sediment Trap has a smaller cone and lighter weight than the Mark 78H Sediment Trap series.

<u>Sediment Trap Options</u>

Optional Sediment Trap features include:

- **Optional Compass/Tilt, Pressure and Temperature:** Optional sensors can be installed to record compass/tilt, pressure and temperature data. The compass collects a time history of tilt magnitude and direction.

- **Optional High Pressure Penetrators:** Sediment Traps deployed at depths from 7,000 to 10,000m, require high pressure penetrators on the controller COM port and motor connector. These high pressure penetrators have a locking collar with an inner locking ring.

Examples in this User Manual use the Standard MarkH-21 Sediment Trap model unless otherwise specified.

Using this Manual

This User Manual provides:

- Descriptions and specifications of mechanical and electrical parts of the system.

- Operating instructions.

- Suggested maintenance procedures to extend sampler performance.

This user manual is designed to provide support from the first steps of powering on and communicating with the instrument, to the final steps of recovering data from a recently deployed system, and storing the instrument. Sampler operators and technicians should read this manual and keep a copy as a reference.

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User Key

This User Manual contains the following symbols that call attention to information:

Note This symbol indicates information and tips that are helpful for operating the instrument.

Important This symbol indicates information that could affect key product operations.

Caution This symbol indicates information that must be followed to prevent instrument damage or user injury.

Customer Resources

McLane Research Laboratories is on the Web at http://www.mclanelabs.com or via email at mclane@mclanelabs.com. The Sediment Trap pages on the McLane website contain links to documentation including Technical Bulletins, and papers that describe the development and use of the Sediment Trap.

Technical Support

When contacting McLane for technical support, please provide the following:

- Firmware version and instrument serial number. Serial number is printed on a label attached to the controller housing or on the Contact screen (Figure 1-2).
- A description of the problem.
- A text file of data created using the MotoCross file capture utility.

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McLane Research Laboratories, Inc.


              Falmouth Technology Park
         121 Bernard East Saint Jean Drive
         East Falmouth, MA 02536-4444  USA

           Email: McLane@McLaneLabs.com
          Web: http://www.McLaneLabs.com
        Tel: 508-495-4000  Fax: 508-495-3333

             Configuration: PST-21
              Source file: CF2-3_12.c
            Electronics S/N: ML12345-01
            Compiled: Oct 27 2015 15:32
```

Figure 1-2: McLane Contact Information

Instrument Training

McLane also offers a 1 day Sediment Trap training course at our facility free of charge with the purchase of a new instrument. Participants conduct trial deployments and work directly with members of the McLane engineering staff. Conducting trial deployments is a beneficial way to learn system operations before actual field investigations.   For more product training information refer to www.mclanelabs.com.

Mechanical Components

Mechanical components of the Sediment Trap include the frame, funnel, and baffle. Controller housing, o-rings, and gear plate assembly. These are described in the section that follows.
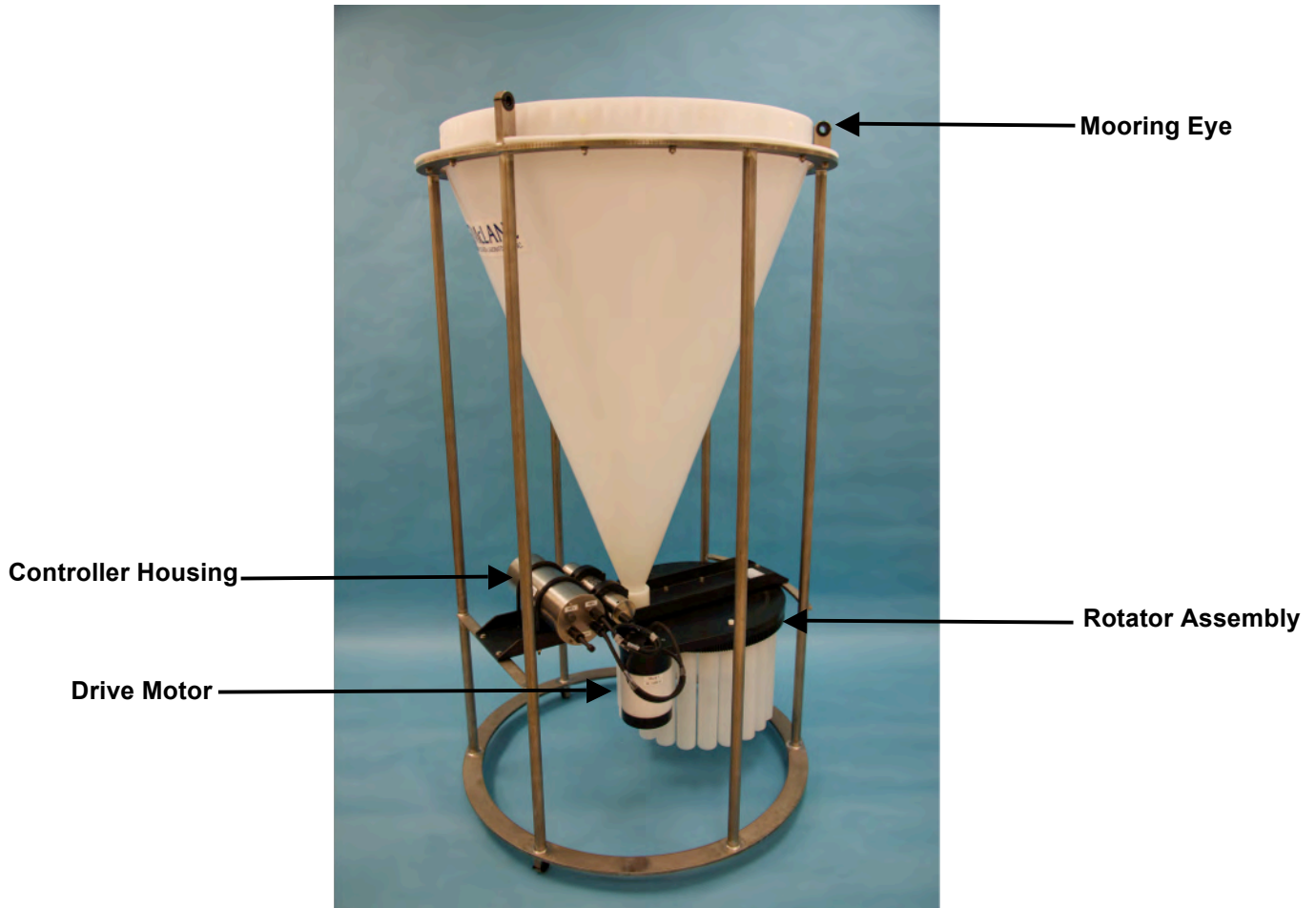

Figure 1-3: Mark 78H-21 Sediment Trap – Full View

Frame

The Sediment Trap frame is an electro-polished 316 stainless steel welded frame designed to protect the controller electronics and rotator. CTD's, fluorometers and other sensors can also be attached to the frame.

Funnel

The funnel collects settling particles from the wide opening at the top of the Sediment Trap and deposits them into individual sample bottles on a user-defined schedule.
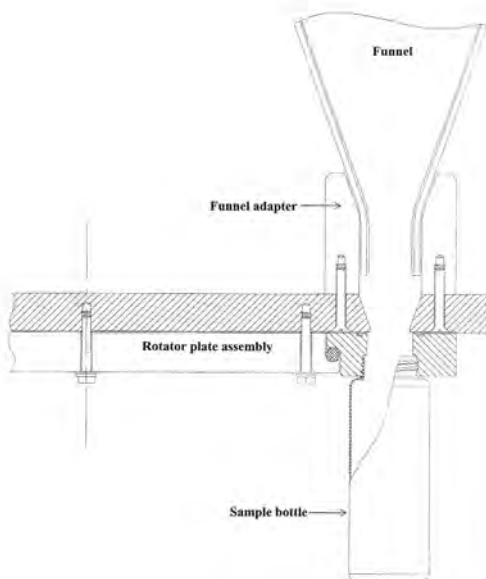

Figure 1-4: Funnel and Sample Bottle Side View

Honeycomb Baffle

A honeycomb baffle tops a short polyethylene mounting cylinder at the top of the Sediment Trap funnel. This baffle prevents large objects and marine life from clogging the sampler because each baffle cell is more narrow than the small aperture at the bottom of the funnel.

Figure 1-5: Honeycomb Baffle

Controller Housing

The standard Titanium controller housing is pressure resistant to 7,000 meters. For more shallow depths, a 5,500 meter rated aluminum housing is available. A deep controller housing option is rated to 10,000 meters. The controller housing holds the battery pack for 14 'C' cell alkaline batteries, and the electronics assembly. Two latex rubber-insulated, 316 stainless steel U-bolts fasten the housing to the frame. The controller can be opened while attached to the frame.
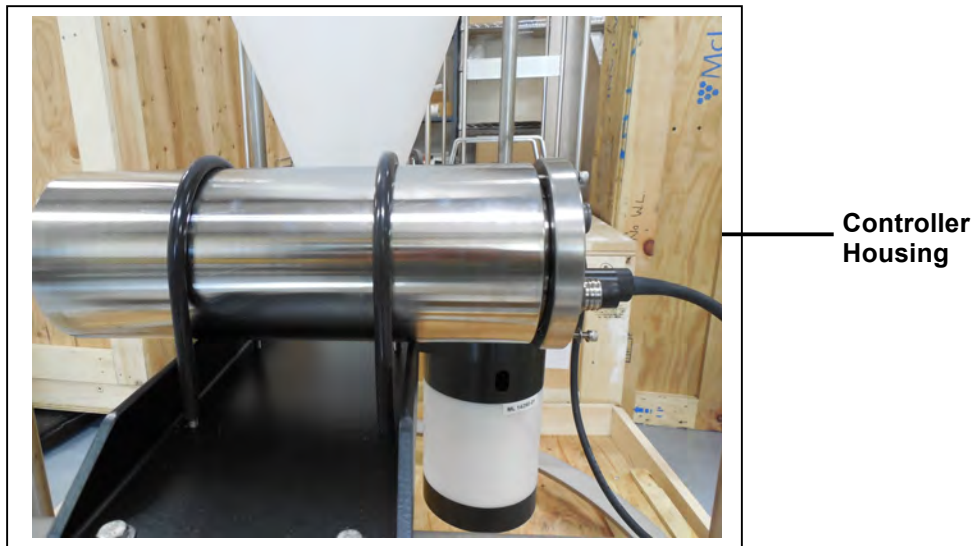

Figure 1-6: Controller Housing

Top and Bottom End Caps

Top and bottom end caps seal the controller housing from water intrusion with a face o-ring seal and a radial o-ring seal (with a backup ring).

O-Rings

The Sediment Trap end cap o-rings are custom-made. O-rings must be installed properly and kept in place at all times. Each set includes three custom o-rings (200-0071, 200-0072, 200-0073).

See Chapter 6, 'Maintenance and Storage' for detailed instructions on cleaning the o-rings and positioning the o-rings when inserting the end cap into the controller housing.
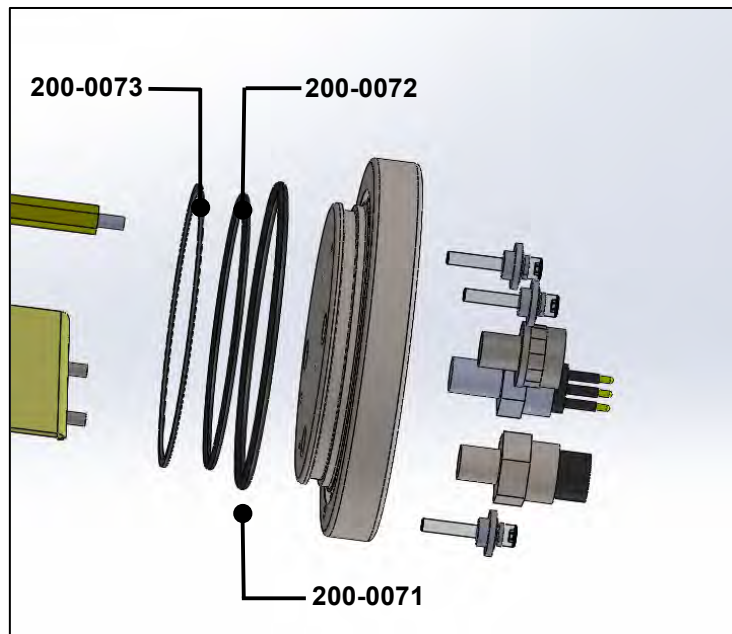

Figure 1-7: Sediment Trap O-Ring Installation - Correct Placement is Critical

O-ring maintenance and correct placement is critical to keep the controller housing end caps from water intrusion. Incorrect o-ring placement results in cracks or splits that could affect the o-ring seal and cause water damage to the controller. Water damage from incorrectly placed or maintained o-rings can void the sampler warranty.

End Cap Bulkhead Connectors

The standard controller housing end cap has bulkhead connectors for the Motor and COM Port. The connectors are labeled "M" (Motor) and "C" (COM Port). The aluminum end cap also has a zinc anode attached. Figure 1-65 shows the standard end cap and bulkhead connectors. Figure 1-76 shows the deep controller housing end cap and bulkhead connectors.
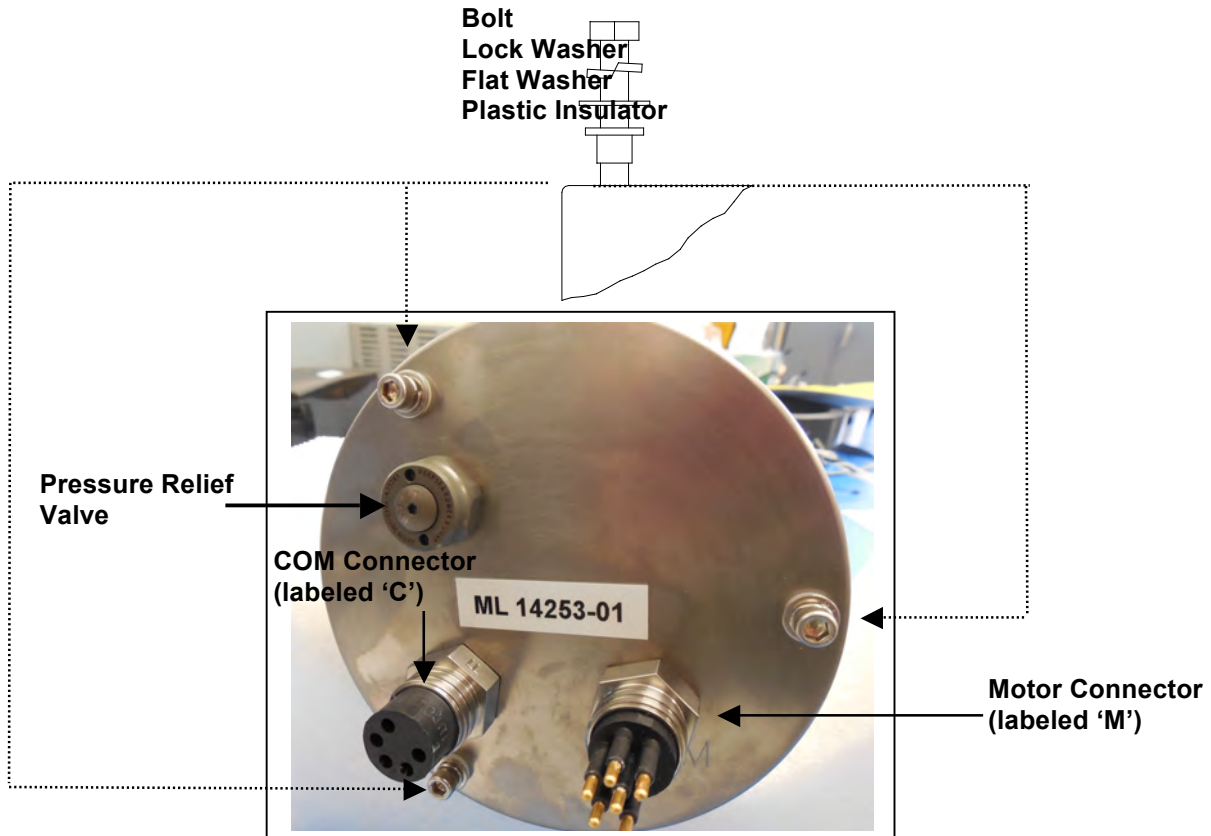

Bolt
Lock Washer
Flat Washer
Plastic Insulator

Pressure Relief Valve

COM Connector (labeled 'C')

ML 14253-01

Motor Connector (labeled 'M')

Figure 1-8: Standard Titanium Controller Housing End Cap and Bulkhead Connectors

Three bolt/washer assemblies secure the end cap. A white plastic insert fits into the screw hole, with a flat washer, spring (lock) washer, and the bolt. Hardware is stainless steel type 316. A 7/16" nut driver is included in the toolkit for tightening the end cap bolts.

Do not overtighten the end cap bolts and do not replace the stainless steel hardware with any other hardware. Spare hardware is included in the Toolkit, or contact mclane@mclanelabs.com for hardware.

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Optional High Pressure Penetrators

Sediment Traps deployed at depths from 7,000 m to 10,000 m, require high pressure penetrators on the controller COM port and motor connector. These high pressure penetrators have a locking collar with an inner locking ring. Sediment Traps with the deep bulkhead connector option do not have a pressure relief valve installed. See Appendix E 'Deep Sediment Trap Connectors' for details about the deep controller housing end cap.

Figure 1-9: Deep Controller Housing End Cap Bulkhead Connectors

Pressure Relief Valve

Attention and care should be taken in maintaining, operating, and opening the pressure housing. As of Summer 2015, McLane includes pressure relief valves (PRV) on all new controller housings.

> Though unlikely, an unsafe internal controller housing pressure is possible, resulting from the chemical reaction between alkaline electrolyte and anodized aluminum due to battery failure with or without the intrusion of seawater. There can be enough pressure to cause the endcap bolts to fail, especially when one or more are loosened or removed.

Pressure Relief Valve Upgrade

> McLane offers a Pressure Relief valve upgrade retrofit for all controller housings (includes installation, not including shipping and insurance costs). The end-cap and anodizing must be in suitable condition for PRV retrofits.

Contact mclane@mclanelabs.com for more information about the PRV retrofit.

Gear Plate Assembly

The gear plate assembly attaches to the top fixed plate with seven (7) bolts. On the gear plate assembly, four (4) bolts with plastic washers attach the gear ring to the bottom fixed plate. An unthreaded alignment hole, referred to as Port 'Zero' (0) aligns the rotator assembly when the Trap is deployed to protect the integrity of the adjacent sealed bottles and prevent sample contamination. The first sample bottle hole is labeled '1'.
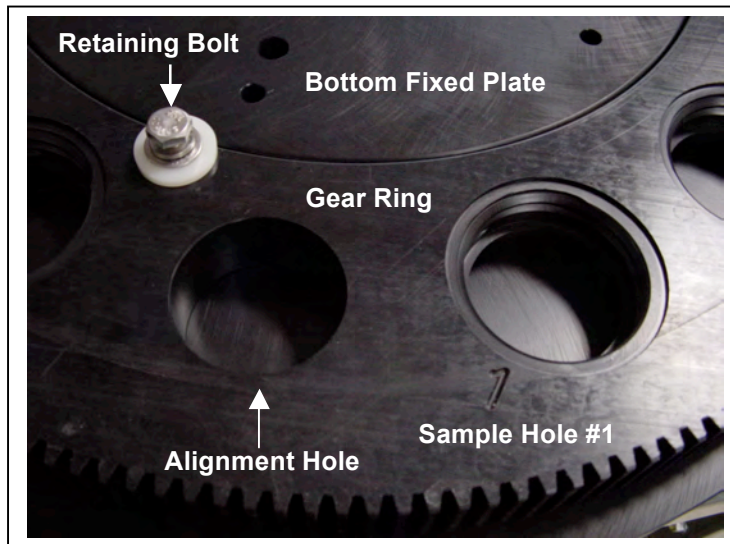

Figure 1-10: Gear Ring Alignment Hole and Sample Bottle Hole #1

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Plastic Ball Bearings

The inside of the Gear Plate Assembly is filled with plastic ball bearings.
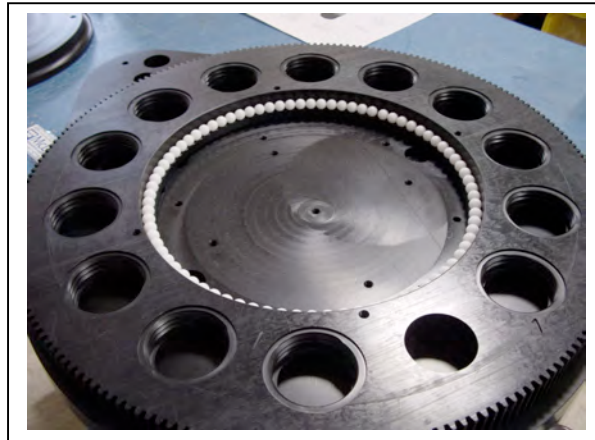

Figure 1-11: Bottom Fixed Plate and Gear Ring

Figure 1-12: Plastic Ball Bearings

Variseals®

The upper openings of the sample bottle holes are fitted with Teflon spring-loaded Variseal® gaskets to seal out ambient water and protect the samples from contamination. Do not apply grease or lubricant to the gear ring, bottom fixed plate, or Variseals®.These gaskets are visible when the gear plate assembly is detached from the top plate. A continuous Hastelloy circular spring inside the gasket expands the upper and lower gasket halves.

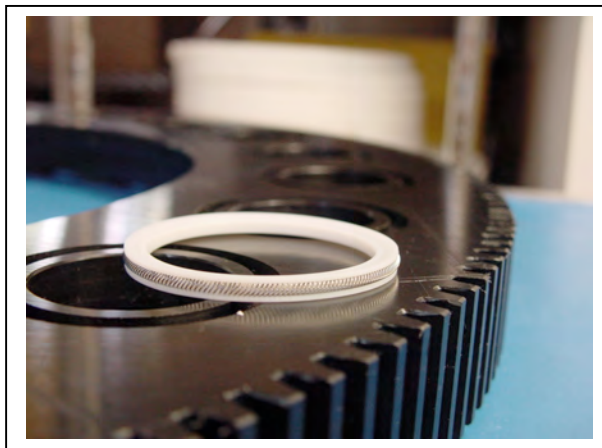*Figure 1-13: Gear Ring with Variseals®*

Figure 1-14: Variseal® Installation

The plastic ball bearings and Variseals® in the gear plate assembly are highly durable and withstand multiple years of deployment activity without replacement. McLane recommends replacing the bearings and seals at the factory.

Drive Motor

The drive motor assembly contains the following:

- A high-torque electronic stepping motor

- A reducing gear train

- A microswitch/cam device

- A titanium main drive shaft

The motor's main drive shaft generates 30 kg/cm torque at the spur gear. A switch and cam assembly in the stepper motor confirms proper alignment of each bottle. The firmware also records the time and fill position when each bottle advances.

The motor housing interior is filled with 450 ml of silicone fluid (a quad-ring around the main drive shaft securely separates the silicone fluid from seawater). A bladder of flexible, impermeable Nitrile allows compression of the silicone fluid to compensate for external static pressure. At l,000 atm, the fluid compresses to 92% of its volume compared at one atmosphere. All interior motor housing shafts are supported by high precision ball bearings.
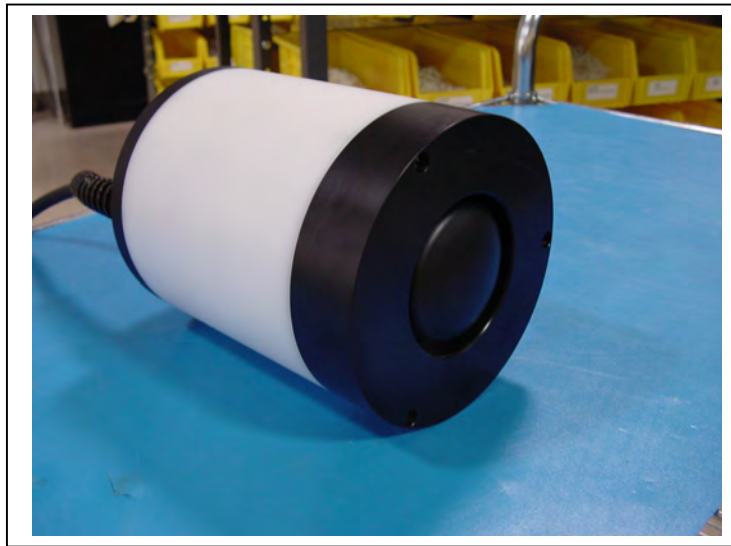

Figure 1-15: Drive Motor Housing

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Sediment Trap Toolkit

Each Sediment Trap comes with a toolkit that contains tools, materials, and devices to use the Sediment Trap. The toolkit and contents are referred to throughout this User Manual, and should remain with the instrument at all times.

Figure 1-16: Sediment Trap Toolkit

The Sediment Trap toolkit in Figure 1-13 is shown only as an example. Do not use the photo to compare with your actual toolkit contents.

Serial Number

The Sediment Trap cross channel support contains the instrument serial number printed on a label. The controller housing end cap and System Menu also display the serial number.

Figure 1-17: Serial Number Label

Electronics Components

The Sediment Trap firmware runs on the Persistor CF2 microcontroller. Older Sediment Trap systems use the TattleTale 8 (TT8) microcontroller. The TT8 was discontinued, and McLane instruments now use the CF2. While most of this User Manual can apply to both current and older McLane instruments, significant firmware, hardware, and procedural changes have been made to the Sediment Trap with the CF2 microcontroller and some sections will not apply to older systems.

Contact mclane@mclanelabs.com for information about upgrading from the TT8 to the CF2 microcontroller. McLane recommends this upgrade. We offer only limited support on devices that use the TT8 microcontroller.

McLane electronics are designed to use minimal power while achieving the longest possible deployment durations. Instrument electronics spend most of their time in low power sleep mode. In this suspended state, the system consumes very little power (micro-amps) while keeping track of time to start and complete scheduled events.

The Sediment Trap electronics communicate using RS-232 serial communications and a terminal emulator. A communications cable included in the toolkit connects the Sediment Trap controller with a computer. Computers that do not have a built-in RS-232 serial port use a USB to RS-232 converter that is also included in the toolkit.
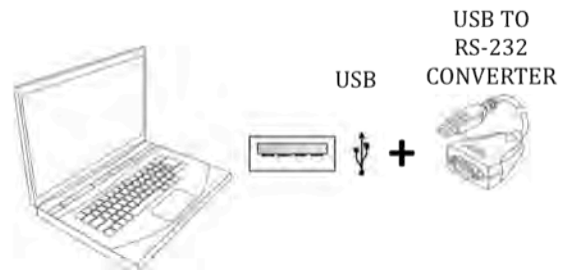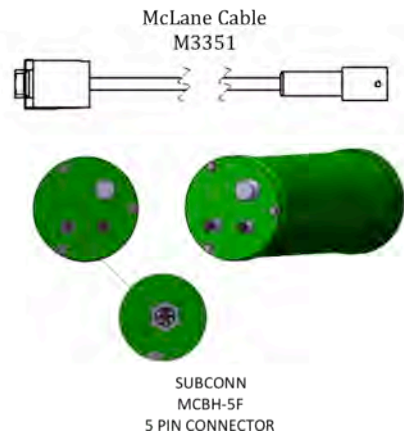
Figure 1-18: USB Communications

Communications Bulkhead Connector Styles

The communications cable bulkhead connector (connection to the sampler) is a 5-pin MCBH style. Some older instruments may have a 3-pin XSG style bulkhead connector.
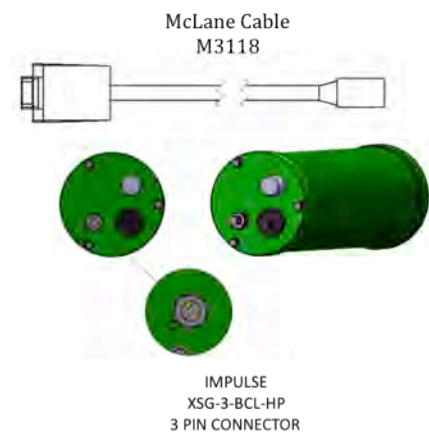

Figure 1-19: Communications Cable Connector Style

Main Battery

The Sediment Trap battery holder holds user replaceable drop-in 'C' cell batteries. Be sure to install the batteries with the correct orientation in the holder terminals. An instructional video showing drop in battery replacement is shown on the Sediment Trap video pages at www.mclanelabs.com.
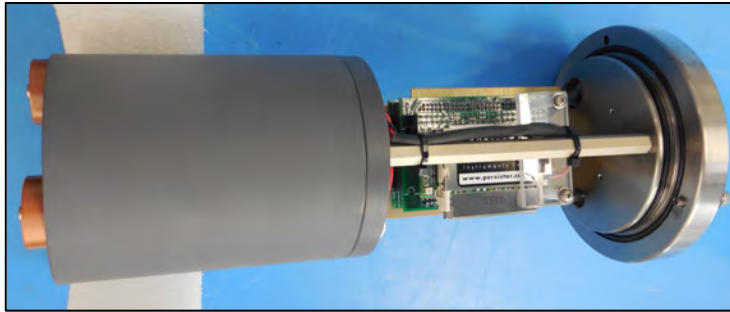

Figure 1-20: Drop-in Battery Holder for 'C' Cell Alkaline Batteries

Always take standard electrostatic discharge (ESD) precautions when handling the electronics.

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Backup Battery

After the spring of 2015, new McLane CF2-based instruments no longer require a backup battery. Prior to this change, the backup batteries served as a voltage source for the electronics while in low power sleep mode. Electronics hardware changes made the backup battery unnecessary, and it was eliminated.

If using an older Sediment Trap, check for backup batteries. If your system has backup batteries, be sure to replace them before each deployment. On the TT8 microcontroller based devices, the backup battery was a 9 volt battery mounted beside the electronics. On the Persistor CF2 microcontroller based devices, the backup battery was two AAA batteries mounted near the electronics.
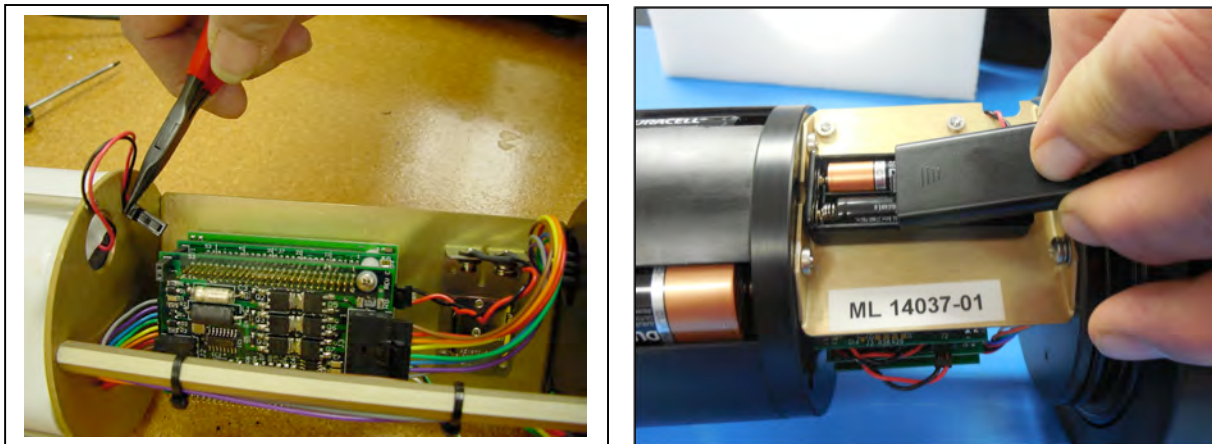

Figure 1-21: Backup Battery 9V and AAA Styles (Older Model systems)

Notes

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Chapter 2
Getting Started with your McLane Sampler

This chapter provides the information that will help you become familiar with your sampler, connect to a computer, and power on the system. This includes the following:

- Setting up a computer for the sampler.

- Connecting the sampler to a computer.

- Powering on the sampler.

- Waking the sampler from low power sleep.

Section   2.1
Setting up a Computer for the Sampler

You will need a computer and a terminal emulation program to communicate with your sampler. Ideally, the computer will have a built-in RS-232 serial port. A USB to RS-232 adapter is included in the sampler toolkit for computers without the built-in serial port. While different terminal emulators can be used to communicate with McLane instruments, only MotoCross, a terminal emulator for Windows, can be used to upgrade McLane firmware.

A MotoCross installer is located in the firmware directory of the USB drive shipped with your system. The MotoCross installer can also be downloaded from the sampler's Software page on the McLane website: www.mclanelabs.com.

> MotoCross is available from other sources, but the version provided by McLane is programmed with default settings to work with McLane instruments.

Installing MotoCross

1. Find and double-click the file "Setup_Motocross.exe" on your USB drive (or directory if you downloaded "Setup_Motocross.exe" from the Mclane website mclanelabs.com).

2. The installer program will guide you through a series of screens.

3. When prompted to choose a destination for the extracted files, navigate to C:\Program Files (x86) and create a new folder named MotoCross.

4. When MotoCross is extracted, right-click the executable 'MotoCrossML' and create a shortcut on the desktop for easy access.
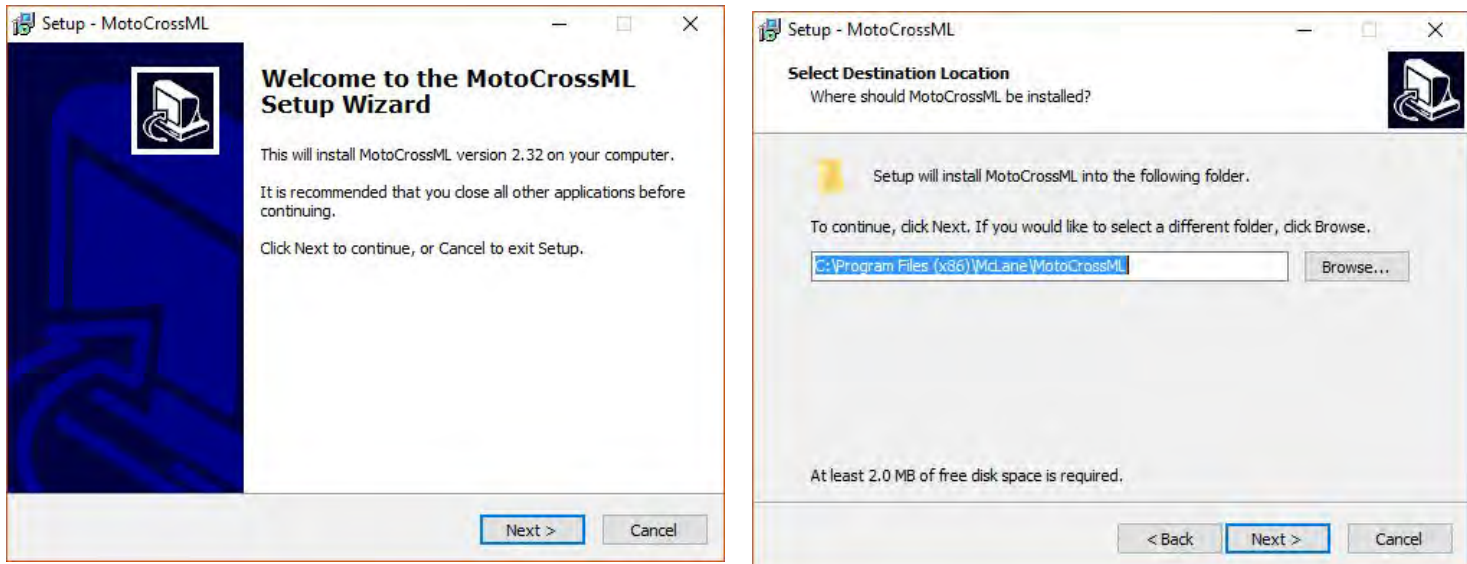

Figure 2.1-1: MotoCrossML Setup Wizard Screens 1 and 2
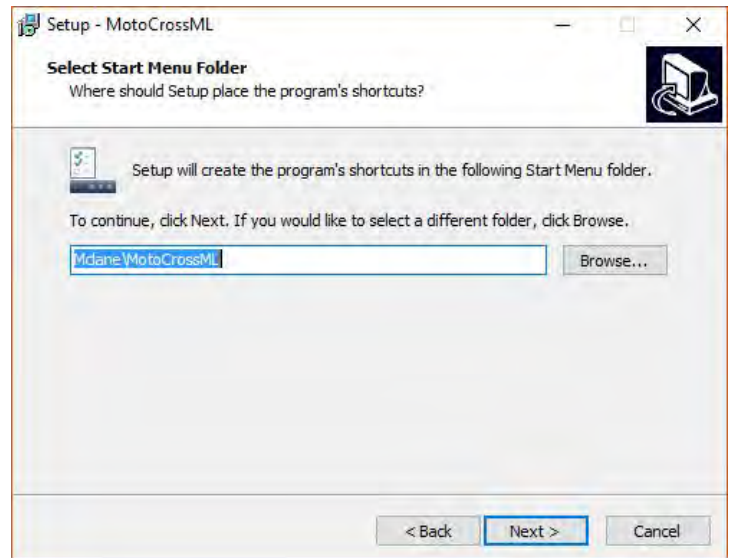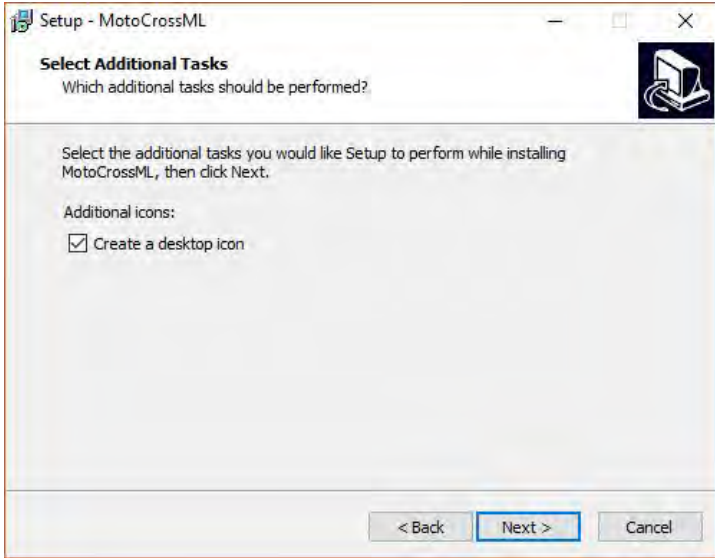
Figure 2.1-2: MotoCrossML Setup Wizard Screens 3 and 4
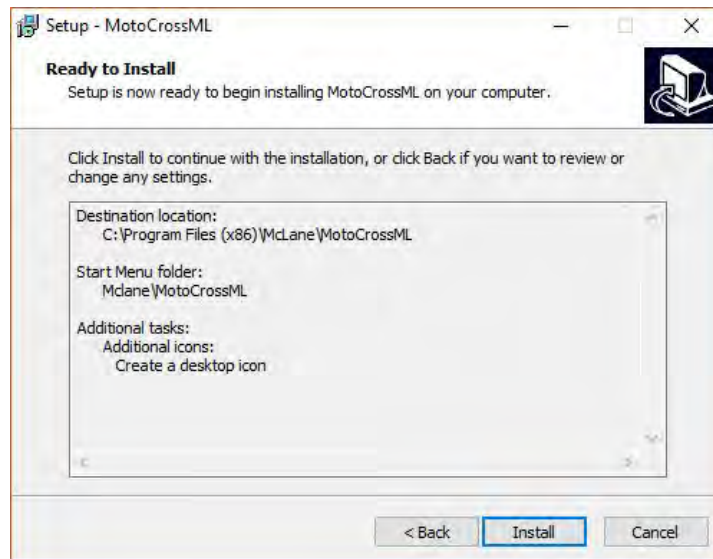
Figure 2.1-3: MotoCrossML Setup Wizard Screen 5

Section 2.2
Connecting the Sampler to a Computer

Communicating with the instrument requires connecting the communications cable to the computer that has the terminal emulation and configuring the terminal emulation software, MotoCross.

Connecting a Computer

Connect to the sampler by plugging the communications cable from the communications bulkhead on the end cap to a computer RS-232 serial port.

For a computer without a built-in RS-232 serial port, locate the USB to RS-232 adapter included in the sampler toolkit. Using the USB to RS-232 adapter, plug in the USB port, wait for the drivers to install, and then check the computer's Device Manager for the new USB Serial Port. Windows downloads and installs the necessary drivers automatically when the USB to RS-232 adapter is plugged into a USB port.

Figure 2.2-1: Communications Cable

Configuring MotoCross Communications Settings

1. From the Windows Start Menu – search the Control Panel for the device manager.

2. Open the device manager.

3. Scroll down to "Ports (COM & LPT)".

4. If you are using a USB to RS232 adapter and you see a device named USB Serial Port, you can verify this is your adapter by unplugging the adapter and waiting for it to disappear from the device manager COM Port list.

5. If your device is not listed, contact McLane Research Labs (mclane@mclanelabs.com) for assistance.
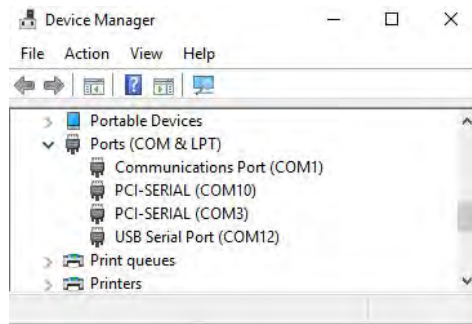
Figure 2.2-2: *Device Manager COM Port list*

Once you have identified your communication port, you will have the information needed to configure MotoCross communication settings.

1. Select "Communication Settings" from the MotoCross File Menu.

2. Enter the following values:

Port :	Communications Port # identified in the previous steps.
Baud Rate:	9600
Mx Download Baud:	115200
Parity:	None
Data Bits:	8
Stop Bits:	1
Flow Control:	None

Control Character Transmission

All McLane instruments use the control character [CTRL]-[C] to wake from Suspend mode, navigate the menu system, and cancel operations. The McLane version of MotoCross is pre-configured to transmit control characters.

MotoCross offers a configurable option to either transmit control characters, or to perform standard Windows editing functions with CTRL-key combinations. It is possible to switch to perform standard Windows editing functions with CTRL-key combinations by accidentally pressing [CTRL]-[SHIFT]. If this switch is made, [CTRL]-[C] will not transmit the control characters needed to wake McLane instruments from Suspend mode.

Always ensure MotoCross is configured to transmit control characters by selecting "Copy – Paste Options" from the Edit Menu, and confirming the configuration as displayed in Figure 2.2-3.
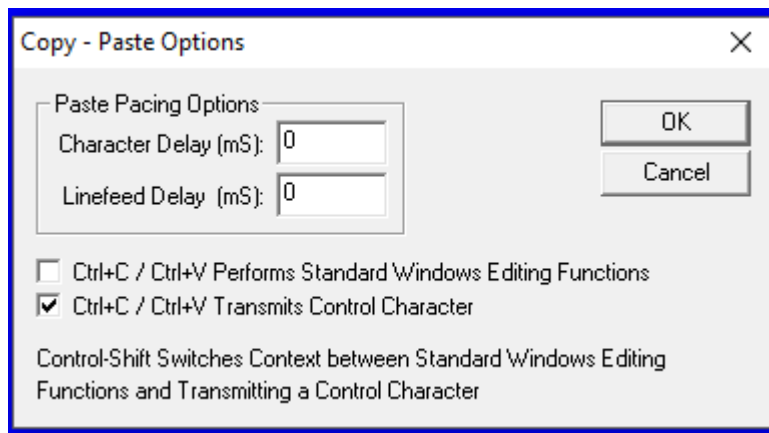
Figure 2.2-3: Confirm Motocross Configuration

Creating a Capture File

MotoCross and other terminal emulators have a "Capture" or "Log" feature. It is **very important** that all communications to your McLane instruments are captured to file. Capture files are used for troubleshooting with McLane technical support, and provide a record of your deployment settings, bench tests, and so on.

Follow these steps to log communications in MotoCross to a file:

1. Select Capture Test > Start from the MotoCross Transfer Menu.

2. Select a location to save the file.

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3. To clear any existing file contents, select 'Overwrite'. To add to existing file contents select 'Append'.

4. When asked to include buffer text, select 'No'.
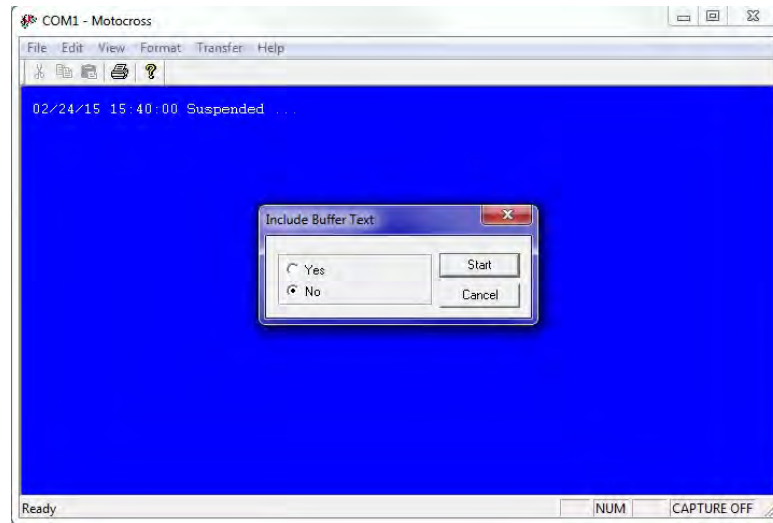
Figure 2.2-4: Do not include Buffer Text

If MotoCross has been running for a long time, a large buffer can crash the program if it is included in the buffer. If you must, save data that has already printed to the screen.

1. Use Windows Notepad to create a text file.

2. Copy and paste the data you wish to include.

3. Save and close the file.

4. Start capturing communications to the file you created, Append data to the file instead of Overwriting data.

Troubleshooting the USB Adaptor

The USB adaptor has LED indicator lights for transmitting and receiving data. Typing any key in MotoCross terminal emulation should be indicated by the LED. If no LED light flashes on keystrokes, you may have selected the incorrect COM Port. Refer to the section that follows for instructions on MotoCross setup.

Section 2.3
Powering on the Sampler

Connecting the battery is the only way to power on the sampler electronics. This step requires opening the controller housing. Be sure to perform this procedure in a dry area and familiarize yourself with steps for using the Pressure Relief Valve.

Opening the Controller Housing Equipped with the PRV

Attention and care should be taken in maintaining, operating, and opening the pressure housing. All samplers shipped after summer 2015 have a pressure relief valve (PRV) on the controller housing. This valve releases automatically at a pressure differential greater than 10psi. The PRV style may have a center hole and release tool, or the style may have a flat relief valve that must be manually pulled out.

> Observe safety precautions including removing personnel and objects from the path of the end-cap when removing the controller housing.

Figure 2.3-1: Releasing Pressure Relief Valve (Flat Style)
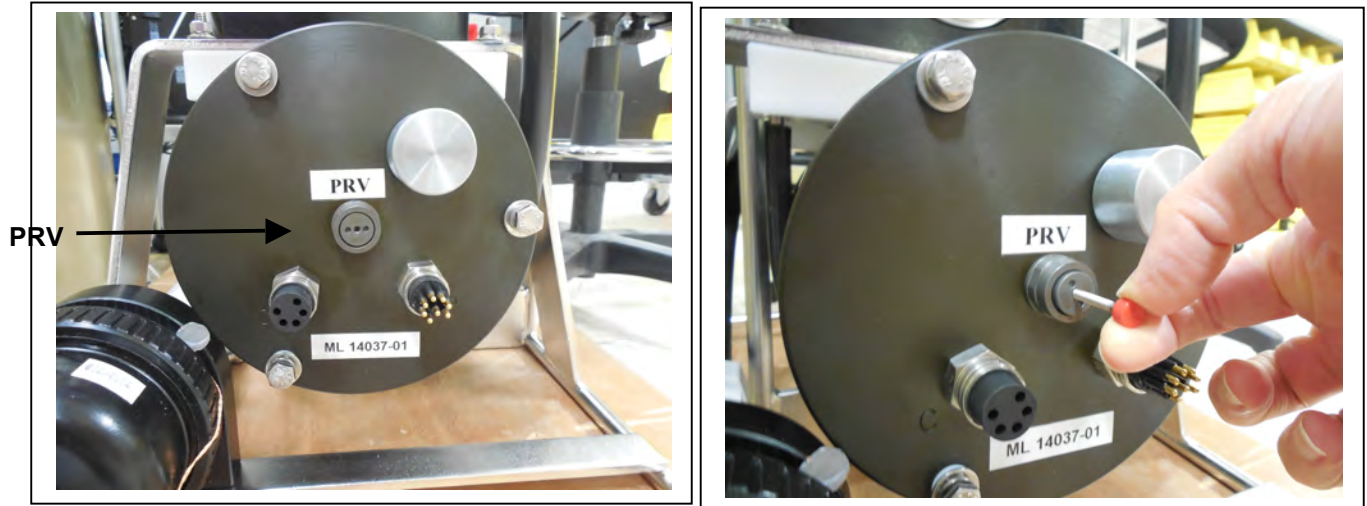
Figure 2.3-2: Releasing Pressure Relief Valve (Style with Release Tool)

As a safety measure, the valve should be manually released prior to opening the controller housing by following the steps below. Steps for opening a controller housing that does not have a PRV installed are included at the end of this section. Follow those steps if you have a controller housing manufactured before 2015 that does not include a PRV.

1. Disconnect the cables from the end cap (if connected).

2. Slowly pull on the pressure relief valve to release any vacuum or built up pressure in the housing.

3. Loosen each end cap bolt a few turns at a time in a star pattern.

> If the end cap separates from the housing as you loosen the bolts, this could indicate a possible pressure buildup inside of the housing. Stop loosening bolts and continue to gently pull on the pressure relief valve.

4. Remove and place the end cap hardware somewhere safe. Typically plastic inserts have a snug fit and will remain in the end cap.

5. Grasp the end cap lip with fingertips and pull the end cap out of the housing (Figure 2.3-3).
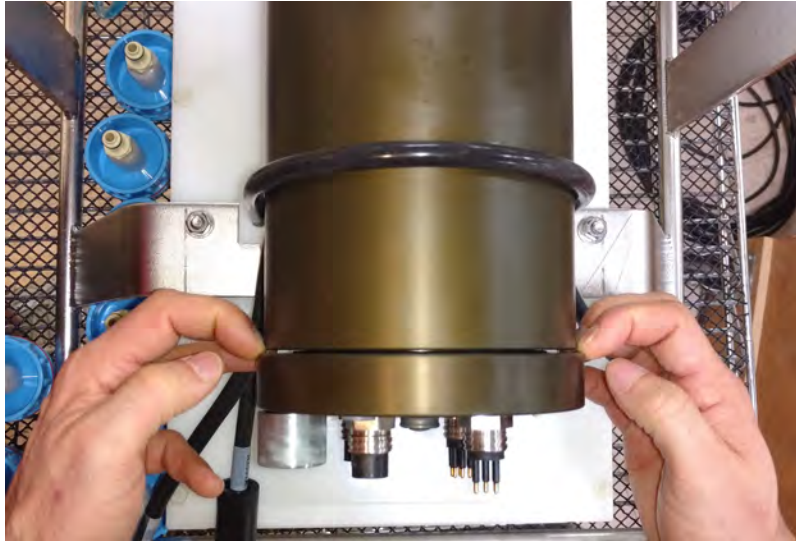
Figure 2.3-3: *Separating the Housing and End Cap*

The end cap to housing seal is tight and sometimes difficult to open. Do not use a tool to pull open the housing. The end cap o-rings can be damaged if objects are used to separate the end cap from the housing.

Connecting the Battery and COM Cable

Once the controller housing is open, the battery can be connected.

1. Locate the battery conductors. The black two pin MTE connector will only fit into one connector on the electronics stack. Find the two pin female connector that mates with the battery connector on the Aux / Stepper board and plug in the batteries.

Figure 2.3-4: Connecting the Battery

Backup batteries are not installed with firmware v2.05 and higher. Electronics hardware changes made the backup battery unnecessary and it was elminated. If deploying a Sediment Trap that still has a backup battery, install a fresh battery before every deployment.

2. Find the communication cable provided in the toolkit.

3. Connect the communications cable to the computer serial communication port before connecting to the communications connector on the controller end cap.

4. Align the bulkhead connection pins, and push bulkhead in place on the controller end cap.

Figure 2.3-5: Connecting the COM Cable

5. On the computer, open a properly configured MotoCross window.

6. Connect the DB9 end of the communication cable to the computer communication port configured in MotoCross.

7. Enter [CTRL]-[C] in MotoCross. If the computer setup procedures were completed correctly, the Main Menu, a system clock confirmation message, or a message that indicates the system is Suspended will print to the screen.

Opening a Controller Housing not Equipped with the PRV

To open a controller housing without a PRV installed, follow the steps below, otherwise skip this section and continue with the steps to power on the sampler. Steps to detect and release a pressure build up are also provided.

1. Loosen all end cap bolts slightly. <u>Do not</u> completely remove the bolts.

Do not remove any individual bolts until pressure has equalized.

2. Observe whether the end cap moves once the bolts are loosened. Movement could indicate a pressure build-up inside the controller housing.

3. If a pressure build-up is suspected, loosen a bulkhead connector only one turn (do not remove the bulkhead connector) to allow the pressure to equalize.

4. Let the controller sit undisturbed to allow pressure to equalize before attempting to further loosen the end-cap bolts.
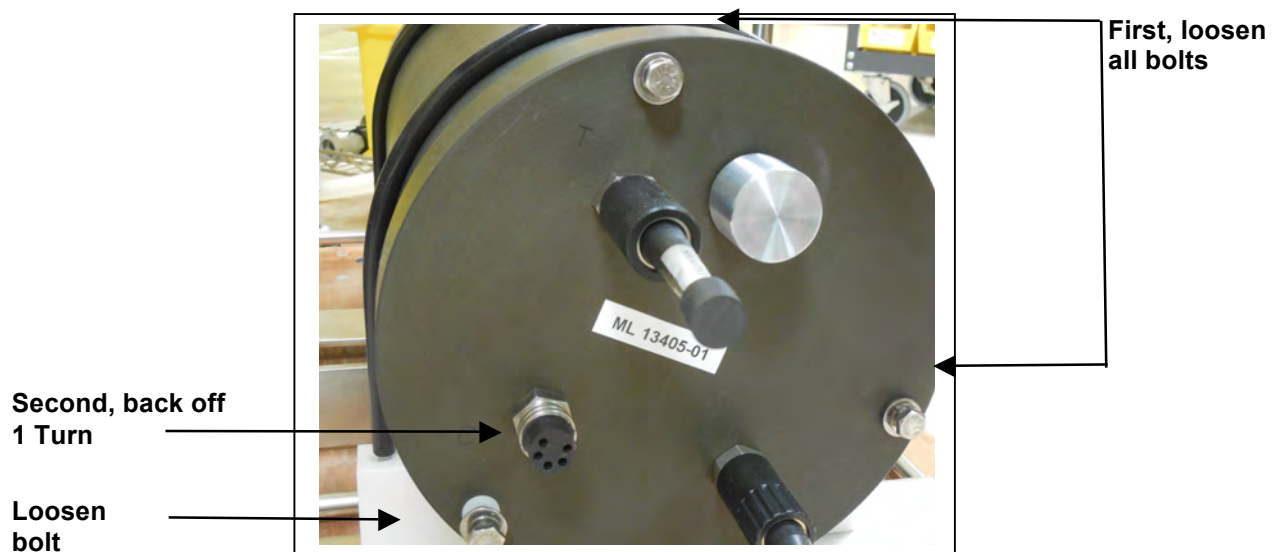
Figure 2.3-6: Controller End Cap, No PRV

Section 2.4
Waking the Sampler from Low Power Sleep

The sampler will enter a low power mode if it sits idle for more than 20 minutes. To wake the system from this suspended state, hold down [CTRL]-[C]. After three seconds of holding down [CTRL]-[C], the Main Menu will display (Figure 2.4-1).

If [CTRL]-[C] is held down for more than 5 seconds and nothing happens, check the previous sections of this chapter to make sure procedures were followed correctly. If your system has backup batteries, confirm they are properly seated in the backup battery housing, and make sure they are plugged into the electronics.

```
_____
CF2-PST-3.12 R1 L2.3 |  PST-3_12.c compiled Oct 27 2015 at 15:32

       PST-21_CT  S/N ML?????-??  ParFlux Sediment Trap

 © 1996-2015 McLane Research Laboratories. All rights reserved.
_____

Clock reads 12/23/19 00:01:17.  Change [N] ? y

Format is mm/dd/[yyyy or yy] hh:mm:ss

Enter correct time [12/23/2019 00:01:18] ? 09/29/2016 08:21:43

Clock reads 09/29/16 08:21:43.  Change [N] ?

_____
Configuration: PST-21_CT              CF2 V3_12 of Oct 27 2015

             McLane Research Laboratories, Inc.
                  ParFlux Sediment Trap
                       ML12345-01


              _____
                        Main Menu
              _____

                  Thu Sep 29 08:21:45 2016

         <1> Set Time          <5> Create Schedule
         <2> Diagnostics       <6> Deploy System
         <3> Fill Containers    <7> Offload Data
         <4> Sleep             <8> Contact McLane

         <C> Configure
```

Figure 2.4-1: Main Menu

See Chapter 3 for more information about the Main Menu and other user interface menus.

Notes

Chapter 3
User Interface

This chapter introduces the user interface including the Main and Configuration Menus, and explores some basic functions of the Sediment Trap menu-driven user interface. See Chapter 2 for information about connecting the Sediment Trap to a computer and powering on the system. Topics covered in this chapter include:

- Main and configuration Menus
- Instrument Settings (time, diagnostics, manual operations, sleep)
- Deployment Settings (create schedule, deploy Sediment Trap)

Section 3.1
Main and Configuration Menus

Main Menu

The Main Menu is the Sediment Trap home screen. All operations end up back at the Main Menu when completed. The Main Menu automatically displays after system initialization.

Configuration string ↓   ↓ **Firmware version and compile date**

```
_____
Configuration: PST-21_CT_RBR-TD        CF2 V3_12 of Oct 27 2015

          McLane Research Laboratories, Inc.
              ParFlux Sediment Trap    ←—— Serial number
                   ML12345-01
          _____
                      Main Menu
          _____
               Thu Sep 29 08:21:45 2016

        <1> Set Time           <5> Create Schedule
        <2> Diagnostics        <6> Deploy System
        <3> Fill Containers     <7> Offload Data
        <4> Sleep              <8> Contact McLane

        <C> Configure
```
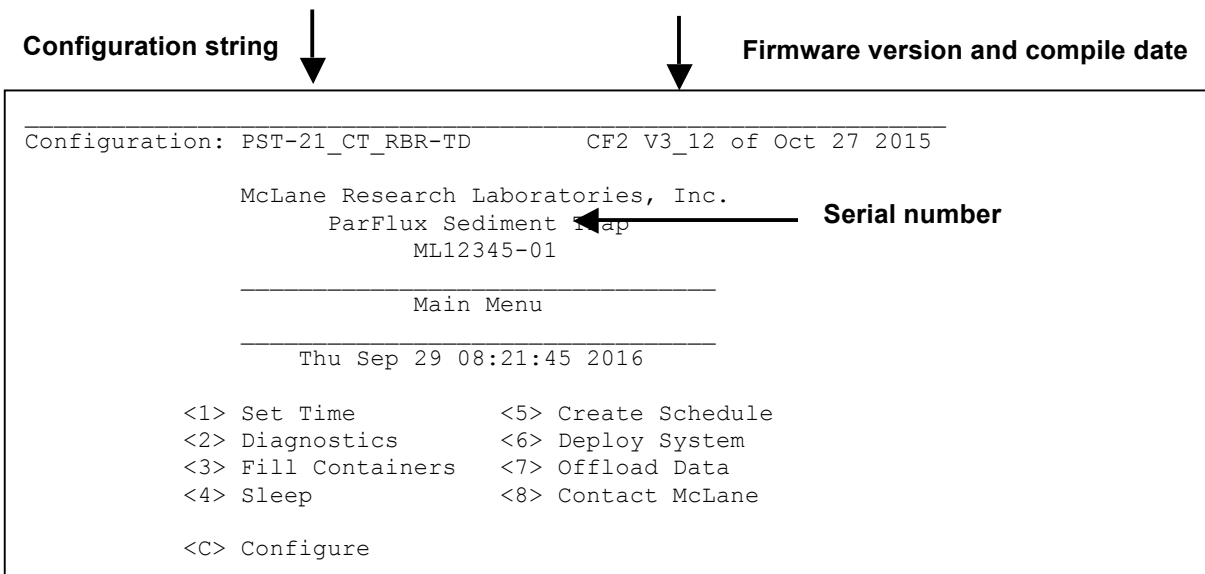
Figure 3.1-1: Sediment Trap Main Menu

- **Configuration String**: The configuration string indicates the current instrument configuration. The configuration string in Figure 3.1-1 indicates the Sediment Trap is a 21 cup model with the Compass/Tilt and RBR Pressure and Temperature sensors.

- **Firmware Version and Compile Date**: The currently running firmware version and the compile date are displayed on the top right corner of the Main Menu.

- **Serial Number**: The McLane Serial Number can be found on the Main Menu and should be included in all system inquiries to McLane Research Labs.

Configuration Menu

The Configuration Menu allows the user to program which components are installed on the system. McLane properly configures the instrument before shipping. You may need to reconfigure the system if mechanical components are added or the system firmware is updated.

```
_____
Configuration: PST-21               CF2 V3_12 of Oct 27 2015


               _____
                     Configuration Menu
               _____
                   Thu Sep 29 08:51:11 2016

          <A> Number Of Cups              [21]
          <B> Compass Tilt                [No]
          <C> Integral Temperature Sensor [No]
          <D> Integral Pressure Sensor    [No]
          <E> RBR duo TD                  [No]
          <F> RBR virtuoso D              [No]

          <X> Save & Exit          <^C> Cancel & Exit

          Selection [ ] ? x

          Configuration successfully stored
```

Figure 3.1-2: Configuration Menu

To configure the Sediment Trap:

1. Enter "C" at the Main Menu.

2. When asked for a password, enter "*CON*".

3. Use menu option A to select the system model (21 cup or 13 cup).

The Number of Cups setting must match the installed Sediment Trap rotator. Contact mclane@mclanelabs.com with your instrument serial number if you have questions about your Sediment Trap configuration.

4. Use <B> -<F> to select options that are installed on the Sediment Trap.

5. Save and exit using Configuration Menu option <X>.

<u>Optional Compass/Tilt, Pressure and Temperature Sensors</u>

These options are enabled on the Configuration Menu. The compass/tilt sensor is an additional electronics board installed on the Sediment Trap controller. The tilt sample interval controls the frequency for data collection. Recording compass/tilt data contributes to battery drain, Setting the tilt recording interval less frequently (such as only when each sample event occurs) will conserve the battery. All tilt data is stored in the non volatile memory file TILT.DAT. EEPROM volatile backup also copies every record from the tilt time history. Pressure and Temperature recordings are an option available with RBR sensors. See Appendix B in this User Manual for detailed information about optional pressure and temperature sensors.

Section 3.2
Instrument Settings

<1> Set Time

The Set Time Menu allows you to program the system real time clock (RTC). McLane recommends setting the RTC during the power-up sequence. When the sampler is powered on, the clock defaults to January 1,1970, 00:00:00. The clock can be set to any date and time in the allowed range and the count will continue from the new value.

Systems with a backup battery will retain the date and time as long as the backup batteries are installed and have an acceptable voltage. Systems without a backup battery will not keep time when the main battery pack is unplugged. To set the time:

1. Select the Set Time option.

2. Enter the date and time using the provided format.

3. Accept the changes to the system clock.

```
 Clock reads 02/08/70 02:20:25.  Change [N] ? y

Format is mm/dd/[yyyy or yy] hh:mm:ss

Enter correct time [02/08/1970 02:21:25] ? 03/04/2015 11:29:11

Clock reads 03/04/2015 11:29:11.  Change [N] ?
Initializing data array .............................
```

Figure 3.2-1: Set Time

<2> Diagnostics

Diagnostics scrolls a display of system status including date, time, battery voltage (in Vb), temperature (in °Celsius), and Rotator status. To exit Diagnostics and return to the Main Menu type *X* or [CTRL]-[C]. Toggle the scrolling on and off without exiting by pressing any other alphanumeric key.

```
              Selection [] ? 2

Hold down ^C to exit. Any other key to pause/continue.

  Date      Time      Battery    Int. Temp      Rotator
09/29/16 08:52:03   21.1 Vb       23.9∞C        aligned
09/29/16 08:52:05   21.1 Vb       23.9∞C        aligned
09/29/16 08:52:07   21.1 Vb       23.9∞C        aligned
09/29/16 08:52:09   21.1 Vb       23.9∞C        aligned
09/29/16 08:52:11   21.1 Vb       23.9∞C        aligned
```

Figure 3.2-2: Diagnostics

- Diagnostics data printed to the screen can be paused and resumed by entering any key into MotoCross.

- Tilt magnitude (in degrees of tilt), and compass heading also display if the compass/tilt option is installed and configured.

- Exit and return to the Main Menu by entering [CTRL]-[C].

Battery Warnings

- Low battery voltage triggers warning messages during the exit from the Diagnostics display. If the main battery falls below 32 V, a message displays suggesting battery replacement before deployment.

- If the main battery falls below 20 V, the message shown below displays, the Diagnostic routine terminates, and the program returns to the Main Menu.

- If critically low battery voltage (under 20 V) is detected and a data file has not been offloaded, the additional warning shown next displays before the system returns to the Main Menu.

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Confirm that deployment data is offloaded and is accurate before disconnecting the battery. The firmware detects only the successful execution of the Offload Data option and not whether the data file was successfully logged by MotoCross. Any deployment data in RAM is lost if the battery is unplugged.

- Type [X] or [CTRL]-[C] to exit from Diagnostics and return to the Main Menu.

<3> Fill Containers

Fill Containers provides direct control of advancing the rotator for bench testing, system assessment, and deployment preparation.

```
            Selection [] ? 3

Rotator is aligned.

Next bottle [Y] ? y Advance how many? (1-22) [1] ? 1

09/29/16 08:52:48 Moving rotator assembly ......... rotor aligned
09/29/16 08:53:12 Lowest battery detected: 20.9V

Rotator is aligned.

Next bottle [Y] ? n
```

Figure 3.2-3: Fill Containers

Main Menu <4> Sleep

Sleep suspends the Sediment Trap in Low power sleep mode to conserve battery power. When the sampler is not rotating to the next sample bottle, this mode automatically triggers after 20 minutes of inactivity.

```
            Selection [] ? 4
10/03/16 14:01:22 Suspended ...
```

Figure 3.2-4: Low Power Sleep Mode

Prior to Sleep mode, the current time will display. During Suspend mode, the system will wake every 20 minutes to check system status, display the time and then return to Suspend mode. Suspend mode automatically occurs after a sample is completed. To wake the system and return to the Main Menu, press [CTRL]-[C] three times (with one second pauses between each keystroke).

Section 3.3
Deployment Settings

The remaining Main Menu options are used to prepare and perform a deployment. These options are:

- **Create Schedule**: Defines the number of samples and frequency of rotation events. A maximum of 22 possible events (21 samples and the closing of the last sample) or 14 possible events (13 samples and the closing of the last sample) can be scheduled. The schedule re-displays for verification when <6> Deploy is selected.

- **Deploy System**: Checks EEPROM requires a reboot if data is stored there, and warns if there is data ready to be offloaded. Confirms rotator alignment, date and time, and displays the sample event schedule for confirmation or change. Displays a final sample parameter check with options to make changes. After the date, time and sampling parameters are confirmed, the final check is performed and a final prompt is displayed.

- **Offload Data**: Works with the "Capture to file" feature of MotoCross. After recovering the Sediment Trap, and re-establishing the communications link with the computer, select <7> Offload Data to capture data to a text file. Confirm that MotoCross "Capture to File" is ON during offload. Offload data before disconnecting the battery to prevent data loss.

Deployment Settings (create schedule, deploy system) are explained in the 'Programming a Deployment' section in Chapter 4 of this user manual. Offload Data options are explained in Chapter 5 of this user manual.

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<8> Contacting McLane

This option displays McLane contact information and includes the software version and serial number of your instrument.

```
Selection [] ? 8

McLane Research Laboratories, Inc.
                Falmouth Technology Park
           121 Bernard East Saint Jean Drive
           East Falmouth, MA 02536-4444  USA


             Email: McLane@McLaneLabs.com
            Web: http://www.McLaneLabs.com
          Tel: 508-495-4000  Fax: 508-495-3333

              Configuration: PST-21_CT
              Source file: CF2-3_12.c
            Electronics S/N: ML12345-02
            Compiled: Oct 27 2015 15:32

 Press any key to continue.
```

Figure 3.3-1: McLane Contact Information

Notes

Chapter 4
Operations

This chapter describes the procedures involved in preparing the Sediment Trap for a deployment. Topics include:

- Preparing and attaching the sample bottles.

- Aligning the rotator to the open position.

- Filling the sample bottles.

- Programming deployment parameters.

Section 4.1
Preparing and Attaching the Sample Bottles

Preparing and attaching the sample bottles includes filling each sample bottle approximately 7/8 full with neutral water.

1. Follow the steps in Chapter 2, 'Getting Started with your McLane Sampler' to establish communications with the Sediment Trap.

2. Close and seal the controller housing (see Chapter 6 in this User Manual for instructions).

3. If using the Compass/Tilt sensor, see Section 4.4 'Orienting End Cap for Optional Tilt'. Otherwise, skip to Step 4.

4. Wash and rinse the sample bottles with neutral/distilled water.

5. Dry bottles thoroughly.

6. Slide one silicone o-ring onto each sample bottle.

7. Screw the sample bottles into the holes on the Gear Plate and hand-tighten. It is helpful to number bottles with their port number on the outside with a permanent marker.
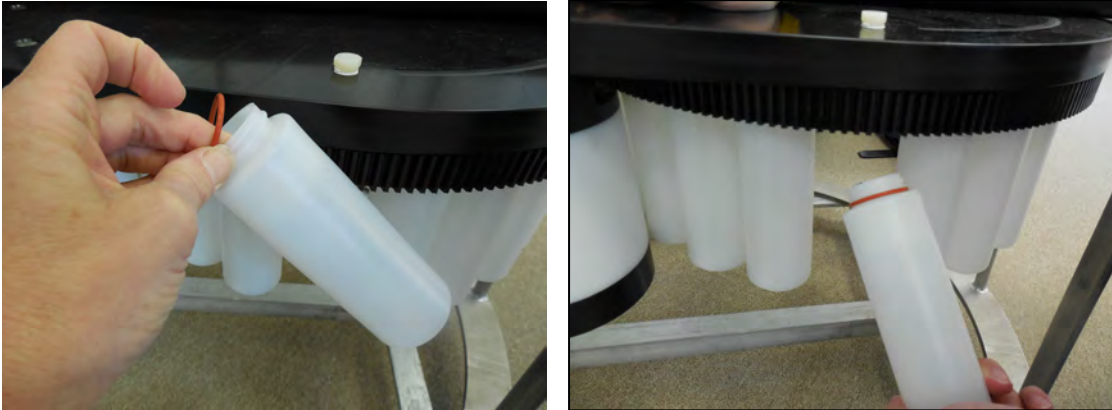

Figure 4.1-1: Installing the Sample Bottles

Section 4.2
Aligning the Rotator to the Open Position

To position the rotator to the starting point, complete the following steps.

1. From the Main Menu, select <3> Fill Containers.

2. Advance the sample bottles until you reach the position with no bottle. This is the starting position for the deployment.

```
Selection [] ? 3

Rotator is aligned.

Next bottle [Y] ? y Advance how many? (1-22) [1] ? 2

10/20/16 09:38:00 Moving rotator assembly .. rotor aligned

10/20/16 09:38:04 Lowest battery detected: 34.2V
10/20/16 09:38:05 Moving rotator assembly .. rotor aligned
10/20/16 09:38:09 Lowest battery detected: 34.2V

Rotator is aligned.
Next bottle [Y] ? n
```

Figure 4.2-1: Moving Rotator to Open Position

Section 4.3
Filling the Sample Bottles

1. Remove the rotator assembly fill plug (a 7/16" wrench is included in the toolkit).
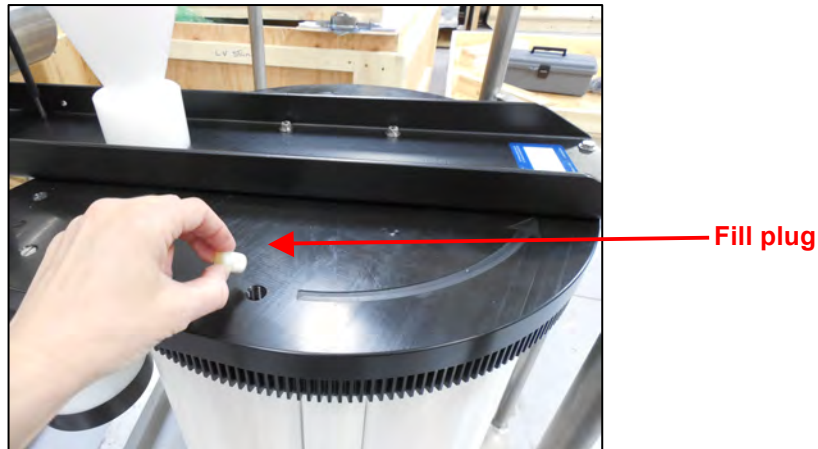

Fill plug

Figure 4.3-1:Removing the Plug from the Fill Hole

2. From the Main Menu, select option <3> Fill Containers.

```
                Selection [] ? 3

Rotator is aligned.

Next bottle [Y] ? y Advance how many? (1-22) [1] ? 1

09/29/16 08:52:48 Moving rotator assembly ......... rotor aligned
09/29/16 08:53:12 Lowest battery detected: 20.9V

Rotator is aligned.        ◄──────  Repeat this step 21 (or 13) more times
                      ◄──────────   Display shortened to save space
Next bottle [Y] ? y
. . .
Next bottle [Y] ? n
```

Figure 4.3-2: Fill Containers

3. Repeat Step 2 for 21 (or 13) more times, moving the rotator around and filling the sample bottles approximately 7/8 full of neutral water.

4. Return the plug to the fill hole, using a 7/16" wrench to tighten.

Sample collection starts and ends on an open hole in the rotator (the 22nd or 14th sample event, depending on model). If not using all sample bottles, program the schedule to <u>end the deployment on an open hole</u>. Ending on a closed hole fills the cone with water and makes the Sediment Trap much heavier to recover.

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Section 4.4
Orienting End Cap for Optional Tilt

The Compass/Tilt option is a separate sensor board on the Sediment Trap electronics stack. This optional feature records a time history of tilt magnitude and direction and can be used to adjust sample data during analysis. If you do not have this option installed, skip to section 4.5.

The Sediment Trap ships with the compass calibrated. Follow these steps only if you have removed the controller housing.
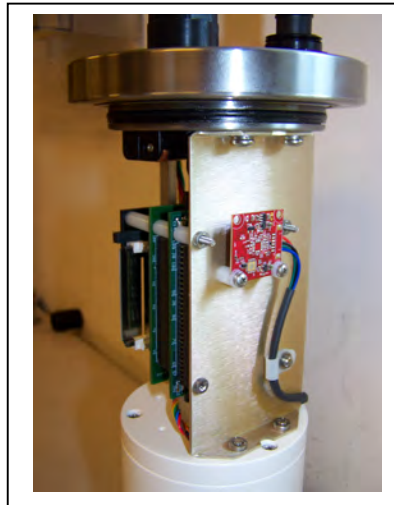
Figure 4.4-1: Compass/Tilt Sensor Board

Controller housing orientation is critical if the tilt sensor is installed. Contact mclane@mclanelabs.com if you are not sure whether or not your Sediment Trap has this optional feature.
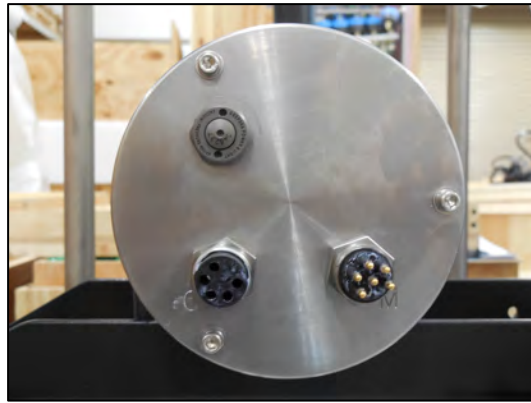
Figure 4.4-2: Correct Controller Housing Orientation with Compass/Tilt Sensor
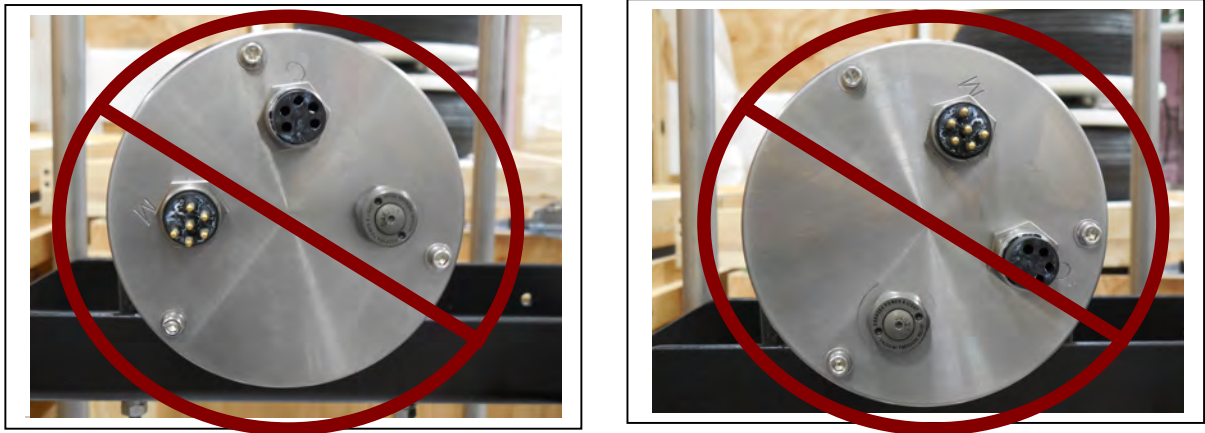
Figure 4.4-3: Incorrect Controller Housing Ori

1. Confirm the Sediment Trap is level
   Sediment Trap cross channel and on th
   both axes are level).
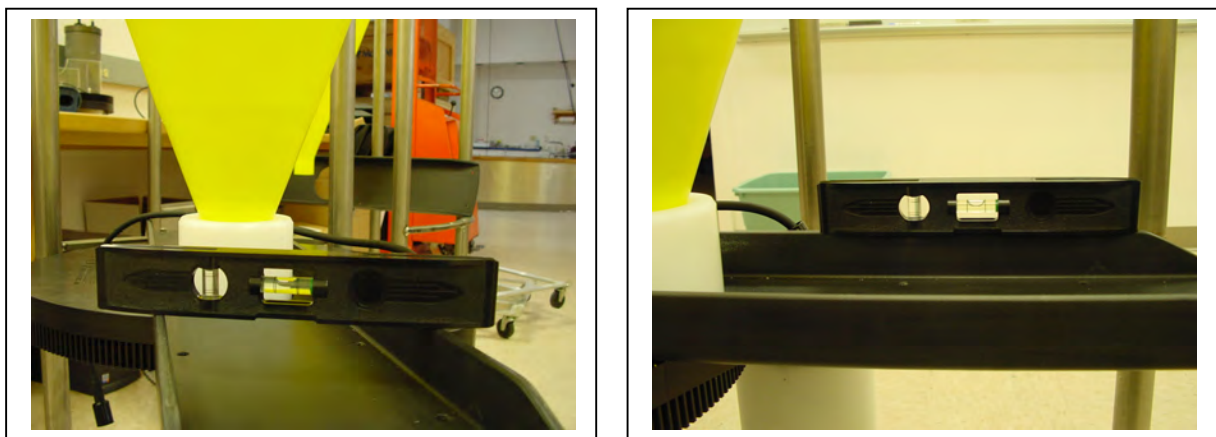
Figure 4.4-4: Confirm that the Sediment Trap is Level

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2. Loosen the u-bolts that secure the controller housing to the cross channel.

3. From the Main Menu select <D> Diagnostics.

4. Place the controller housing (with end cap oriented as shown is Figure 4.4-5) under the u-bolts but do not tighten the u-bolts.

5. Watch the tilt reading as the Diagnostics display scrolls forward and turn the controller housing until the tilt reading is zero.

6. When zero tilt is reached, tighten the u-bolts around the controller housing.
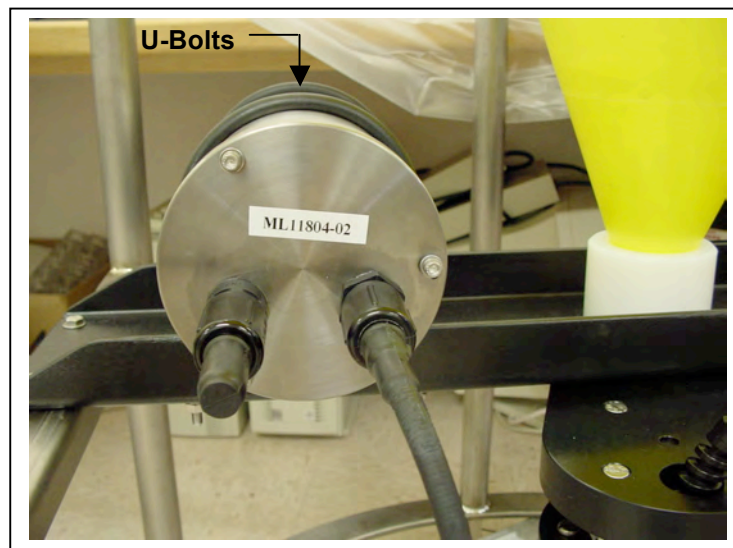
Figure 4.4-5: Secure U-Bolts Around the Controller Housing

Section 4.5
Programming Deployment Parameters

After the sample bottles are filled and attached to the rotator, the next step for a deployment is programming the Deployment Parameters. Follow the steps in this section to program the Sediment Trap deployment parameters.

Create a Deployment Schedule

The Create Schedule option of the Main Menu allows users to define a deployment event schedule without entering a deployment immediately afterwards. While programming a schedule, use the file capture utility available in MotoCross to log all communication with the Sediment Trap.

To define a Sediment Trap deployment schedule, complete the following steps.

1. Power on the computer and start MotoCross terminal emulation.

2. Start a capture file.

3. Remove the dummy plug from the communications connector on the end cap and connect the communications cable.

4. Connect the communications cable to the computer serial port and connect the battery (see 'Connecting the Battery and COM Cable', in Chapter 2 of this User Manual).

5. Confirm the system clock is correct (McLane firmware uses a 0-24 military time convention).

6. After the firmware powers on, select Main Menu option <5> 'Create Schedule'.

```
                McLane Research Laboratories, Inc.
                      ParFlux Sediment Trap
                            ML12345-01


                 _____
                             Main Menu
                 _____
                        Thu Jan 29 11:42:52 2015

           <1> Set Time            <5> Create Schedule
           <2> Diagnostics         <6> Deploy System
           <3> Fill Containers    <7> Offload Data
           <4> Sleep               <8> Contact McLane

           <C> Configure

               Selection [] ? 5

Current value of number of events to program: 22
Enter number of events to program (0-22) [22] ?
```

Figure 4.5-1: Create Schedule Menu

7. Enter the number of events in the deployment.

Sample collection starts and ends on an open hole in the rotator (the 22nd or 14th sample event, depending on model). If not using all sample bottles, program the schedule to end the deployment on an open hole. Ending on a closed hole fills the cone with water and makes the Sediment Trap much heavier to recover.

This prompt will be preceded by warnings if previous deployment records (a data file) or a deployment schedule exist. The system requires a reboot to clear EEPROM before saving a new schedule if there is at least one file in memory. If a reboot is needed, the message in Figure 4.5-2 displays.

```
Selection [] ? 5

Records show that the system requires a post-deployment
reboot before proceeding with deployment setup.

 A data set exists in system memory that has
 not been offloaded.  Existing data will be lost
 if the system is rebooted.

 Reboot now? [Y] ? y

Resetting...
```

Figure 4.5-2: System Reboot Required

8. At the Schedule Menu, deployment event times can be programmed individually, at a set interval, or by defining a deployment start and stop time.

```
_____
Configuration: PST-21                    CF2 V3_12 of Oct 27 2015

                    _____
                            Schedule Menu
                    _____
                        Mon Oct  3 06:53:15 2016

                     <1> Enter each event time
                     <2> Enter start date & interval
                     <3> Enter start date & end date

                     <M> Main menu
```

Figure 4.5-3: Schedule Menu

9. At the Schedule Menu, deployment event times can be programmed individually, at a set interval, or by defining a deployment start and end time.

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Option <1> Enter each event time

This option enters events one at a time (month, day, year, hour, minute, and second). The events do not have to be entered in chronological order and will be automatically sorted.

```
_____
Configuration: PST-21              CF2 V3_12 of Oct 27 2015
              _____
                    Schedule Menu
              _____
                  Mon Oct  3 06:53:15 2016

                <1> Enter each event time
                <2> Enter start date & interval
                <3> Enter start date & end date

                  <M> Main menu
Selection [3] ? 1
Event 01  [mm/dd/yy hh:mm:ss] ? 04/12/2017 13:19:42

Event  1 = 04/12/17 13:19:42

Event 02  [mm/dd/yy hh:mm:ss] ? 04/13/2017 13:19:48

Event  1 = 04/12/17 13:19:42
Event  2 = 04/13/17 13:19:48

Event 03  [mm/dd/yy hh:mm:ss] ? 04/14/2017 13:19:54
Event  1 = 04/12/17 13:19:42
Event  2 = 04/13/17 13:19:48
Event  3 = 04/14/17 13:19:54
...  ◄──────────────────── Display shortened to save space

Event 22  [mm/dd/yy hh:mm:ss] ? 05/03/2017 13:21:44   Schedule Verification
Event  1 of 22 at 04/12/17 13:19:42 Event  2 of 22 at 04/13/17 13:19:48
Event  3 of 22 at 04/14/17 13:19:54 Event  4 of 22 at 04/15/17 13:19:59
Event  5 of 22 at 04/16/17 13:20:04 Event  6 of 22 at 04/17/17 13:20:08
Event  7 of 22 at 04/18/17 13:20:15 Event  8 of 22 at 04/19/17 13:20:20
Event  9 of 22 at 04/20/17 13:20:27 Event 10 of 22 at 04/21/17 13:20:31
Event 11 of 22 at 04/22/17 13:20:36 Event 12 of 22 at 04/23/17 13:20:42
Event 13 of 22 at 04/24/17 13:20:49 Event 14 of 22 at 04/25/17 13:20:54
Event 15 of 22 at 04/26/17 13:21:00 Event 16 of 22 at 04/27/17 13:21:09
Event 17 of 22 at 04/28/17 13:21:17 Event 18 of 22 at 04/29/17 13:21:22
Event 19 of 22 at 04/30/17 13:21:29 Event 20 of 22 at 05/01/17 13:21:34
Event 21 of 22 at 05/02/17 13:21:40 Event 22 of 22 at 05/03/17 13:21:44
```

Figure 4.5-4: Schedule – Option 1

Option <2> Enter start date & interval

This option enters a start date and an interval between event start times. The interval can be days, hours and minutes. The example in Figure 4.5-2 shows the current date and time, 10:25:45 AM March 18, 2015, and sets the deployment start at March 18, 2015, 10:45 AM with rotator/sample duration every 20 minutes. You can then modify events individually if needed.

```
                 Selection [2] ? 2

Enter START date and time [03/18/2015 10:25:45] ? 03 18 15 10 45 00
Enter interval
                                          Deployment starts
Days     (0-365) [  0] ?
Hours    (0- 23) [  0] ?            20 minute
Minutes  (0- 59) [  0] ? 20        intervals

Schedule Verification

Event  1 of 48 at 03/18/15 10:45:00
Event  2 of 48 at 03/18/15 11:05:00
Event  3 of 48 at 03/18/15 11:25:00
Event  4 of 48 at 03/18/15 11:45:00
. . .                        Display shortened to save space
Event 47 of 48 at 03/19/15 02:05:00
Event 48 of 48 at 03/19/15 02:25:00

Modify an event [N] ?y
```

Figure 4.5-5: Schedule – Option 2

Option <3> Enter start date & end date

This option allows the firmware to calculate the sampling interval based on the entered start and end dates. Entering a start and end date is convenient when a deployment spans a specific time period. Each event is spaced evenly throughout the deployment.

```
                 Selection [2] ? 3

Enter START date and time [11/14/2016 11:53:24] ? 11/14/2016 12 00
Enter END date and time   [11/14/2016 11:53:59] ? 11/14/16 15 00 0

Schedule Verification

Event  1 of 21 at 11/14/16 12:00:00
Event  2 of 21 at 11/14/16 12:09:00
Event  3 of 21 at 11/14/16 12:18:00
Event  4 of 21 at 11/14/16 12:27:00
. . .                        Display shortened to save space
Event 19 of 21 at 11/14/16 14:42:00
Event 20 of 21 at 11/14/16 14:51:00
Event 21 of 21 at 11/14/16 15:00:00
```

Figure 4.5-6: Schedule – Option 3

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10. Review to confirm correct dates and times (press any key to scroll the display forward).

```
Schedule Verification

Event  1 of 21 at 11/14/16 11:50:00
Event  2 of 21 at 11/14/16 11:58:00
Event  3 of 21 at 11/14/16 12:06:00
Event  4 of 21 at 11/14/16 12:14:00
...  ◄──────────────────────  Display shortened to save space
Event 20 of 21 at 11/14/16 14:22:00
Event 21 of 21 at 11/14/16 14:30:00

Modify an event [N] ?
```

Figure 4.5-7: Schedule Verification

11. Type *N* to exit and save or type *Y* to change an event date or time.

Enter a Deployment

To enter a Sediment Trap deployment, complete the following steps. Use the file capture utility available in MotoCross to log this information.

1. Power on the computer and start MotoCross terminal emulation.

2. Remove the dummy plug from the communications connector on the end cap and connect the communications cable to the computer.

3. Connect the communications cable to the computer serial port and connect the battery (see Chapter 2 'Connecting the Battery and COM cable).

4. After the firmware powers on, select Main Menu option <6> 'Deploy System'.

5. If prompted, confirm the post-deployment reboot. This warning displays if the power has not been cycled since the last deployment.

```
Selection [] ? 6

Records show that the system requires a post-deployment
reboot before proceeding with deployment setup.

 A data set exists in system memory that has
 not been offloaded.  Existing data will be lost
 if the system is rebooted.

 Reboot now? [Y] ? y

Resetting...
```

Figure 4.5-8: Post Deployment Reboot Required if Data Exists

6. The prompt confirms that the rotator is aligned to the open hole. Type *N* if the rotator is not aligned, and advance to the open hole.

7. Confirm the system clock is correct (McLane firmware uses a 0-24 military time convention).

8. If prompted, confirm that existing data will be erased

9. If prompted, confirm whether you are entering a new schedule. Type *N* if you have previously entered a schedule for the deployment.

```
Selection [] ? 6

Is the rotator aligned to the open hole [N] ? y

Clock reads 06/16/17 14:10:52.  Change [N] ?

Existing deployment data file will be erased. Continue [N] ? y

Enter new deployment schedule [N] n
```

Figure 4.5-9: Confirming Rotator Position, System Clock and Number of Events

Checking for Event Overlap and Schedule Verification

- After a schedule is accepted, the Sediment Trap firmware checks for potential problems, such as expired or overlapping events.

- If an overlap occurs during deployment, the start of the next event is delayed until the current event is completed (an overlap condition does not terminate the deployment).

- The system compares the time limit of each event to the scheduled start time of each subsequent event.

> The warning message indicates an overlap is possible, not certain. Entering a schedule with intentionally short intervals can be a technique to secure rapid, sequential samples. The overlap message is only a reminder and can be ignored if tight scheduling is intended.

```
Schedule Verification

Event  1 of 22 at 02/22/72 06:38:47
Event  2 of 22 at 02/22/72 06:43:47
Event  3 of 22 at 02/22/72 06:48:47
Event  4 of 22 at 02/22/72 06:53:47
Event  5 of 22 at 02/22/72 06:58:47
Event  6 of 22 at 02/22/72 07:03:47
Event  7 of 22 at 02/22/72 07:08:47
Event  8 of 22 at 02/22/72 07:13:47
Event  9 of 22 at 02/22/72 07:18:47
Event 10 of 22 at 02/22/72 07:23:47
Event 11 of 22 at 02/22/72 07:28:47
Event 12 of 22 at 02/22/72 07:33:47
Event 13 of 22 at 02/22/72 07:38:47
Event 14 of 22 at 02/22/72 07:43:47
Event 15 of 22 at 02/22/72 07:48:47
Event 16 of 22 at 02/22/72 07:53:47
Event 17 of 22 at 02/22/72 07:58:47
Event 18 of 22 at 02/22/72 08:03:47
Event 19 of 22 at 02/22/72 08:08:47
Event 20 of 22 at 02/22/72 08:13:47
Event 21 of 22 at 02/22/72 08:18:47
Event 22 of 22 at 02/22/72 08:23:47

Modify an event [N] n

 WARNING -- Start time(s) of event(s) 1 - 1 already
            passed.  These event(s) will be missed if
            you chose to proceed with the deployment.

 Return to Event Scheduler [Y] ? n
```

Figure 4.5-10: Overlap Check and Schedule Verification

The Deployment parameters displays next. These settings will be applied globally to all events in the deployment.

```
 Header              A|  System Test
                     B|  ML 12345-01
                     C|  MWB                              Setting for optional
                                                          compass/tilt
                     D|  Sensor sampling interval [minutes]: 1  ◄──────────

                     V|  Verify and proceed.

          Selection  [ ] ? v
```

Figure 4.5-11: Header and Optional Compass/Tilt Settings

- **Headers**: Options A, B, and C of the Event Parameters allow the user to define three headers to describe the deployment.

- **Sensor sampling interval**: If the Sediment Trap is configured with the optional compass/tilt sensor, the sensor sampling interval can be changed from the default of 1 minute.

10. Type *v* to proceed with the deployment.

Proceeding with the Deployment

After the status line (and battery warnings if any), a final prompt displays.

```
Performing 6 second Backup Battery test...

System status:
  Date      Time        Battery    Int. Temp      Rotator

10/03/16 06:54:18   21.0 Vb      22.8∞C      aligned
Caution: Deployment will overwrite the EEPROM data backup cache.
                              ◄──────────  Proceed with the deployment
Proceed with the deployment [N] y
```

Figure 4.5-12: Status Line

With firmware v3.12 and higher, electronics hardware changes made the backup battery unnecessary and it was elminated. If deploying a Sediment Trap that still has a backup battery, install a fresh battery before every deployment. The pre-deployment program confirms backup batteries are installed, and if not detected, the firmware will not accept the 'Y' entry to start the deployment.

11. Type *Y* to commit to the deployment (or *N* to cancel and return to the Main Menu). Prior to submerging the sampler, disconnect the communications cable from the controller housing and reconnect the dummy plug to the communications connector on the controller housing.

12. The Sediment Trap enters a low power sleep mode until the time of the first scheduled event. The Sediment Trap automatically wakes up and begins sampling at the scheduled time of the first event.

```
>>> Remove communication cable and attach dummy plug. <<<

>>> System is ready to deploy. <<<

03/06/15 10:38:46 Waiting for event 01 of 05 @ 03/06/15 11:30:00
03/06/15 10:38:46 Suspended until 03/06/15 11:30:00 ....
```
Figure 4.5-13: Deploy System

13. For a bench test, leave the communications cable attached to the Sediment Trap electronics to observe the operation of the instrument in the MotoCross window.

14. For a deployment, proceed to Chapter 5 and follow the Deployment Preparation steps to disconnect the communications cable, seal the end cap, and attach the dummy plug.

Chapter 5
Deployment and Recovery

Attaching to a Mooring

The Sediment Trap must remain upright on the mooring to collect falling sediment. The frame connects to the mooring array with three-legged, 3/16" wire rope bridles. Two bridles can be used, one on the top and one on the bottom of the Sediment Trap. Or, one 3/16" wire rope bridle can be used on the top of the Sediment Trap and users can make their own chain bridles for the bottom of the Sediment Trap.
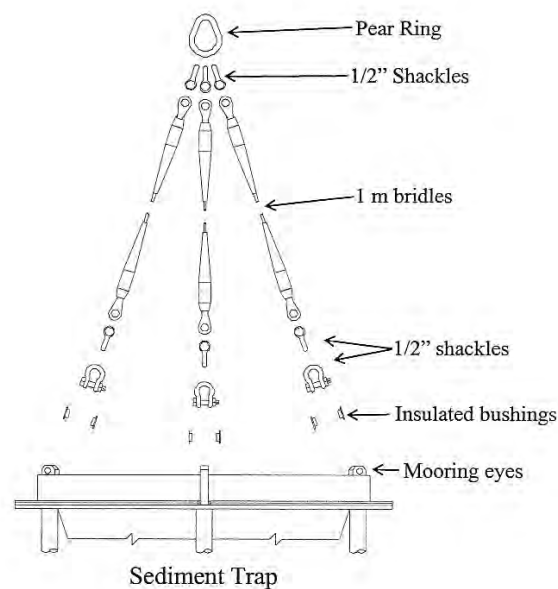

Figure 5-1: Sediment Trap Mooring Array

Deployment Preparation

After the sample bottles are installed and the rotator is positioned for deployment, deploying the Sediment Trap requires the following (in order):

1. Connect the battery and close the end cap (see chapter 4 for details about the end cap and battery installation).
2. Connect the COM cable and confirm firmware deployment settings (see chapter 4 for details about programming the deployment).
3. Disconnect the COM cable and attach the dummy plug.
4. Attach the Sediment Trap to the bridle(s), or chain.

Attaching to the Bridles and Mooring Wire

To attach the Sediment Trap to a mooring, complete the following.

1. Place the insulating (black) Acetel bushings into each side of the Sediment Trap's top mooring eyes.

2. Install a 1/2" shackle through the insulated mooring eye.

3. Loop another shackle through the first shackle and connect it to the 1m bridle.

4. Repeat Steps 1 through 3 for the rest of the mooring eyes.

5. Loop three shackles around the pear ring (weldless sling link) and connect it to the ends of the three 1m lengths of wire (a single pear ring should be connected to three 1m lengths of wire which are connected to the Sediment Trap).

6. Repeat the previous steps for the bottom mooring eyes (using 3/8" chain instead of wire).

7. Connect the pear-rings to the rest of the mooring system.

Recovery Procedure

After the deployment is completed, the firmware positions the alignment hole (the hole with no bottle) under the funnel to seal the samples from ambient water. Post-recovery steps include the following:

- Drain the funnel. If drainage is restricted by an incomplete rotation, unscrew the sample bottle that is directly under the collecting hole. All samples will be protected except for the last sample.

- Remove the sample bottles for storage.

- Offload the deployment data.

- Follow maintenance procedures to rinse and perform thorough maintenance before storage.

Removing the Sample Bottles

To remove the sample bottles, complete the following steps:

1. Confirm that the funnel is drained (water in the funnel should drain quickly while the Trap is lifted to the deck).

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2. Disconnect the Sediment Trap from the mooring through the pear-ring and secure in a protected area.

3. Use caution when handling the disconnected bridles. Dropping bridles onto the top of the Sediment Trap cone can damage the honeycomb baffle.

4. Remove the sample bottles and cover securely with the screw-on lids.

5. Store the samples in a clean refrigerated area.

6. If the Sediment Trap is not being immediately redeployed, perform any necessary maintenance as described in this User Manual in Chapter 6, "Maintenance and Storage".

Offloading Data

Once the recovery steps are completed and the sample bottles are removed, data can be offloaded. This section contains instructions for running the data offload. The deployment data will display on screen and a log file can be created for use in analysis.

This procedure can be repeated. Deployment data remains in memory until a new deployment schedule is entered or the batteries are drained and/or removed.

Do not disconnect the battery (which erases the data) until checking the capture files to confirm that the data offload was successful.

1. Start terminal emulation on the host computer (see Chapter 2 in this User Manual for terminal emulation details).

2. Within MotoCross, specify a "Capture file" for the offloaded data.

3. If necessary, turn the capture On.

4. Connect the COM cable to the computer and then connect the COM cable to the Sediment Trap.

The computer should be on and MotoCross running before connecting to the Sediment Trap electronics.

5. From the Offload/Display Data File Menu, select <1> Display ALL data. The screen shown next displays.

```
_____

Configuration: PST-21_CT              CF2 V3_12 of Oct 27 2015


                    _____
                            Offload Menu
                    _____

                     Tue Apr 11 12:07:32 2017

                 <1> Display ALL data
                 <2> Display event summary data
                 <3> Display sensor data
                 <4> EEPROM data backup cache
                 <M> Main Menu

                 Selection [1] ? 1
```

Figure 5-2: Offload/Display Data File Menu

The screens that follow show Option <1> 'Display All Data'.

6. Press any key to offload the data and display to the screen (the data is saved to the Capture filename specified in Step 2). An example data offload file is shown next.

If the compass/tilt option is installed, the file TILT.DAT stores the tilt time history in non volatile memory (the CF2 flashcard). In Sediment Traps with the CF2 controller, EEPROM volatile backup memory copies and displays every record from the tilt time history (TILT.DAT) on the CF2 flashcard.

Figure 5-3 and 5-4 show the offloaded data with the Compass/Tilt option installed.

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```
 Start the capture file now.
 Then, press any key to start the transfer.  The data
 file will remain in memory and is not erased by this
 offload procedure.

Configuration:     PST-21_CT
Software version:  PST-3_12.c
Compiled:          Oct 27 2015 15:32:17

Electronics S/N:   ML12345-01

Data recording start time: 04/10/17 09:10:58
Data recording  stop time: 04/11/17 07:30:35

 HEADER
 _____
 Freezer Test, 4-11-17
 12345-01

 CGP

 SCHEDULE
 _____
 Event 01 of 22 @ 04/10/17 21:00:01
 Event 02 of 22 @ 04/10/17 21:30:01
 Event 03 of 22 @ 04/10/17 22:00:01
 Event 04 of 22 @ 04/10/17 22:30:01
. . . ◄──────────────────────── Display shortened to save space
Event 21 of 22 @ 04/11/17 07:00:01
Event 22 of 22 @ 04/11/17 07:30:01

 DEPLOYMENT DATA
 _____
 Event 01
 Scheduled start time:  04/10/17 21:00:01
 Event start time:      04/10/17 21:00:01
 Event stop time:       04/10/17 21:00:30
 Event duration:        29 seconds

      Aligned   Battery Temperature    Tilt Heading

 Start:     Y       17.8     -18.9°C      92°    271°
 Stop:      Y       16.5     -18.8°C      92°    271°

 Event 02
 Scheduled start time:  04/10/17 21:30:01
 Event start time:      04/10/17 21:30:01
 Event stop time:       04/10/17 21:30:30
 Event duration:        29 seconds

      Aligned   Battery Temperature    Tilt Heading

 Start:     Y       18.0     -18.9°C      92°    271°
 Stop:      Y       16.6     -18.8°C      92°    272°

 Event 03
 Scheduled start time:  04/10/17 22:00:01
 Event start time:      04/10/17 22:00:01
 Event stop time:       04/10/17 22:00:30
 Event duration:        29 seconds

      Aligned   Battery Temperature    Tilt Heading

 Start:     Y       18.0     -18.3°C      92°    271°
 Stop:      Y       16.6     -18.1°C      92°    270°
```

Figure 5-3: Offload/Display Data File Menu Example (screen 1 of 2)

```
  SENSOR DATA
  _____

 Sensor sampling interval: 1 minute

      Date,      Time,  Event,  Tilt,  Hdng,  Temp,  Aligned
   04/10/17, 21:01:01,      1,  92.1, 275.7, -18.4,        Y
   04/10/17, 21:02:01,      1,  92.3, 275.9, -18.2,        Y
   04/10/17, 21:03:01,      1,  92.2, 275.7, -18.2,        Y
   04/10/17, 21:04:01,      1,  92.4, 276.0, -18.2,        Y
   04/10/17, 21:05:01,      1,  92.4, 276.1, -18.3,        Y
   04/10/17, 21:06:01,      1,  92.2, 275.9, -18.3,        Y
   04/10/17, 21:07:01,      1,  92.4, 276.1, -18.4,        Y
   04/10/17, 21:08:01,      1,  92.2, 276.0, -18.4,        Y
   04/10/17, 21:09:01,      1,  92.5, 276.5, -18.4,        Y
   04/10/17, 21:10:01,      1,  92.3, 275.8, -18.5,        Y
```

· · ⬅——————————————————— **Display shortened to save space**

```
04/11/17, 07:26:01,     21,  92.4, 276.0, -17.8,          Y

   04/11/17, 07:27:01,     21,  92.3, 276.0, -17.8,        Y
   04/11/17, 07:28:01,     21,  92.3, 276.0, -17.9,        Y

   04/11/17, 07:29:01,     21,  92.5, 276.2, -17.9,        Y

04/11/17 07:30:35 Shutdown condition: Schedule completed.
```

Figure 5-4: Offload/Display Data File Menu Example (screen 2 of 2)

7. After the data is offloaded, stop the file capture.

8. From the Main Menu, select <4>, Sleep, to put the system into Low power sleep mode.

9. Disconnect the COM cable from the Sediment Trap controller and reinstall the dummy plug.

Option <4> EEPROM Data Backup Cache

Option 4 accesses a back-up copy of critical data written to non-volatile memory during deployment. In an unlikely system malfunction, EEPROM provides limited data recovery. Make backup copies of the EEPROM capture file.

```
                    Selection [1] ? 4
During deployments, a backup copy of the instrument data
is written to non-volatile EEPROM storage. This allows
for data recovery in the event the instrument data
is no longer resident in active memory.
The sensor time history is recorded in the disk
file "DATA.DAT" which will be displayed here.
(It can also be copied directly from the disk.

To copy the EEPROM cache file to a disk file:
Start the capture file, now.
Then, press any key to start the transfer.
The cache file remains in EEPROM until overwritten during the
next deployment.
Event 01
 Scheduled start time:  04/10/17 21:00:01
 Event start time:      04/10/17 21:00:01
 Event stop time:       04/10/17 21:00:30
 Event duration:        29 seconds

         Aligned  Battery  Temperature  Tilt  Heading
 Start:    Y        17.8     -18.9 °C     92°    271°
 Stop:     Y        16.5     -18.8 °C     92°    271°
· · ·  ◄───────────────── Display shortened to save space
Event 22
 Scheduled start time:  04/11/17 07:30:01
 Event start time:      04/11/17 07:30:01
 Event stop time:       04/11/17 07:30:30
 Event duration:        29 seconds

         Aligned  Battery  Temperature  Tilt  Heading
 Start:    Y        17.6     -18.1 °C     93°    271°
 Stop:     Y        16.3     -17.9 °C     92°    272°
· · ·  ◄───────────────── Display shortened to save space
  04/11/17, 07:28:01,     21,  92.3, 276.0, -17.9,        Y
  04/11/17, 07:29:01,     21,  92.5, 276.2, -17.9,        Y
End of EEPROM tilt backup cache.
Terminate file logging operation now
and press any key to continue.
 SENSOR DATA
 _____
     Date,      Time,  Event,  Tilt,  Hdng,  Temp,  Aligned
  04/10/17, 21:01:01,     1,  92.1, 275.7, -18.4,        Y
  04/10/17, 21:02:01,     1,  92.3, 275.9, -18.2,        Y
  04/10/17, 21:03:01,     1,  92.2, 275.7, -18.2,        Y
  04/10/17, 21:04:01,     1,  92.4, 276.0, -18.2,        Y

Terminate file logging operation now
and press any key to continue.
```

Figure 5-5: EEPROM Data Backup Cache (Compass/Tilt Data Included)

Notes

Chapter 6
Maintenance and Storage

Proper maintenance after every deployment is critical for ensuring smooth operation and long instrument life for your Sediment Trap. Reference lists are provided in this chapter for guidance on the maintenance recommendations immediately following the recovery, upon returning to a lab setting, and to prepare for long term storage.

<u>Always remove drop-in batteries</u> (and back up battery if present) from the controller housing when the sampler is not in use. Batteries left in the controller housing during shipping or storage can leak, causing damage that can void the sampler warranty.

Section 6.1
Immediately Following Recovery

Immediately Following Recovery		
Step		**Note**
1	Rinse cone, housing, motor and rotator with fresh water	Once back in the Lab there are more cleaning steps (refer to Section 6.2).
2	Offload all data from memory	See 'Offloading Data' in Chapter 5 for data offload steps.
3	Open controller housing and unplug battery from the controller	See 'Opening the Controller Housing' in Chapter 2 for steps.
4	Reseal all components for return shipment.	Ensure that alkaline batteries are removed from controller housing.

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Rinsing the Sediment Trap

Rinsing the cone, controller housing. motor and rotator with fresh water immediately following recovery is extremely important for long-term care of your Sediment Trap. The results of skipping this procedure can directly affect the condition and future performance of your instrument. Figure 6.1-1 shows the results of poor rinsing directly following deployment.

Figure 6.1-1: Results of Poor Rinsing After Deployment

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Section 6.2
Upon Returning to your Lab

Several maintenance steps should be completed when the Sediment Trap returns from a deployment before longer term storage.

Upon Returning to your Lab	
Step	**Note**
1	Rinse and scrub the cone, housing, motor and rotator with fresh water.	Take extra care around the flow straightner.
2	Check Oil Bladder in Drive Motor Assembly	It is only necessary to add silicone oil if the bladder is low (see 'Check the Oil Bladder in the Drive Motor Assembly' in this chapter).
3	Remove and inspect controller housing internals (check o-rings, remove batteries)	See 'Remove and Inspect Controller Housing Internals' in this chapter.
4	Remove rotator and rinse ball bearings with fresh water	See 'Remove Rotator and Rinse Ball Bearings' in this chapter.
5	Reinstall the components onto the frame	See 'Reinstall Components onto the Frame' in this chapter.
6	Cover top/funnel with clean plastic for storage	Take care not to put weight on the honeycomb baffle

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Check the Oil Bladder in the Drive Motor Assembly

Visually inspect the drive motor cable and housing assembly before deployment. Confirm that the compensating oil bladder has sufficient silicone oil (the oil can be topped off if necessary). To inspect the drive motor oil bladder, complete the following steps:

1. Keep the drive motor connected to the rotator assembly. Place an index finger on the oil bladder located at the bottom of the drive motor housing and press gently.
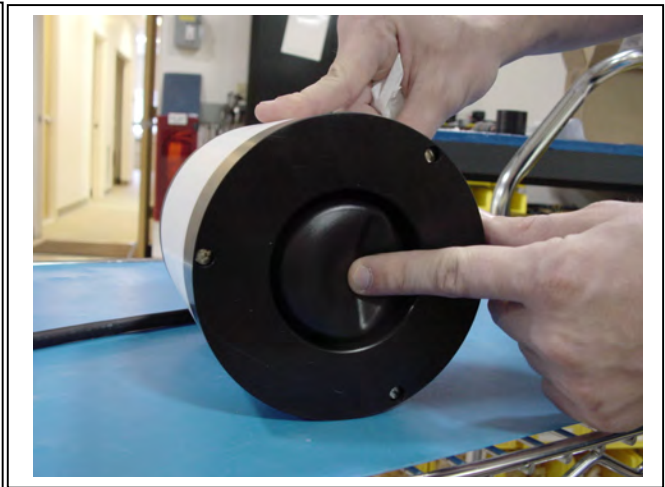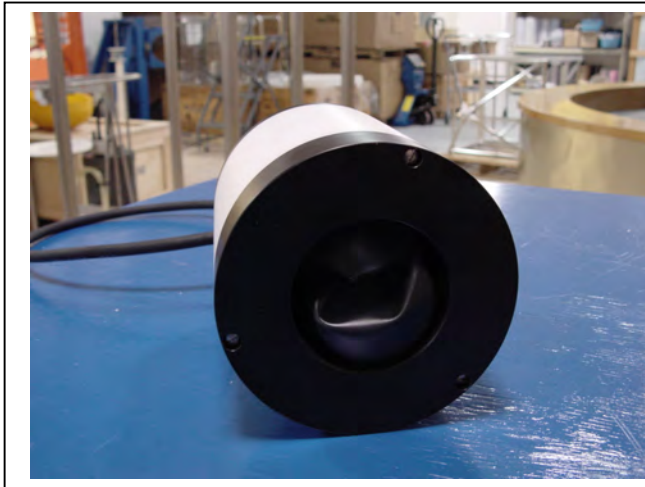

Figure 6.2-1: More Silicone Oil Needed   *Figure 6.2-2: Correct Silicone Oil Level*

2. A properly filled bladder (as shown in Figure 6.2-2) indents approximately one inch when slight pressure is applied with the index finger on the center of the bladder.

3. If the bladder indents further than one inch, complete the steps listed next to top off the oil.

When inspecting the compensating oil bladder, keep clear of sharp objects.

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Adding Oil to the Drive Motor (only if Necessary)

Follow the Steps Below <u>only if</u> more oil is needed to top off the oil in the compensating bladder. The bladder takes 20 CST silicone oil which you can purchase from McLane.

1. Unplug the drive motor cable from the controller housing.

2. Remove and set aside the three (3) screws and spacers that secure the drive motor to the rotator assembly.

3. Place the drive motor housing upright on a dry surface.

4. Hold the drive motor housing firmly at the bottom and side and slowly unscrew the fill plug at the top of the drive motor housing.

5. Insert a funnel or syringe into the fill hole (as shown in Figure 6.2-3) and slowly pour in silicone oil while gently pressing up on the bladder to 'burp' out air bubbles. (The oil will be drawn into the fill hole as the air bubbles are released).
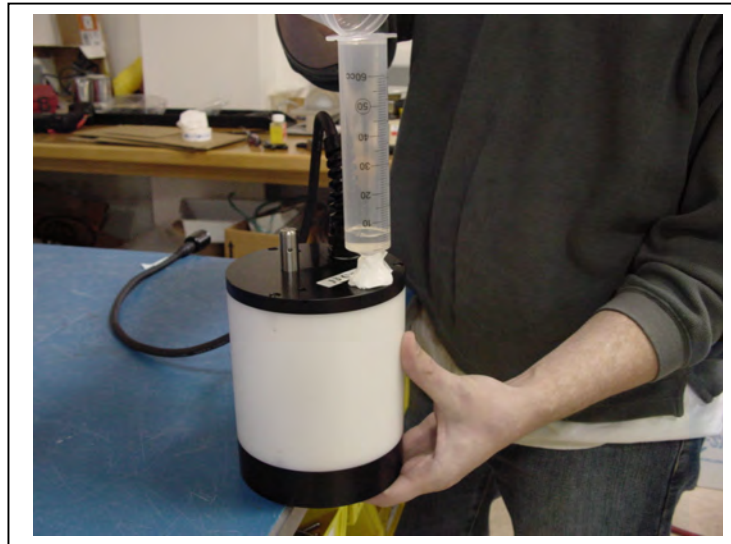

Figure 6.2-3: Adding Silicone Oil

6. Replace and tighten the fill plug screw.

7. Let the drive motor sit for 24 hours.

8. After 24 hours release any residual air bubbles by backing off the fill plug screw just enough to loosen the o-ring seal.
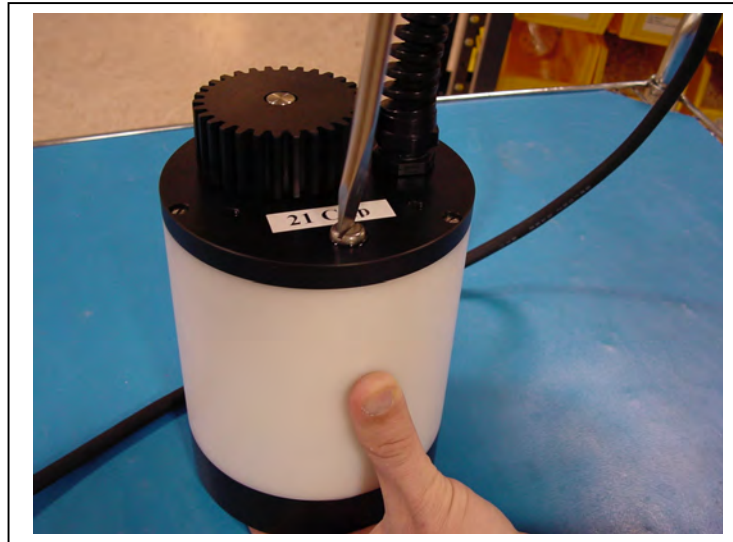

Figure 6.2-4: Back Off Fill Hole Screw and Press Up on Bladder

9. Gently press up on the bladder until oil comes up around the fill hole screw. Tighten the screw.
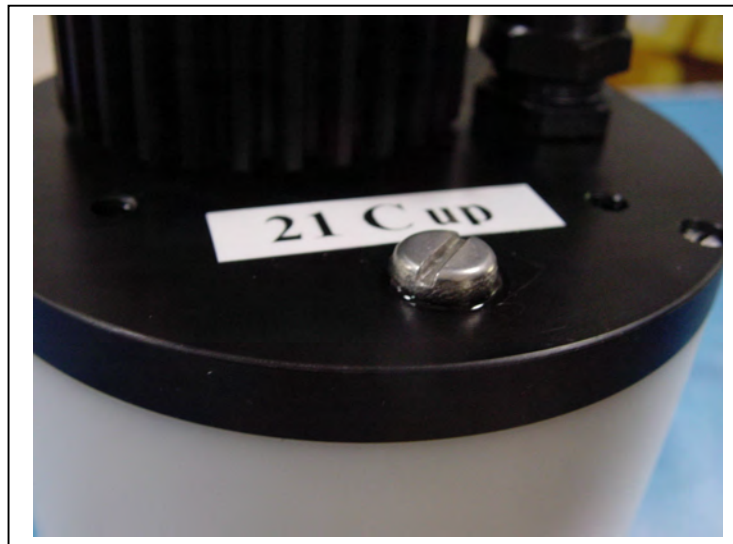

Figure 6.2-5: Oil Around Fill Hole Screw

10. Use an alcohol wipe to thoroughly clean the oil from around the fill plug screw.
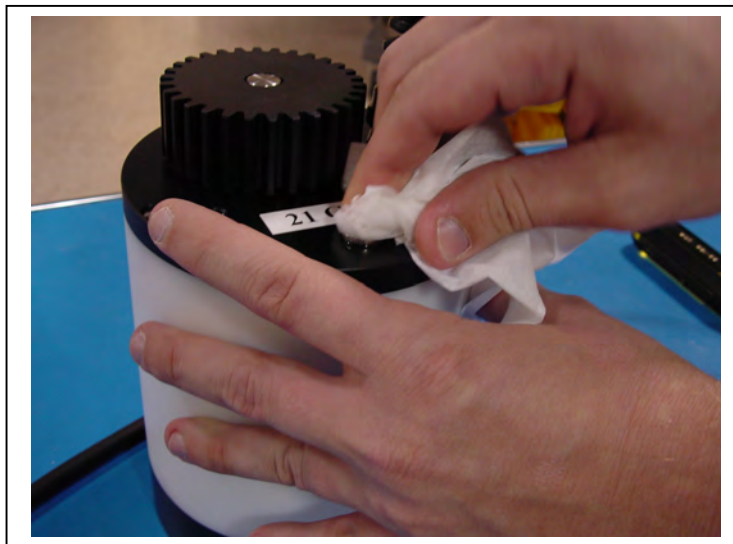

Figure 6.2-6: Cleaning Excess Oil from Fill Plug

11. Follow the steps listed next to align the rotator assembly Fixed Plate and Gear Plate holes and reattach the drive motor.

Remove and Inspect Controller Housing Internals

The controller housing should be removed and several maintenance steps can be performed once the Sediment Trap is back in a lab.
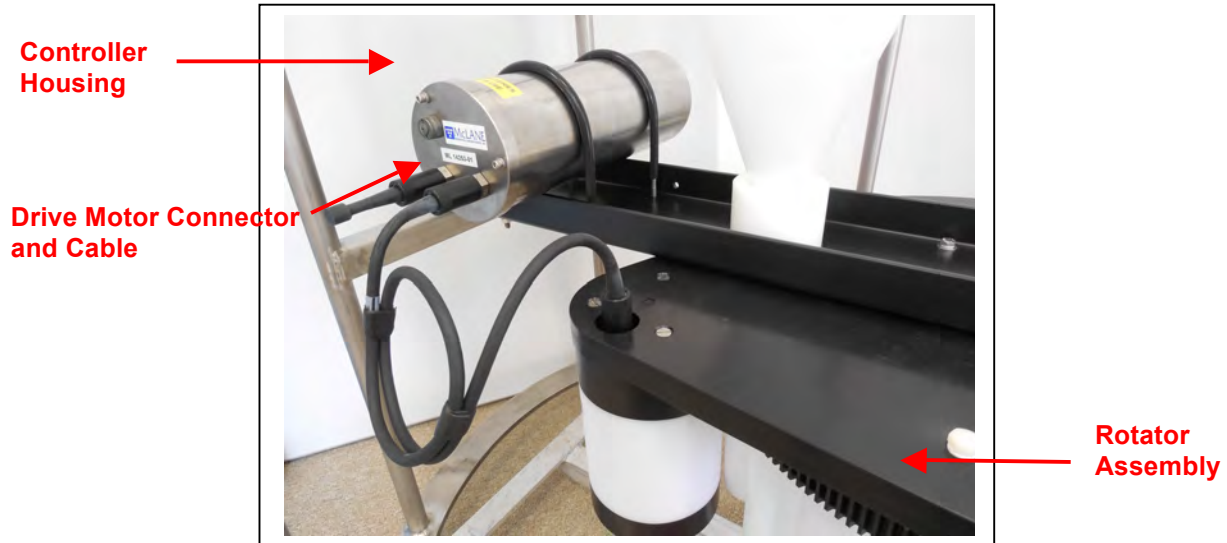

Controller Housing

Drive Motor Connector and Cable

Rotator Assembly

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O-Rings

Inspect the o-rings. Each end of the Sediment Trap controller housing has a set of three custom manufactured o-rings in the end cap (200-0071, 200-0072, 200-0073). The Sediment Trap toolkit will include spare custom o-rings. More of o-rings can be purchased from McLane. Do not substitute custom o-rings with other material
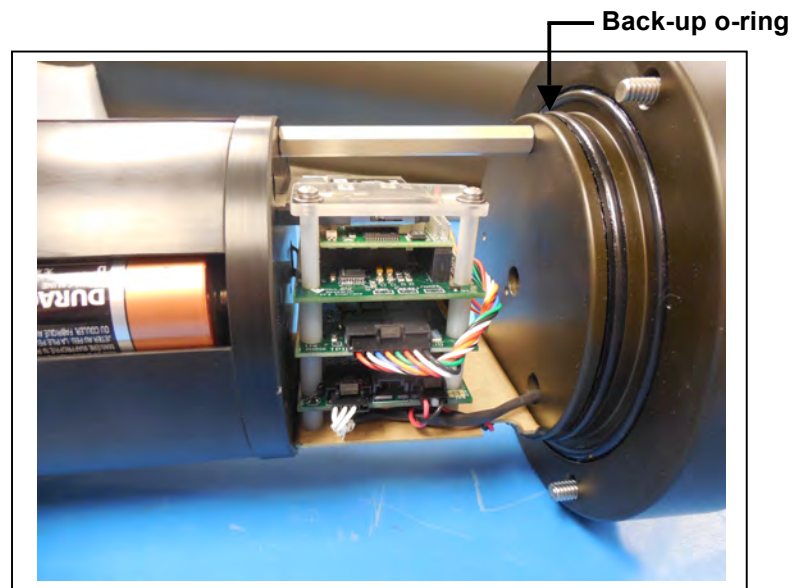
Back-up o-ring

Figure 6.2-8: Sediment Trap Controller Housing Top End Cap with O-Ring Seals

O-ring maintenance and correct placement is critical to keep the controller housing end caps from water intrusion. Incorrect o-ring placement results in cracks or splits that could affect the o-ring seal and cause water damage to the controller. Water damage from incorrectly placed or maintained o-rings can void the sampler warranty.

Battery Maintenance

Using fresh Duracell batteries for each deployment is strongly recommended (a new battery pack has a 5,000 mAhr capacity). Before replacing the batteries, offload all data. Disconnecting the battery erases all deployment data stored in memory.

Figure 6.2-9: Controller End Cap Attached to Battery Holder

Battery Installation

Selecting <2> Diagnostics from the Main Menu displays battery voltage. Batteries with less than 18 V should be replaced before the next deployment (battery packs below 18 V trigger a warning message and voltage below 12 V triggers a critically low battery voltage message). For details about diagnostics and battery voltage messages, see Chapter 3 in this User Manual.

When the Compass/Tilt sensor is installed, you must degausse new batteries before placing in the battery holder.

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To change the batteries, complete the following steps:

Confirm that the "C" cell batteries are installed in the battery holder correctly (See Figure 6.2-10 for a detailed photo).

1. Place the Trap in a dry area.

2. Offload all deployment data before removing the main battery. All data except the non-volatile backup cache is lost when the battery is disconnected (unless the backup battery is in place).

3. Open the controller housing and disconnect the main battery from the electronics assembly. Move the electronics assembly end cap to a grounded electronics bench.

4. Remove the negative terminal screw from the bottom of the battery end cap.

5. Remove the remaining three screws and the battery end cap.

6. Remove the old batteries (if applicable) and clean the battery pack holder.

7. Install the new batteries, checking the marks on the terminal connectors to ensure the correct polarity (the springs in the battery holder are the negative terminal connectors).
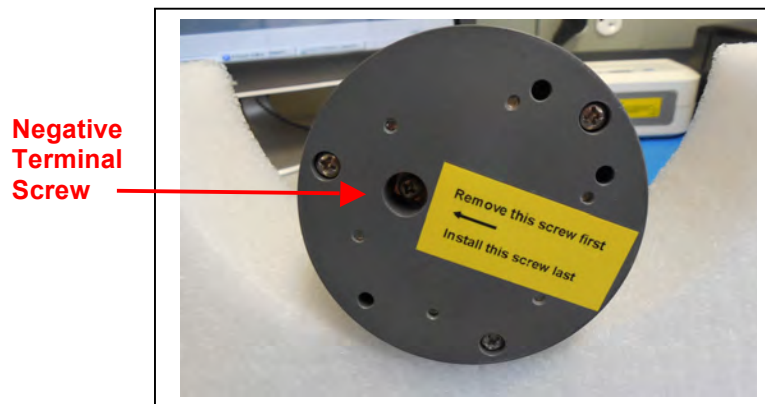

Figure 6.2-10: Battery End Cap

Negative Terminal Screw

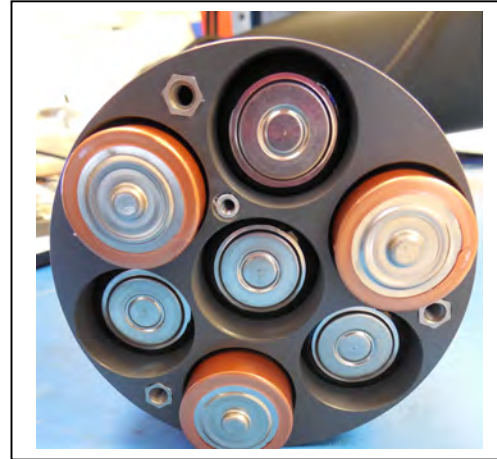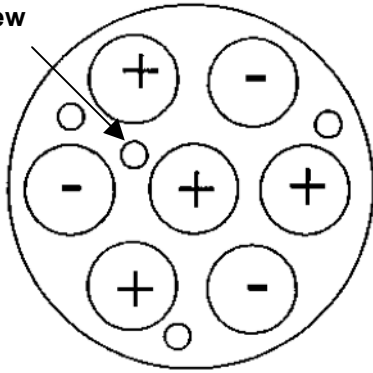*Figure 6.2-11: Battery Holder Correct Battery Direction*

8. Align the battery end cap with the negative terminal screw and replace the screws (the springs in the battery holder are the negative terminal connectors).

9. Work around the battery end cap slightly tightening each screw to close down the end cap. Continue around the end cap until all screws are tight.
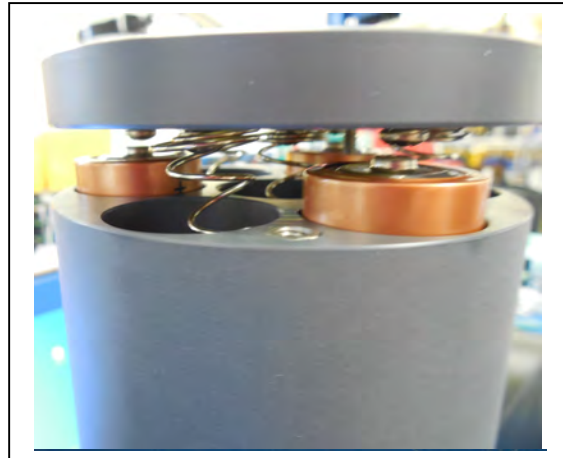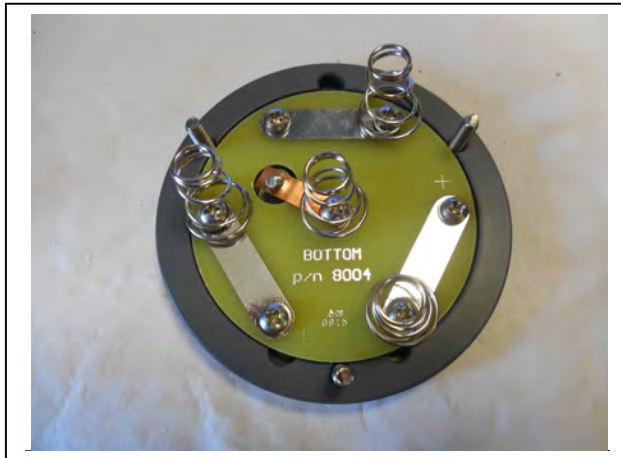
Figure 6.2-12: Battery End Cap

10. Before connecting to the electronics assembly, use a volt meter to confirm correct battery connector polarity and voltage of approximately 21 volts.

11. Connect the battery to the electronics (see Chapter 2 "Communicating with your McLane Instrument" for steps to connect the battery.

12. Insert the electronics assembly into the controller housing.

13. Seal the controller housing.

Backup Battery

With firmware v3.12 and higher, the electronics hardware was changed making the backup battery unnecessary and it was eliminated. If your Sediment Trap still has a backup battery, install a fresh battery before every deployment. Install the backup battery correctly, as reversing polarity damages the electronics.

Closing the Controller Housing

Before sealing the controller housing, confirm the smaller o-ring and the back-up o-ring are seated in the radial grooves and position the larger o-ring (200-0071) in the face. Check to ensure there is no foreign material, cracks, grit, sand, or hair present. Clean o-rings with alcohol and lubricate with a thin coating of o-ring grease before deployment.
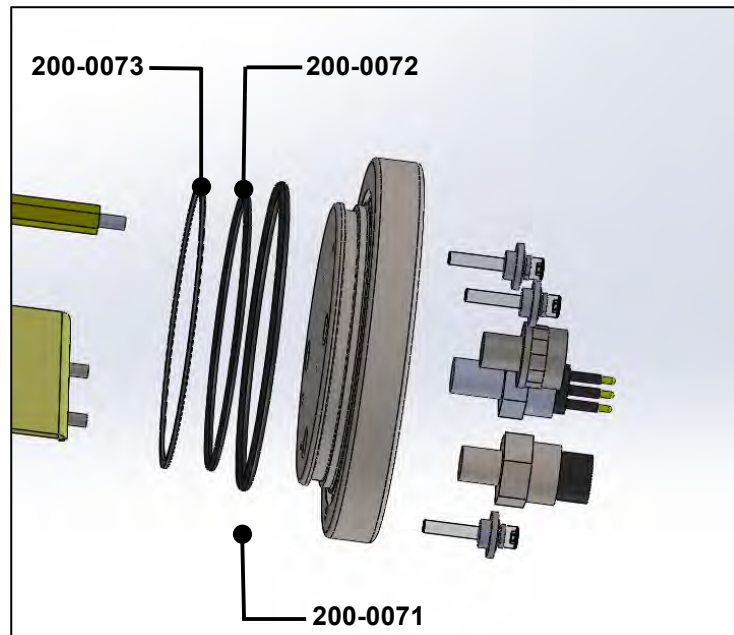

Figure 6.2-13: *Sediment Trap O-Ring Installation - Correct Placement is Critical*

When inserting the end cap into the controller housing, ensure that the face o-ring remains seated in its groove and that the radial o-rings enter the housing uniformly without pinching.

Remove Rotator and Rinse Ball Bearings

Aligning the Fixed and Gear Plates and Reattaching the Drive Motor

The fixed plate and gear plate holes are aligned during assembly at McLane. Realigning these plates should not be necessary unless the drive motor has been removed from the rotator assembly (for example, if the drive motor is removed so that oil can be added to the compensating bladder). To realign the plates and reattach the drive motor complete the following steps:

1. Align the fixed plate hole with the unthreaded gear plate alignment hole.

2. Visually confirm that the drive motor and Gear Plate gears correctly mesh and that the Fixed Plate hole is centered over the Gear Plate hole.

3. Mount the drive motor back onto the rotator assembly.

4. Attach the drive motor to the rotator assembly and tighten the screws.

5. Clean and lightly lubricate the drive motor bulkhead with Dow-Corning 55.

6. Plug the drive motor connector into the controller housing.

Rotator Assembly Variseals® and Bearings

Rinsing before and after each deployment keeps the rotator assembly working for many deployments and/or years. The plastic ball bearings inside the gear plate assembly and the Variseals® in the gear ring holes are durable and long-lasting.

The steps in this section can be used with consultation from McLane if it is necessary to replace Variseals® or ball bearings. Spare ball bearings are included in the Sediment Trap toolkit and Variseals® can be obtained from McLane.

> Contact McLane before replacing Variseals® or ball bearings. The rotator assembly must be handled with care to prevent damage.

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Replacing Varisals® and/or ball bearings is a multi-step process that consists of the following:

- Step 1 – Remove Components From the Frame

- Step 2 – Clean and/or Replace Variseals®

- Step 3 – Clean and/or Replace Ball Bearings

- Step 4 – Reassemble Rotator Plates

- Step 5 – Perform a Leak Test

- Step 6 – Reinstall Components Onto the Frame

Step 1 – Remove Components from the Frame

The first step for replacing Variseals® and/or ball bearings is to carefully remove the drive motor, controller housing, funnel, and rotator assembly from the Trap frame.

> If the compass/tilt option is installed, removing the controller housing will require tilt realignment. See the Appendix in this User Manual on the Compass/Tilt for more detailed information.

To remove components from the frame, complete the following steps:

1. Remove the sample bottles from the rotator assembly and disconnect the drive motor cable from the controller housing.

2. Remove the three (3) bolts and three (3) spacers that hold the drive motor to the top fixed plate and carefully remove the drive motor.
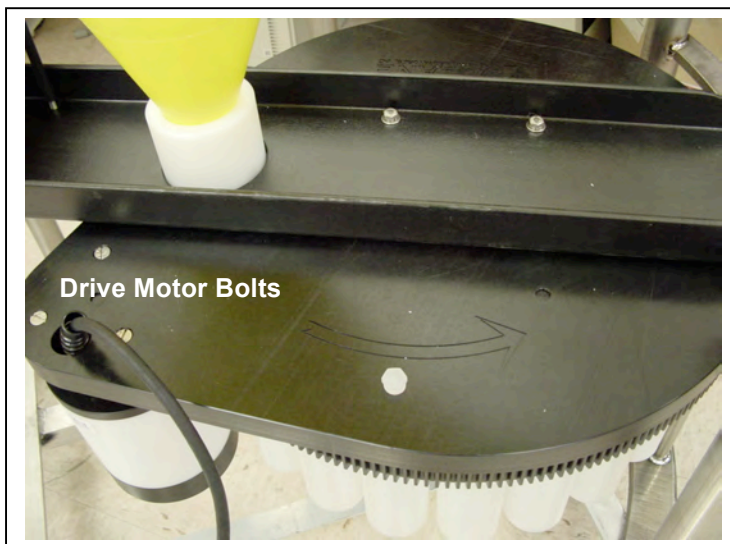
Figure 6.2-14: Remove Drive Motor from Top Fixed Plate

3. Remove the two (2) u-bolts that secure the controller housing to the cross channel and carefully remove the controller housing.
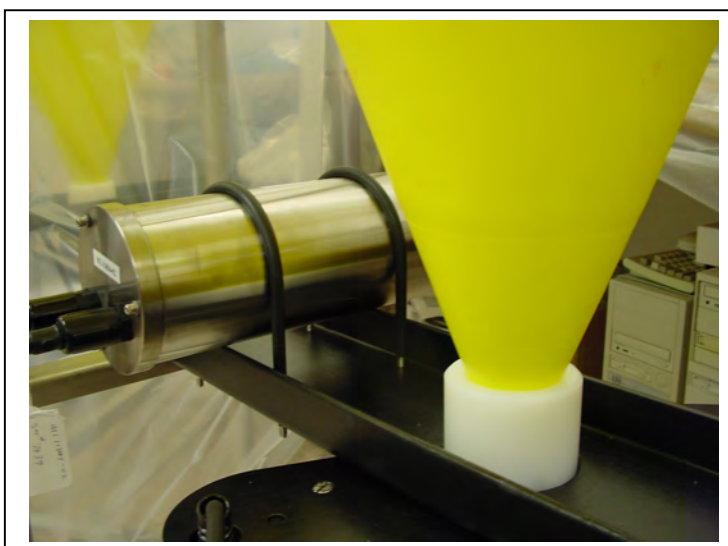
Figure 6.2-15: Remove Controller Housing from the Cross Channel

4. Remove the twelve (12) bolts that hold the funnel to the frame and the four (4) bolts that hold the cross channel to the frame. Place the plastic inserts that hold the bolts in a safe place so they are not lost.

Figure 6.2-16: Remove Cross Channel From Frame
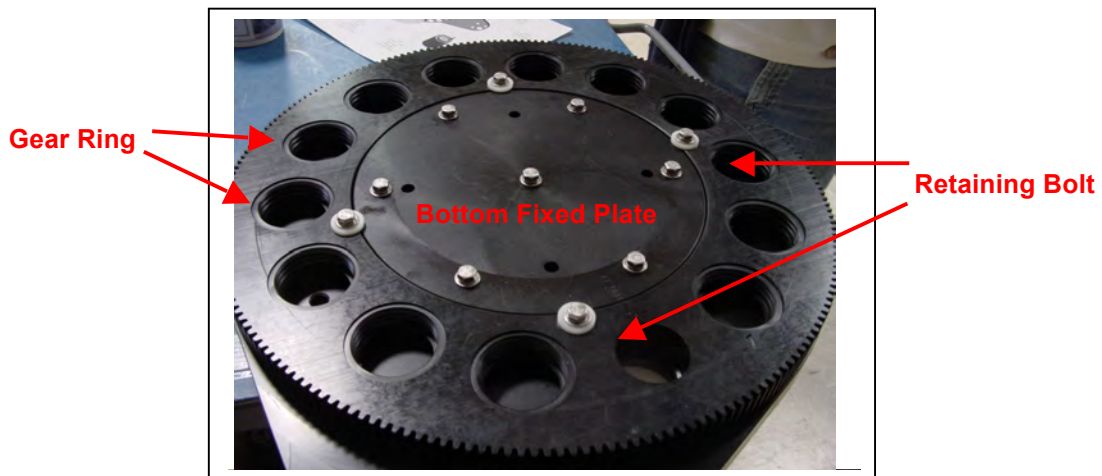
Figure 6.2-17: Gear Plate Assembly Under the Top Fixed Plate

5. While lifting the funnel, remove the cross channel and rotator assembly. Keep the cross channel attached to the rotator assembly top fixed plate. Lower the funnel back onto the frame and secure in a clean area.

6. Remove the seven (7) bolts (without the plastic washers) that secure the gear plate assembly to the top fixed plate and gently remove the gear plate assembly. The gear plate assembly will be visible on the underside of the top fixed plate. The Variseals® will be visible on the underside of the gear plate assembly once it is removed from the top fixed plate.

The four retaining bolts (with plastic inserts) keep the bottom fixed plate in place and hold the plastic ball bearings. Keep these bolts attached or the ball bearings will fall out.

Step 2 – Clean and Replace Variseals®

To clean and replace the Variseals® in the gear plate assembly, complete the following steps:

1. Lay the gear plate assembly with Variseals® facing up on a clean, flat surface.

Figure 6.2-18: Variseals® in Gear Ring Grooves

2. Remove Variseals® from the gear ring grooves (using fingers or a plastic tool to avoid scratching the seals).

3. Clean the grooves with alcohol and a lint free wipe.

4. Thoroughly rinse and dry each Variseal®.

5. Inspect Variseals® for signs of wear and the presence of any foreign material (such as hair or grit) that could affect the seal.

6. Do not grease or lubricate the gear ring, bottom fixed plate, or seals.

7. Place Variseals® back in the gear ring grooves, replacing with new seals as needed.
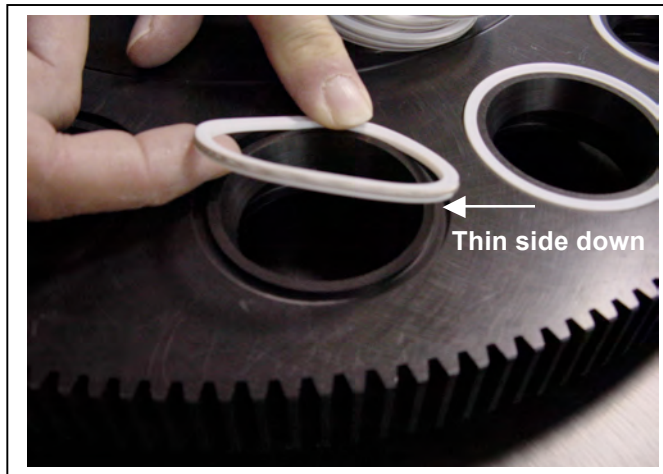
Figure 6.2-19: Installing Variseal® Thin Side Down

One Variseal® edge is thinner than the other. To obtain the correct seal, the Variseal® must be placed in the gear ring groove with the thin side down.

8. If also replacing bearings, continue to the next section: Step 3 – Clean and Replace Ball Bearings." Otherwise, continue to Step 4.

Complete the steps in this section to clean and replace ball bearings.

1. If not already done, the gear plate assembly should be removed from the top fixed plate (see Figure 6-13).

2. Place the gear plate assembly with Variseals® facing up on a clean, flat surface and remove the bottom fixed plate.

3. Remove the four (4) retaining bolts (with plastic washers) that secure the bottom fixed plate to the gear ring and remove the bottom fixed plate.
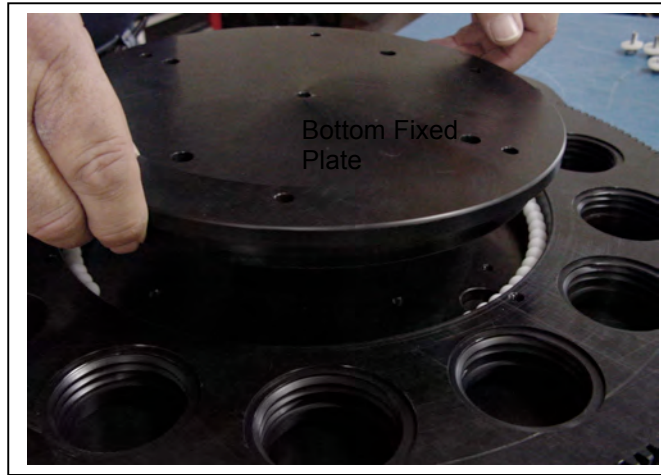
Figure 6.2-20: Removing Bottom Fixed Plate

4. Remove the bearings and rinse and dry thoroughly to remove salt or other foreign matter.

5. Clean the bearing groove with alcohol and a lint free wipe.

6. Inspect bearings and confirm that there are no chips or other damage. Damaged bearings should be replaced with spares from the Toolkit.

7. Fill the bearing groove with bearings. The bearing groove for the 21 cup Sediment Trap holds approximately 99 bearings (approximately 78 bearings for the 13 cup Trap). A fast method for filling the groove in either size Trap is to add bearings until no more will fit and then remove four (4) bearings.

8. Reinstall the bottom fixed plate and tighten the 4 retaining bolts.

9. Tighten the 7 securing bolts only until the lock washers become flat.

10. Proceed to Step 4 shown next, Reassemble Rotator Assembly.

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Step 4 – Reassemble Rotator Assembly

1. Rinse the top fixed plate and gear plate assembly with fresh water. <u>Do not</u> clean the plates with an abrasive cleaner. The surface of the top fixed plate must remain smooth to correctly seal.

2. Reattach the gear plate assembly to the top fixed plate by aligning the center holes and tightening the bolts (position the bolts in the threaded holes and tighten only until the lock washer is flat).

3. Manually rotate the gear plate assembly so that the unthreaded alignment hole matches up with the hole in the top fixed plate.

Step 5 – Perform a Leak Test

After parts are replaced and the rotator is reassembled, a leak test should be performed to ensure that the rotator assembly is properly sealed. To perform a leak test, complete the steps shown next.

1. Confirm that the rotator assembly fill plug is in place before beginning the leak test.

2. Place the rotator assembly in a sink or wet area.
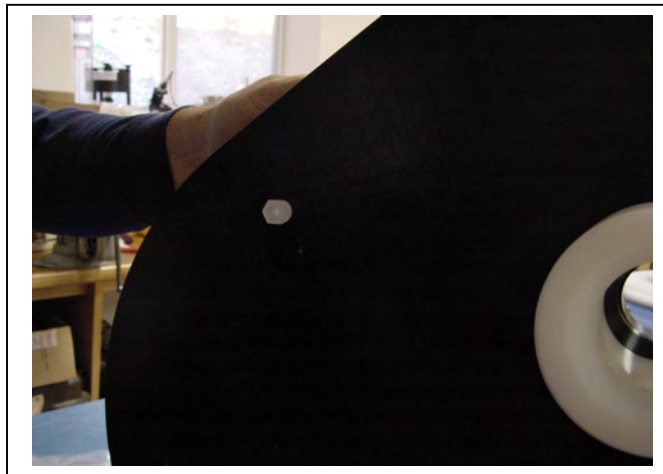
Figure 6.2-21: Fill Plug on Rotator Assembly

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3. Pour neutral water into each Gear Plate hole as shown in Figure 6.2-22.
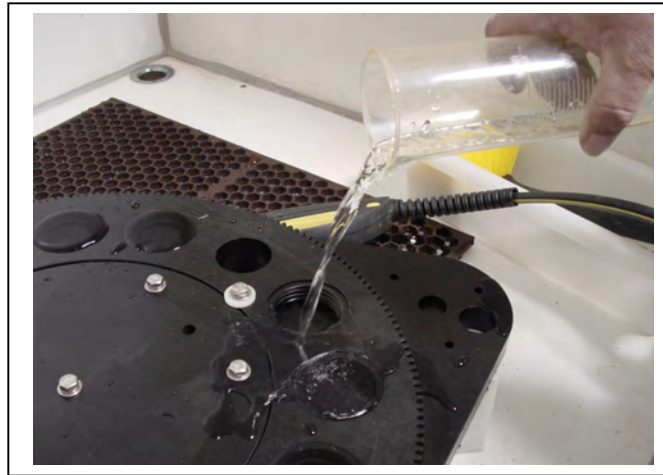
Figure 6.2-22: Performing Leak Test

4. Let the rotator assembly sit for approximately one hour. A quickly leaking hole can indicate a reassembly problem, for example, a Variseal® that is installed with the thin lip facing incorrectly. If leakage occurs, separate the Top and Bottom Fixed Plates, recheck seals, reassembly the rotator assembly, and repeat the leak test.

Reinstall Components onto the Frame

After the leak test confirms that the rotator assembly is sealed, the drive motor, rotator assembly and controller housing must be reattached to the frame. To reinstall components onto the frame, complete the following steps:

1. On the rotator assembly, confirm that the drive motor gear meshes with the gear plate assembly and that the hole in the top fixed plate matches up with the unthreaded alignment hole in the gear ring. Do not overtighten the screws.

2. Reattach the funnel to the frame by lifting the funnel up about ten (10) inches and placing the rotator assembly onto the resting brackets of the Trap frame. Lower the funnel, making sure the funnel is aligned with the funnel adapter (the plastic insert should go in from the bottom of the frame).

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3. Secure the funnel to the Trap frame with the twelve (12) sets of nuts and bolts. When attaching the funnel, confirm that the plastic inserts are correctly placed in the holes on the frame.

> The mounting holes in the funnel are not spaced symmetrically. The funnel lip and the frame were marked with black ink prior to shipment to help align the bolt holes during re-assembly.

4. Secure the four (4) sets of nuts and bolts to reattach the cross channel to the frame.

5. Carefully re-install the drive motor by reattaching the three (3) bolts and three (3) spacers that hold the drive motor to the rotator assembly top fixed plate.

6. Carefully reattach the controller housing to the cross channel by re-securing the two (2) u-bolts.

7. Re-check gear ring alignment prior to deployment.

Storage

Cover Top/Honeycomb Baffle with Clean Plastic for Storage

Cover the top honeycomb baffle with clean plastic for storage.

The shipping crate is a reusable international freight container that is ISPM-15 compliant for international transport.

To prevent instument damage during transport or storage, avoid excessive vibration and extreme temperatures for prolonged periods of time.

- Cover the top of the Sediment Trap with clean plastic and store in a protected area away from extreme heat. Cold temperatures do not affect the Sediment Trap while in storage (the instrument has been tested to –2° C).

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Appendix A
Wet Sample Particle Divider

The Wet Sample Particle Divider (WSD-10) divides wet particulate samples for bio-geochemical analysis into five or ten equal parts. Dividing wet particulate samples provides more pure samples than drying samples to obtain the particulate.

A video that explains use of the WSD-10 can be downloaded from the Sediment Trap Videos page on our website, www.mclanelabs.com.
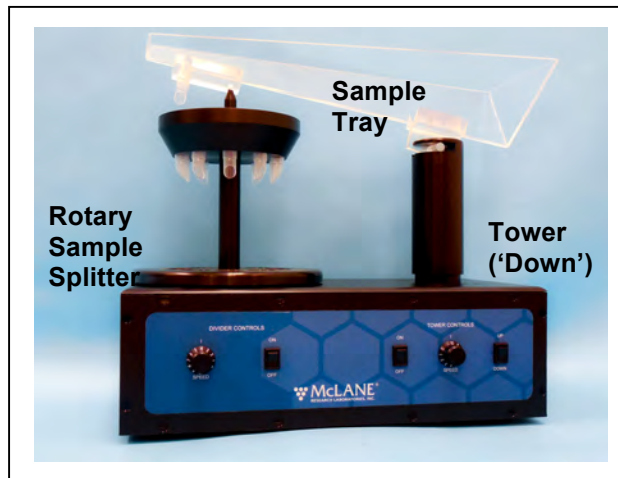
Figure A-1: WSD-10 Wet Sample Divider

The WSD-10 includes a rotary sample splitter head, tower, and sample tray with a 500 ml capacity. Dials set the movement speed for the rotary splitter and tower. A quantity of 100 glass vials and 5 plastic sample cups are provided with a new WSD-10.

Figure A-2: WSD-10 Controls

Setting Up the Wet Sample Divider

To prevent damage, the Wet Sample Divider is shipped with the sample tray uninstalled. To install the tray, complete the following steps:

1. Wash the sample tray and rotary head with neutral water.

2. Plug the Wet Sample Divider into an AC power outlet.

3. Turn the Tower switch 'On' and Press the 'Up' button (the Tower must be all the way up before the sample tray can be installed).

4. Slide the sample tray into the grooved notch at the top of the Tower.

Figure A-3: Installing Sample Tray into Groove

5. Slide the front of the tray down over the Rotary Splitter Head.
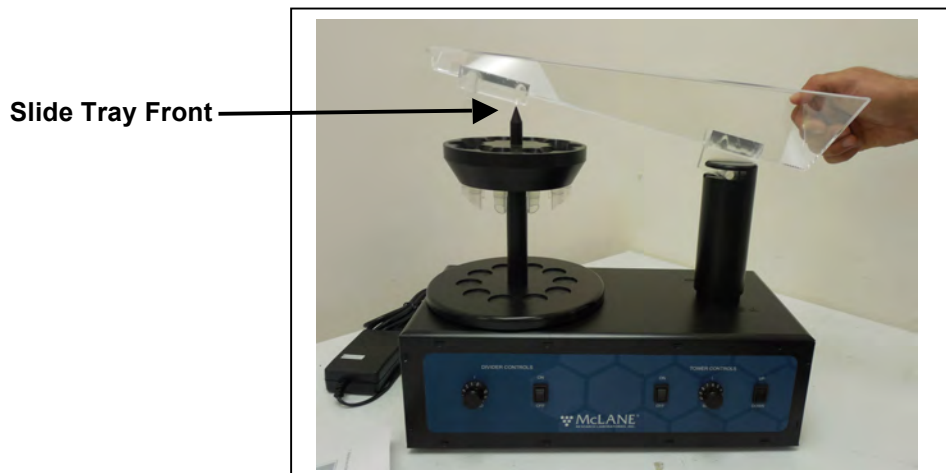
Slide Tray Front

Figure A-4: Installing Sample Tray Front

Using the Wet Sample Divider

To use the Wet Sample Divider, complete the following steps:

1. Set the rotary head speed dial to 10 (1 revolution per second).

2. Set the tower speed dial to 4 (5 cm per second).

3. Place sample cups under the rotary head.

4. Confirm that tower is completely in the 'Down' position.

5. Turn the rotary head switch 'On'.

6. Slowly pour the wet sample into the tray.

7. Press the tower switch 'On'.

8. When the sample begins to drain from the tray, use a squirt bottle to pour a constant stream of neutral water into the tray and move the sample down into the sample bottles.

9. After the tower stops in the upward position, rinse the sides of the tray with water from the squirt bottle.

10. Press the rotary head switch 'Off' and Remove the sample tray.

11. Rinse the side walls of the rotary head.

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Notes

Appendix B
Optional RBR Pressure and Temperature Sensors

Sediment Traps with optional RBR sensors record pressure and temperature data. Sediment Traps manufactured at an earlier date used older style pressure and temperature loggers (McLane retired these sensors in 2015). For information about using the older style pressure and temperature loggers, refer to the archived Sediment Trap User Manual at mclanelabs.com or contact mclane@mclanelabs.com.

The RBR pressure and temperature sensors are available in several models. A dual channel model logs both pressure and temperature readings, or single channel models collect either pressure or temperature readings. These sensors are integrated with the Sediment Trap firmware. A standalone RBR dual channel sensor can be used with the McLane Sediment Trap or as an independent self-logging sensor.
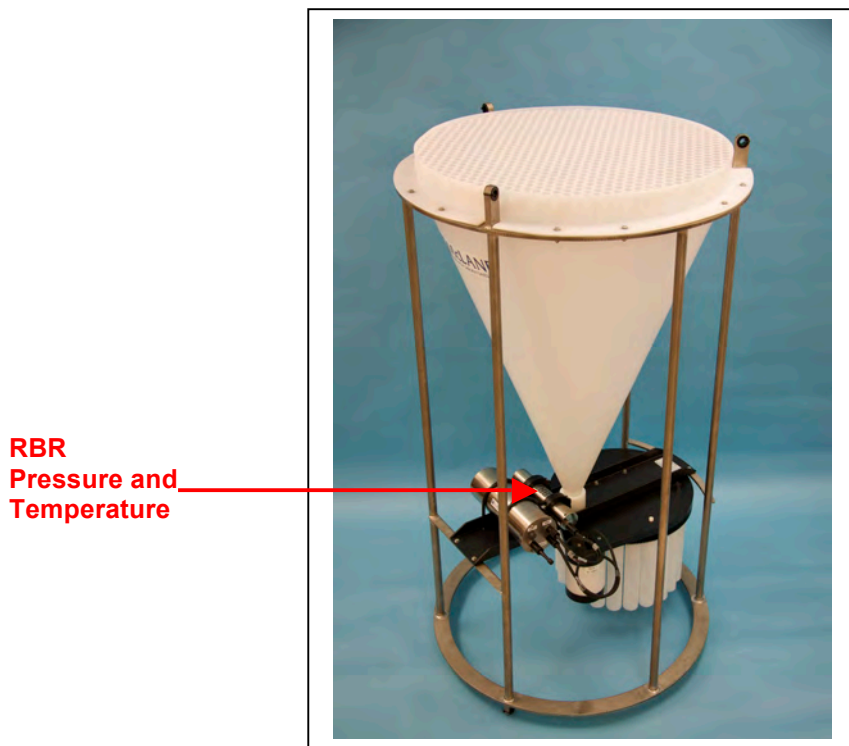
Figure B-1: Trap with RBR Pressure and Temperature Sensor

The Sediment Trap firmware Configuration string indicates whether the Pressure and/or Temperature sensors are installed (see Figure B-2).

Configuration string   **RBR Duo Pressure and Temperature**

```
_____
Configuration: PST-21_CT_RBR-TD        CF2 V3_11 of Aug 20 2015

              McLane Research Laboratories, Inc.
                   ParFlux Sediment Trap
                        ML12345-02
              _____
                         Main Menu
              _____
                 Mon Aug 24 16:09:43 2015

          <1> Set Time            <5> Create Schedule
          <2> Diagnostics         <6> Deploy System
          <3> Fill Containers     <7> Offload Data
          <4> Sleep               <8> Contact McLane

          <C> Configure
```

Figure B-2: Sediment Trap Main Menu Configuration String with Pressure and Temperature

RBR pressure and/or temperature data is logged to the DATA.DAT file on the system compact flash drive. If a single or dual channel RBR logger is installed, the following also applies:

- The Diagnostics display shows pressure (dbar)and/or external temperature (Celsius).

- Data offload also contains pressure and/or external temperature.

- If using the Pressure option, an atmospheric pressure option on the Configuration Menu allows you to zero the pressure sensor.

- Default for recording pressure and/or temperature readings is 1 minute. This default can be changed on the Deployment Menu.

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Connecting Directly with RBR Sensors

The Sediment Trap firmware communicates with the RBR sensors @9600 baud. Do not change this setting.

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

_____

Configuration: PST-21_CT_RBR-TD        CF2 V3_11 of Aug 11 2015


              _____
                    RBR sensor functions
              _____

                 Wed Aug 12 13:32:22 2015

              <1> Direct communications (9600 Baud)
              <M> Return to Main Menu

              Selection [M] ? 1


Expecting sensor at 9600 baud. Change [N] ?

Powering up sensordone.

Opening communications channels ...

Press ^C to terminate COMM session.
```

Figure B-3: Diagnostics with RBR Sensor Installed

Once connected directly to the sensor, typing commands at the command prompt provides additional sensor information. This Appendix describes basic commands and confirms correct configuration and commands. For a full set of commands, see the RBR user information included with the sensor.

Figure B-4 shown next displays examples of direct communications with the RBR sensor. For specific RBR commands and variables, refer to the sensor manual. Settings should not be changed without consulting McLane or RBR.

```
*******************************************************************
$C214.7P-13.4R9.1T14.8D0.0000*61
$C214.5P-13.4R9.1T15.0D0.0000*6A
$C214.4P-13.4R9.1T15.3D0.0000*68
CMD:&&
FW_Version=V2.6-4
FW_Date=3-Nov-10
Serial_number=000033740
Test_date=24 Sep 14
Output_Format=1
Acclerometer=2
Display_Fields=31
HW_Mounting_Pos=1
Baud_Rate=3
Set-Reset_Rate=8
Output_Rate=1
Averaging=0
AD_Update_Rate=3
lifeskip=8
Euler=4
MaxG=2
Deviation=0
Declination=0
Temp_Offset=33
Depth_Offset=0.00
Depth_Units=Meters
Max_PSI=0
Acc_X_Offset=0.0000
Acc_Y_Offset=0.0000
Acc_Z_Offset=0.0000
Acc_X_Scale=622.0000
Acc_Y_Scale=622.0000
Acc_Z_Scale=622.0000
Mag_X_Offset=23.4
Mag_Y_Offset=100.3
Mag_Z_Offset=69.4
Mag_X_Offset_Factor=8
Mag_Y_Offset_Factor=122
Mag_Z_Offset_Factor=52
Temperature_cal=184
Mag_X_Scale=2.958
Mag_X_Scale_HT=3.150
Mag_Y_Scale=2.435
Mag_Y_Scale_HT=2.593
Mag_Z_Scale=3.196
Mag_Z_Scale_HT=3.354
Mag_X_Bridge_Offset=8.34
Mag_Y_Bridge_Offset=122.95
Mag_Z_Bridge_Offset=52.53
Total_Gauss=2007
Gyr_X_Offset=0.000
Gyr_Y_Offset=0.000
Gyr_Z_Offset=0.000
A=0.00
B=0.00
C=0.00
E=0.00
SoftIronCorrection=0
OS5000-S,-US V2.6, SN#000033740, 24 Sep 14
 [^C]***********************************************************
Closing communications channels ... done.
```

Figure B-4: Direct Communications with the RBR Sensor

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Configuration Menu –Atmospheric Pressure Offset

The menu option <P> displays for RBR loggers that will record pressure. Selecting this option allows you to zero the atmospheric pressure either automatically or manually. This sets the current ambient pressure on the RBR logger to zero scale at the surface so that the logger reading reflects the pressure from below the surface.

```
_____
Configuration: PST-21_CT_RBR-TD          CF2 V3_11 of Aug 11 2015

                   _____
                        Configuration Menu
                   _____
                      Wed Aug 12 13:31:07 2015

          <A> Number Of Cups                 [21]
          <B> Compass Tilt                   [Yes]
          <C> Integral Temperature Sensor    [No]
          <D> Integral Pressure Sensor       [No]

          <E> RBR duo TD                     [Yes]
          <P> Atmospheric Pressure Zero Offset

          <X> Save & Exit          <^C> Cancel & Exit
```

Figure B-5: Option <P> Atmospheric Pressure Calculation

This is typically only necessary if deploying in a location that is not near sea level (for example, a high mountain lake).

```
        Selection [ ] ? p
 Retreiving atmospheric pressure value

Current atmospheric pressure value is set at 10.6000

 Change the atmospheric pressure value? [N] ? y

  Manually enter value [M], or determine it automatically [A]? [] ? A

   Determining the current atmospheric pressure . . . . .

    Setting the atmospheric pressure value.

     Atmospheric Pressure = 10.1647
```

Figure B-6: Automatic Atmospheric Pressure Offset

Typing *a* calibrates the pressure automatically. Automatic calibration takes the average of several pressure readings for the atmospheric pressure at the sampler's current location.

Typing *m* allows manual setting of the atmospheric pressure.

```
Selection [ ] ? p


Retreiving atmospheric pressure value

Current atmospheric pressure value is set at 10.10

 Change the atmospheric pressure value? [N] ? y

  Manually enter value [M], or determine it automatically [A]? [] ? m

Current value of Atmospheric pressure: : +10.10 dbar (+0.0 to +100.0)
[+0.0] ? 10.6

 Setting the atmospheric pressure value.

  Atmospheric Pressure = 10.6
```

Figure B-7: Manual Atmospheric Pressure Calculation

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Deployment Menu – Sampling Interval

The sampling interval for logging pressure and/or temperature data is set to the default of 1 minute. This default can be changed on the Deployment Menu (Figure B-8).

```
Modify an event [N] ?

 Header           A|
                  B|
                  C|

                  D| Sensor sampling interval [minutes]: 1   ⬅
                  
                  V| Verify and proceed.

        Selection  [ ] ? a

> S/N 13433-02

 Header           A| S/N 12345-02
                  B|
                  C|

                  D| Sensor sampling interval [minutes]: 1

                  V| Verify and proceed.

        Selection  [A] ?
```

Figure B-8: Change Sample Interval

Diagnostics

Selecting <2> 'Diagnostics' displays a scrolling status that includes the pressure reading in dbars. The external temperature displays in degrees Celsius, if being recorded.

```
Selection [] ? 2

Hold down ^C to exit. Any other key to pause/continue.

Date      Time      Battery    Int. Temp   Ext. Temp    Tilt    Heading    Pressure     Rotator

08/12/15 13:33:07   21.1 Vb    24.1∞C       22.6∞C      15.9∞T   245.7∞H    -0.0 dbar     aligned
08/12/15 13:33:12   21.1 Vb    24.1∞C       22.6∞C      16.1∞T   243.9∞H     0.1 dbar     aligned
08/12/15 13:33:17   21.1 Vb    24.2∞C       22.6∞C      16.3∞T   243.7∞H    -0.0 dbar     aligned
08/12/15 13:33:21   21.1 Vb    24.2∞C       99.0∞C      16.1∞T   244.1∞H    99.0 dbar     aligned
```

Figure B-9: Diagnostics with RBR Sensor Installed

Offload/Display Data with Pressure and/or Temperature

Selecting <7> 'Offload Data', displays deployment data. Pressure readings are recorded for each sample. Your can display only the sensor data by selecting option <3> from the Offload Menu.

```
Selection [1] ? 1
 Start the capture file now.
 Then, press any key to start the transfer.  The data
 file will remain in memory and is not erased by this
 offload procedure.
Configuration:      PST-21_CT_RBR-TD
Software version:  PST-3_11.c
Compiled:          Aug 20 2015 14:18:43
Electronics S/N:   ML2345-02
Data recording start time: 08/24/15 16:12:09
Data recording  stop time: 08/25/15 08:00:41


HEADER
_____
 S/N 12345-02
 System Test
 JSM 8/24/15
 SCHEDULE
_____
 Event 01 of 22 @ 08/24/15 16:15:00
 Event 02 of 22 @ 08/24/15 17:00:00
 Event 03 of 22 @ 08/24/15 17:45:00
. . .                                          Display shortened to save space
Event 21 of 22 @ 08/25/15 07:15:00
Event 22 of 22 @ 08/25/15 08:00:00

 DEPLOYMENT DATA
_____
 Event 01
 Scheduled start time:  08/24/15 16:15:00
 Event start time:      08/24/15 16:15:01
 Event stop time:       08/24/15 16:15:34
 Event duration:        33 seconds
      Aligned     Battery      Temperature  Tilt Heading    Pressure
 Start:     Y         19.8       21.8∞C       1∞     359∞      -0 dbar
 Stop:      Y         19.5       21.8∞C       1∞      8∞       -0 dbar
Event 02
 Scheduled start time:  08/24/15 17:00:00
 Event start time:      08/24/15 17:00:01
 Event stop time:       08/24/15 17:00:34
 Event duration:        33 seconds
```

Figure B-10: Offload/Display Data with Pressure and Temperature Readings

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```
SENSOR DATA

_____

Sensor sampling interval: 1 minute

    Date,      Time,   Event,  Tilt,  Hdng,  Temp,  Pressure,  Aligned

 08/24/15, 16:16:00,      1,   0.6,  20.8,  21.8,     -0.3,       Y

 08/24/15, 16:17:00,      1,   0.6,  11.8,  21.8,     -0.4,       Y

 08/24/15, 16:18:00,      1,   0.6,  20.9,  21.8,     -0.4,       Y
```

Figure B-11: Deployment Data Including Pressure and Temperature Sensor Data

Offload/Display Data – EEPROM Pressure and/or Temperature Sensor

Selecting <4> displays the backup EEPROM. Pressure and/or temperature data is also stored in EEPROM.

```
Selection [1] ? 4

 During deployments, a backup copy of the instrument data
 is written to non-volatile EEPROM storage. This allows
 for data recovery in the event the instrument data
 is no longer resident in active memory.

 The sensor time history is recorded in the disk
 file "DATA.DAT" which will be displayed here.
 (It can also be copied directly from the disk.)

 To copy the EEPROM cache file to a disk file:
 Start the capture file, now.
 Then, press any key to start the transfer.


 The cache file remains in EEPROM until overwritten during the
 next deployment.

 Event Summary:

Event 01
 Scheduled start time:  04/10/17 21:00:01

 Event start time:      04/10/17 21:00:01
 Event stop time:       04/10/17 21:00:30
 Event duration:        29 seconds


        Aligned  Battery  Temperature  Tilt  Heading
 Start:    Y       17.8      -18.9 °C     92°    271°
 Stop:     Y       16.5      -18.8 °C     92°    271°

 Event 02

 Scheduled start time:  04/10/17 21:30:01

 Event start time:      04/10/17 21:30:01
 Event stop time:       04/10/17 21:30:30
 Event duration:        29 seconds
...            ◀————————————————  Display shortened to save space
```

Figure B-12: EEPROM Data Including Pressure and Temperature

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Appendix C
Adaptive Sampling Firmware

Adaptive sampling firmware provides the user with command-line control over the Sediment Trap. By issuing commands from a provided command set, the user has full control over the system after the Sediment Trap has been deployed.

> The Adaptive Sampling option requires a continuous RS-232 connection from the Sediment Trap to a computer or other microcontroller.

An Adaptive Deployment is pre-programmed to perform the same functions as a standard (time-series) deployment, except that a serial command sent to the controller triggers each sample collection. In standard deployment mode, a date and time trigger sample collection.

Using Interactive Sampling Commands

Once deployed, the Sediment Trap sample events can be changed via the communication protocol. Communicating with the Sediment Trap during deployment allows the operator to adapt the sampling schedule in real-time. To use the interactive commands, complete the following steps:

1. Begin terminal emulation and confirm that the firmware is in low power sleep. The 'ML' in the prompt indicates 'McLane Labs', followed by the sampler serial number. The serial number is a unique identifier for each sampler.

2. Press any key to display a prompt (available only when the firmware is in low power sleep during the deployment).

```
05/15/2008 09:59:03 Sleeping . . .
ML12294-02 >  ◄─── Prompt for interactive commands contains the sampler serial
                                                                    number
```

Figure C-1: Prompt for Interactive Commands

3. Type an interactive command to communicate with the firmware (15 seconds of typing inactivity deactivates the prompt, pressing any key reactivates the prompt). After executing an interactive command, the system returns to low power sleep to wait for the next sample event or the next interactive command.

ST - Current Status

The 'ST' command displays Event #, confirms rotator alignment, shows electronics temperature in °C, battery voltage, previous sample date/time, current date/time, next sample date/time (shown in Figure C-8).
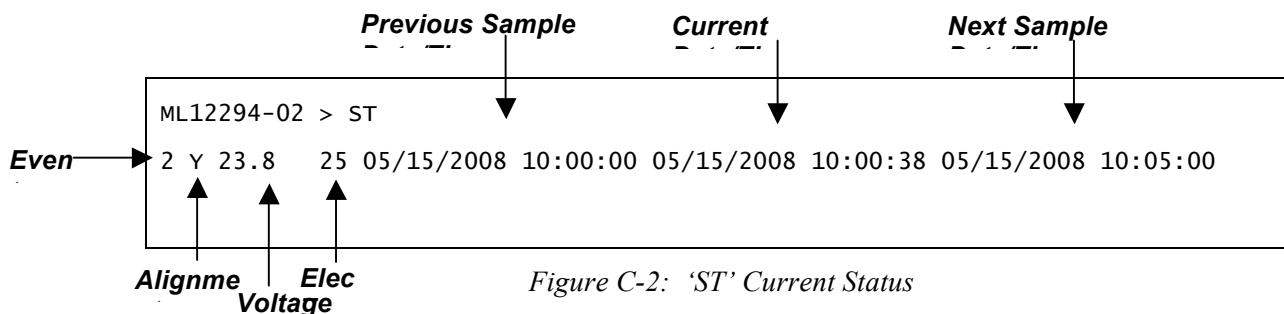
```
                        Previous Sample          Current              Next Sample

ML12294-02 > ST
2 Y 23.8    25 05/15/2008 10:00:00 05/15/2008 10:00:38 05/15/2008 10:05:00


        Alignme       Elec
          Voltage
```

Figure C-2: 'ST' Current Status

RB - Rotate Bottle

'RB' Rotate Bottle commands the firmware to rotate to the next bottle. There is a 5 minute delay between the command and the rotation to allow the user to make corrections. As shown in Figure C-9, no other events are changed. A status line is returned to show the change.

```
05/15/2008 10:03:06 Sleeping . . .
 ML12294-02 > RB
2 Y 23.8    25 05/25/2008 12:00:00 05/25/2008 10:03:16 05/25/2008 10:08:16


 05/15/2008 10:03:18 Sleeping . . .
ML12294-02 > VE ALL
1 of  22 = 05/23/2008 12:00:00
2 of  22 = 05/25/2008 10:08:16
3 of  22 = 05/27/2008 12:00:00
4 of  22 = 05/29/2008 12:00:00
5 of  22 = 05/31/2008 12:00:00
6 of  22 = 06/02/2008 12:00:00
```

Figure C-3: 'RB' Rotate Bottle

VE - View Event

'VE' View event shows the pending sample event number, date/time of rotation as shown in Figure C-10.

```
05/15/2008 10:00:40 Sleeping . . .
 ML12294-02 > VE
2 05/15/2008 10:05:00
```

Figure C-4: 'VE' View Event

VE n - View Event Number

'VE n' View event number shows the number, date/time scheduled for the specified event as shown in Figure C-11.

```
05/15/2008 10:01:04 Sleeping . . .
 ML12294-02 > VE 20   ◄────────────

20 05/15/2008 11:35:00
```

Figure C-5: 'VE n' View Specific Event

VE All - View Event All

'VE ALL' View Event All shows the number, date/time for all scheduled events as shown in Figure C-12.

```
05/15/2008 10:01:48 Sleeping . . .
 ML12294-02 > VE ALL
1 05/15/2008 10:00:00
2 05/15/2008 10:05:00
3 05/15/2008 10:10:00
4 05/15/2008 10:15:00
5 05/15/2008 10:20:00
6 05/15/2008 10:25:00
7 05/15/2008 10:30:00
8 05/15/2008 10:35:00
9 05/15/2008 10:40:00
10 05/15/2008 10:45:00
11 05/15/2008 10:50:00
12 05/15/2008 10:55:00
13 05/15/2008 11:00:00
14 05/15/2008 11:05:00
15 05/15/2008 11:10:00
16 05/15/2008 11:15:00
17 05/15/2008 11:20:00
18 05/15/2008 11:25:00
19 05/15/2008 11:30:00
20 05/15/2008 11:35:00
21 05/15/2008 11:40:00
22 05/15/2008 11:45:00
```

Figure C-6: 'VE ALL' View All Events

CE n Date Time - Change Event Number Scheduled Start

'CE n Date/Time' changes an event scheduled start. Each parameter is separated by a space, and the format is Event #, MM DD YYYY HH MM SS. In Figure C-13, sample event #4 is changed to 5-15-2008 at 10:14:00. The system returns to low power sleep.

```
ML12294-02 > CE 4 05 15 2008 10 14 00
4 05/15/2008 10:14:00

05/15/2008 10:11:48 Sleeping . . .
```

Figure C-7: 'CE # Date/Time' Change Event Number Scheduled Start

DM - Display Main Menu

'DM' suspends the deployment and displays the Main Menu. In the course of normal operations, use of this menu will not be required (commands to view, change and execute events are included in the interactive commands ST, VE, CE and RB). Descriptions of the Main Menu commands are included in this appendix as a reference.

```
05/15/2008 10:14:28 Sleeping . . .
ML12294-02 > DM

<05/15/2008 10:14:39> Deployment terminated by operator.
_____
               McLane Research Laboratories, USA
                  ParFlux 21-Cup Sediment Trap
               Version: PST-21E1.c   S/N: ML12294-02

         ┌─────────────────────────────────────────┐
         │                                          │
         │               Main Menu                  │
         │                                          │
         └─────────────────────────────────────────┘

                  Thu May 15 10:14:39 2008

            <1> Set Time              <5> Change Schedule
            <2> Diagnostics           <6> Resume Deployment
            <3> Fill Containers       <7> Offload Data
            <4> Sleep                 <8> Contacting McLane

         Selection  ?
```

Figure C-8: 'DM' Display Menu

All Main Menu options can be selected to interact with the Sediment Trap.

<6> 'Resume Deployment' must be selected to resume the deployment. If the electronics is allowed to sleep from the Main Menu, it will continue to sleep. No further events will execute.

In the course of normal operations, use of this menu will not be required. Commands to view, change and execute events are included in the interactive commands – 'ST', 'VE', 'CE', 'RB'.

<3> - Fill Containers

The preferred method for triggering a sample is to use the interactive sampling command 'RB' while in a deployment. Selecting <3> Fill Containers triggers on demand sample events. The previous scheduled time for the sample event is overridden and the sample bottle is rotated immediately.

```
05/15/2008 10:14:28 Sleeping . . .
ML12294-02 > DM
<05/15/2008 10:14:39> Deployment terminated by operator.
_____
                  McLane Research Laboratories, USA
                      ParFlux 21-Cup Sediment Trap
                  Version: PST-21E1.c   S/N: ML12294-02


              ┌─────────────────────────────────────┐
              │              Main Menu               │
              └─────────────────────────────────────┘

                     Thu May 15 10:14:39 2008

              <1> Set Time             <5> Change Schedule
              <2> Diagnostics          <6> Resume Deployment
              <3> Fill Containers      <7> Offload Data
              <4> Sleep                <8> Contacting McLane
           Selection  ? 3
Rotator is aligned.
 Next Bottle (Yes/No) [N] ? y

 <05/15/2008 10:18:31> Filling bottle - overriding event #06 . . .
 Moving rotator assembly . . . rotor aligned.
 Lowest battery detected = 23.8 V

 Rotator is aligned.
 Next Bottle (Yes/No) [N] ?
```

Figure C-9: <3> Fill Containers

<5> - Change Schedule

The preferred method for changing events is using the 'CE' command while in a deployment. Selecting <5> Change Schedule displays the Schedule Menu. Typing 'Y' at the prompt displays the Sample Schedule Menu.

```
05/15/2008 10:14:28 Sleeping . . .
ML12294-02 > DM

<05/15/2008 10:14:39> Deployment terminated by operator.
_____
                   McLane Research Laboratories, USA
                      ParFlux 21-Cup Sediment Trap
                   Version: PST-21E1.c   S/N: ML12294-02


                   ┌─────────────────────────────────┐
                   │            Main Menu             │
                   └─────────────────────────────────┘

                        Thu May 15 10:14:39 2008

                 <1> Set Time              <5> Change Schedule
                 <2> Diagnostics           <6> Resume Deployment
                 <3> Fill Containers        <7> Offload Data
                 <4> Sleep                  <8> Contacting McLane
             Selection  ? 5
 8 events have already triggered. ◄──────── Number of completed sample events
  These events will be preserved in the deployment schedule.
  14 events which have not triggered will be erased.
  Continue (Yes/No) [N] ? y
 Change deployment schedule (Yes/No) [N] ? y   ◄──── Type Y to change schedule
 14 pending events removed from deployment schedule.
 Enter the number of events to program  (0 to 14) ? 14


             ┌─────────────────────────────────┐
             │          SCHEDULE MENU           │
             └─────────────────────────────────┘

         <1> Enter each event time
         <2> Enter start date & interval
         <3> Enter start date & end date
         <M> Main Menu
         Selection  ? 2
```

Figure C-10: <5> Change Schedule (screen 1 of 2)

Select a method for changing the schedule (enter each event time, or enter a start date and
interval or specify start and end dates). In Figure C-12, the start interval is changed to 2 days.
You cannot change an event that has been completed (C-13).

```
Enter START date and time [05/23/2008 11:15:06] ? 5  23  2008 12  00  00
Enter interval
      Days     (0 to 365) ? 2
      Hours    (0 to  23) ? 00
      Minutes  (0 to  59) ? 00
 Schedule Verification
 Event   1 of  22 = 05/23/2008 12:00:00 (already triggered)
 Event   2 of  22 = 05/25/2008 12:00:00 (already triggered)
 Event   3 of  22 = 05/27/2008 12:00:00 (already triggered)
 Event   4 of  22 = 05/29/2008 12:00:00 (already triggered)
 Event   5 of  22 = 05/31/2008 12:00:00 (already triggered)
 Event   6 of  22 = 06/02/2008 12:00:00 (already triggered)
 Event   7 of  22 = 06/04/2008 12:00:00 (already triggered)
 Event   8 of  22 = 06/06/2008 12:00:00 (already triggered)
 Event   9 of  22 = 06/08/2008 12:00:00
 Event  10 of  22 = 06/10/2008 12:00:00
 Event  11 of  22 = 06/12/2008 12:00:00
 Event  12 of  22 = 06/14/2008 12:00:00
 Event  13 of  22 = 06/16/2008 12:00:00
 Event  14 of  22 = 06/18/2008 12:00:00
 Event  15 of  22 = 06/20/2008 12:00:00
 Event  16 of  22 = 06/22/2008 12:00:00
 Press any key to continue.

 Event  17 of  22 = 06/24/2008 12:00:00
 Event  18 of  22 = 06/26/2008 12:00:00
 Event  19 of  22 = 06/28/2008 12:00:00
 Event  20 of  22 = 06/30/2008 12:00:00
 Event  21 of  22 = 07/02/2008 12:00:00
 Event  22 of  22 = 07/04/2008 12:00:00

Modify an event  (Yes/No) [N] ?
```

Figure C-11: <5> Change Schedule (screen 2 of 2)

```
Modify an event  (Yes/No) [N] ? y
 Enter the event number  (1 to 22) ?
 Enter the event number  (1 to 22) ? 1
That event has already triggered and cannot be modified
```

Figure C-12: <5> Cannot Change Completed Event

Typing 'N' displays the Main Menu. Select <6> to resume the deployment. The schedule re-displays for verification, shows the system status and returns the system to low power sleep to wait for the next scheduled event. <6> 'Resume Deployment' must be selected to resume the deployment.

```
┌────────────────────────────────────────────────────────┐
│                      Main Menu                           │
└────────────────────────────────────────────────────────┘
                    Thu May 15 10:28:03 2008
        <1> Set Time              <5> Change Schedule
        <2> Diagnostics           <6> Resume Deployment
        <3> Fill Containers       <7> Offload Data
        <4> Sleep                 <8> Contacting McLane
           Selection  ? 6
Schedule Verification
Event   1 of  22 = 05/15/2008 10:00:00  (already triggered)
Event   2 of  22 = 05/15/2008 10:08:16  (already triggered)
Event   3 of  22 = 05/15/2008 10:10:00  (already triggered)
Event   4 of  22 = 05/15/2008 10:14:00  (already triggered)
Event   5 of  22 = 05/15/2008 10:20:00  (already triggered)
Event   6 of  22 = 05/15/2008 10:25:00  (already triggered)
Event   7 of  22 = 05/15/2008 10:30:00  (already triggered)
Event   8 of  22 = 05/15/2008 10:35:00  (already triggered)
Event   9 of  22 = 05/15/2008 10:30:00
Event  10 of  22 = 05/15/2008 10:32:00
Event  11 of  22 = 05/15/2008 10:34:00
Event  12 of  22 = 05/15/2008 10:36:00
Event  13 of  22 = 05/15/2008 10:38:00
Event  14 of  22 = 05/15/2008 10:40:00
Event  15 of  22 = 05/15/2008 10:42:00
Event  16 of  22 = 05/15/2008 10:44:00
Press any key to continue.
Event  17 of  22 = 05/15/2008 10:46:00
Event  18 of  22 = 05/15/2008 10:48:00
Event  19 of  22 = 05/15/2008 10:50:00
Event  20 of  22 = 05/15/2008 10:52:00
Event  21 of  22 = 05/15/2008 10:54:00
Event  22 of  22 = 05/15/2008 10:56:00

Modify an event  (Yes/No) [N] ?
System status:

 05/15/2008 10:28:18   23.7 Vb    27 øC  aligned

Proceed with the deployment (Yes/No) [N] ? y  ◄─────── Proceed with deployment
<05/15/2008 10:28:21> Waiting for Event 09 of 22 @ 05/15/2008 10:30:00

05/15/2008 10:28:23 Sleeping . . .
```
Figure C-13: <6> Resume Deployment

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Offload Data <7> can be used at any point during the deployment to display data for completed samples. Re-run option <7> at the end of the deployment to see data for all samples.

```
                        ┌─────────────────────────────────────┐
                        │             Main Menu               │
                        └─────────────────────────────────────┘

                          Thu May 15 10:28:03 2008

        <1> Set Time              <5> Change Schedule
        <2> Diagnostics           <6> Resume Deployment
        <3> Fill Containers        <7> Offload Data
        <4> Sleep                 <8> Contacting McLane
         Selection  ? 6
                    ┌─────────────────────────────────────┐
                    │       Offload/Display Data File      │
                    └─────────────────────────────────────┘

                       Thu May 15 10:32:20 2008
        <1> Display data file
        <2> Display backup EEPROM
        <M> Main Menu

           Selection  ? 1

 To copy the instrument data file to a disk file, initiate
 your communication program's file logging command now and
 then press any key to start the transfer.  The instrument
 data file will remain resident and is not erased by this
 offload procedure.

 Software version:  PST-21E1.c
 Compiled:          May 14 2008 10:49:29
 Electronics S/N:   ML12294-02

 Data recording start time = 05/15/2008 10:28:21
 Data recording stop time  = 05/15/2008 10:31:57

 HEADER
 ──────

 SCHEDULE
 ────────
 Event 01 of 22 @ 05/15/2008 10:00:00
 Event 02 of 22 @ 05/15/2008 10:08:16
 …
 Event 22 of 22 @ 05/15/2008 10:56:00
```

Figure C-14: <7> Offload Deployment Data (screen 1 of 2)

As shown in Figure C-16, deployment data for Events 01-09 displays because only these events have been completed.

```
DEPLOYMENT DATA
_____
Event 01

 Scheduled start time:  05/15/2008 10:00:00
 Event start time:      05/15/2008 10:00:00
 Event stop time:       05/15/2008 10:00:25

         Aligned     Battery     Temperature
 Start:     Y          23.7          24 øC
 Stop:      Y          23.8          24 øC

Event 02

 Scheduled start time:  05/15/2008 10:08:16
 Event start time:      05/15/2008 10:08:16
 Event stop time:       05/15/2008 10:08:41

         Aligned     Battery     Temperature
 Start:     Y          23.8          25 øC
 Stop:      Y          23.8          25 øC
…
Event 09

 Scheduled start time:  05/15/2008 10:30:00
 Event start time:      05/15/2008 10:30:00
 Event stop time:       05/15/2008 10:30:25

         Aligned     Battery     Temperature
 Start:     Y          23.7          26 øC
 Stop:      Y          23.7          27 øC

 Schedule was not completed.

 System recovered early.

 End of instrument data file.

 Terminate file logging operation now
 and press any key to continue.
```

Figure C-15: <7> Offload Deployment Data (screen 2 of 2)

To redeploy the Sediment Trap, the electronics must be reset and/or the power cycled by disconnecting the battery pack.

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Appendix D
Optional Ethernet Communication

Ethernet communication in an available option that can be used with adaptive sampling instead of an RS-232 connection. This Appendix explains the Ethernet hardware, Ethernet configuration and communication.

Ethernet Hardware

A PERLE Ethernet to serial board (IOLAN-TS2) is added to the standard electronics for Ethernet communication. An external, 24V power source and connection to an Ethernet network are required to communicate with the Sediment Trap. If the external power is removed, the Ethernet board power will turn off and the RS232 communications will turn on. The electronics will continue to operate on the internal batteries.

End Cap Connectors, Test Cable and Current Draw

The Ethernet/External Power bulkhead connector on the controller housing is a 6 pin MCBH(WB)-6-MP-SS connector that mates to an Impulse MCIL-6-FS cable connector. A test cable (included for bench testing - do not use for deployment) has the cable connector, an RJ45 Ethernet connector and a dual, in-line banana jack as shown in Figure C-3. Figure C-5 shows the test cable wiring diagram.The external power source must be 24V DC, capable of 750mA (minimum) (not to exceed 30VDC). Current draw is 70 mA (motor off) and 350 mA (motor on).
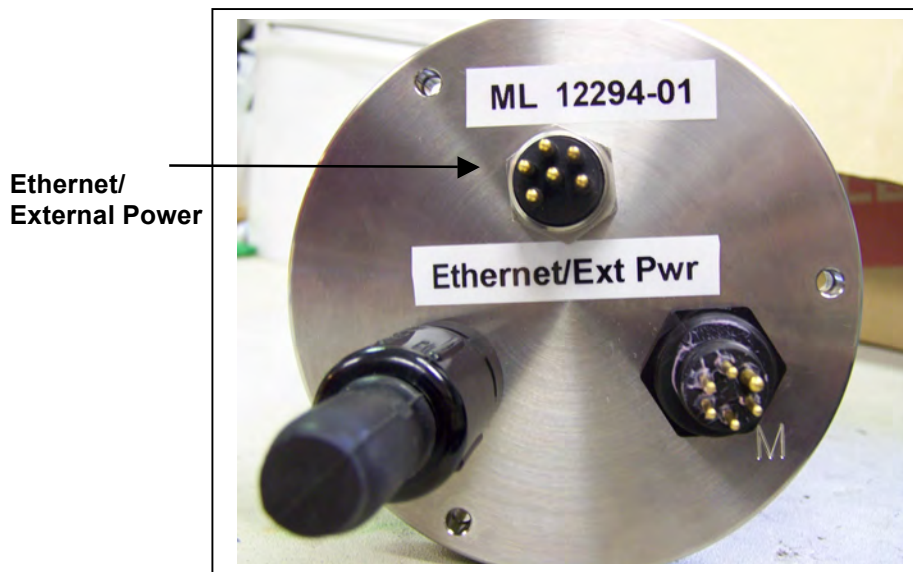
Figure D-1: Endcap with Ethernet Bulkhead Connector
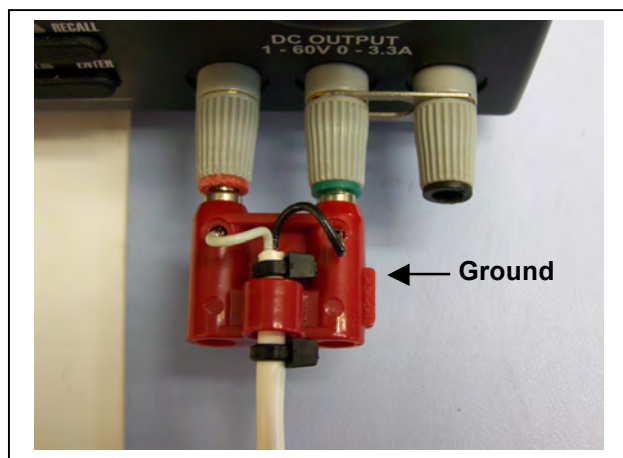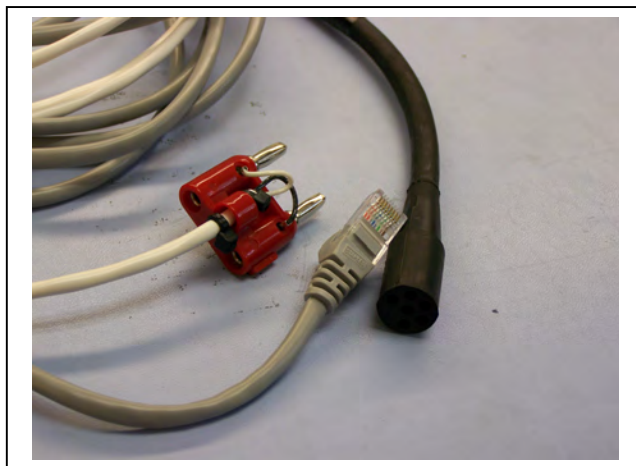
Test Cable Wiring Diagram
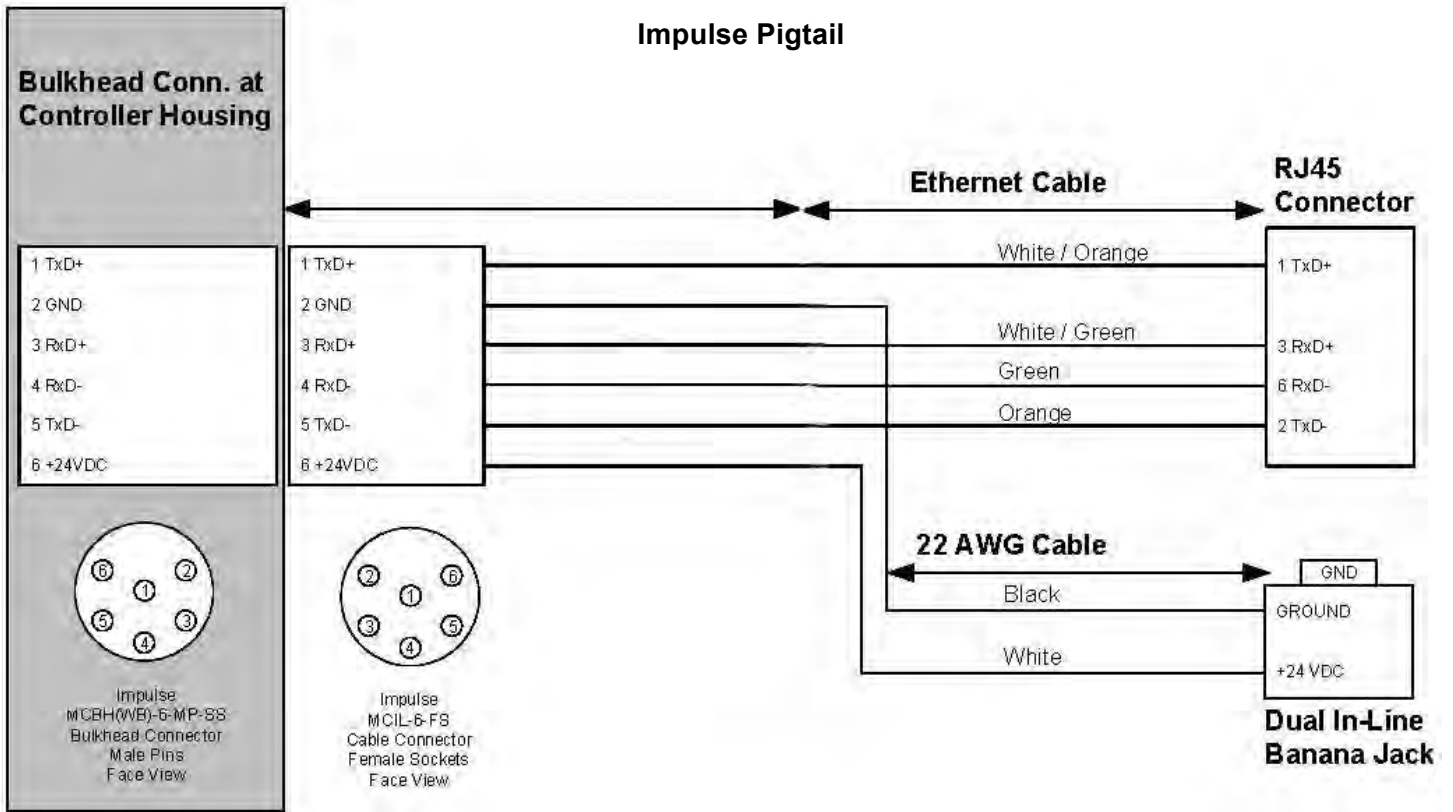
Figure D-2: Test Cable Wiring Diagram

Ethernet Configuration

The Ethernet board can be configured using the PERLE software on the CD-ROM included with the Sediment Trap. The factory settings are shown in the Web Browser Interface (Figure D-3).
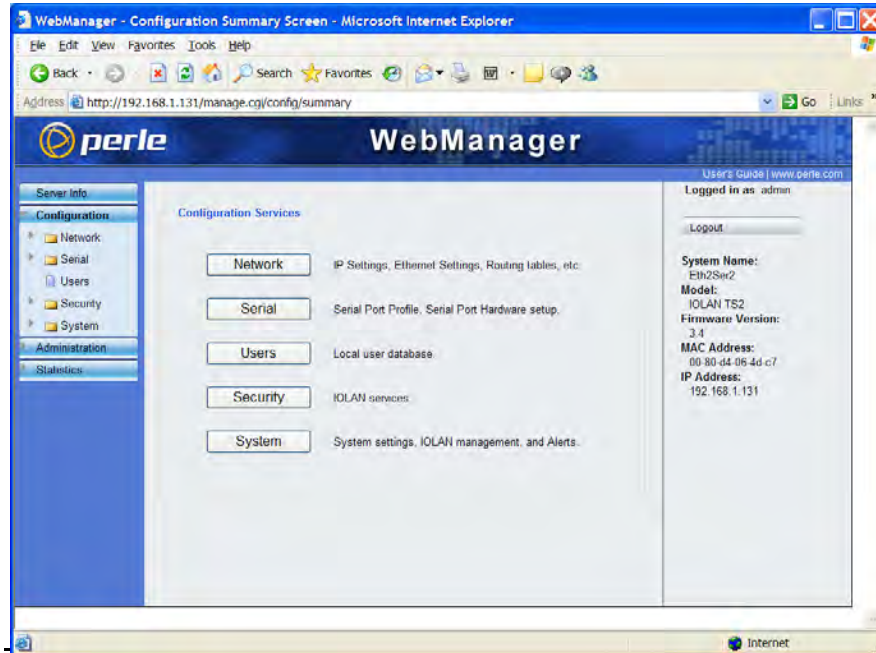
Figure D-3: Web Interface to Ethernet Board

Ethernet Communication

Once configured, the Ethernet board will accept raw TCP/IP commands and pass them to the Sediment Trap firmware. The TCP/IP communication module would include the following components:

1. Establish the TCP/IP connection with the controller IP Address and port (10001).

2. Send commands using a TCP Transmit command.

3. Receive data using a TCP Read command.

4. Disconnect using a TCP Close command.

Matlab, LabVIEW, and many C compilers include raw TCP/IP example code.

There are two COM ports on the Ethernet board. COM Port 1 is used for communication (Ethernet Port 10001), COM Port 2 (Ethernet Port 10002) is used to reboot the electronics if emergency recovery is required. Connecting to Ethernet Port 10002, automatically reboots the electronics.

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Appendix E
Deep Sediment Trap Connectors

Sediment Traps deployed at depths from 7,000 to 10,000m, require high pressure penetrators on the controller COM port and motor connector. These high pressure penetrators have a locking collar with an inner locking ring.

To remove the motor from the Sediment Trap, the motor connector must fit through a hole in the rotator. First, the red locking collar and inner locking ring must be removed.
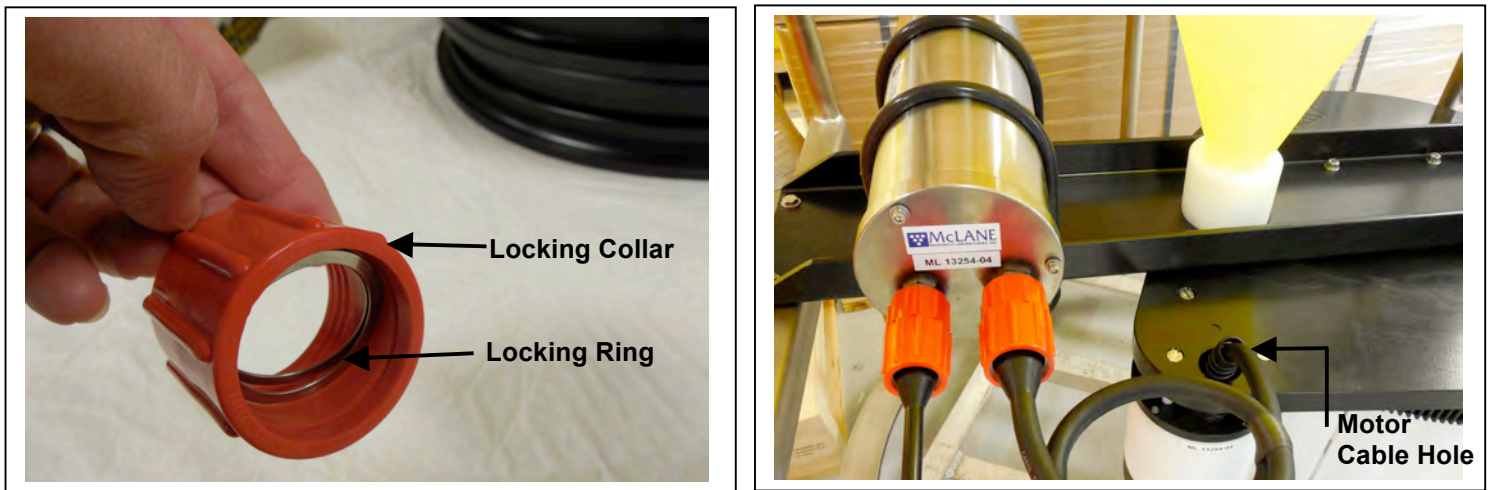
Figure E-1: High Pressure Penetrators with Locking Collar and Inner Locking Ring

Removing Penetrator Locking Collar and Locking Ring

Before removing the motor from the Sediment Trap, you must complete the following steps to remove the high pressure penetrator locking collar and locking ring.

> **ℹ** Remove the locking collar and locking rinrg only if you are removing the motor from the Sediment Trap.

1. Unscrew the locking collar from the Sediment Trap controller housing and unplug the motor bulkhead and slide the red locking collar onto the motor cable.
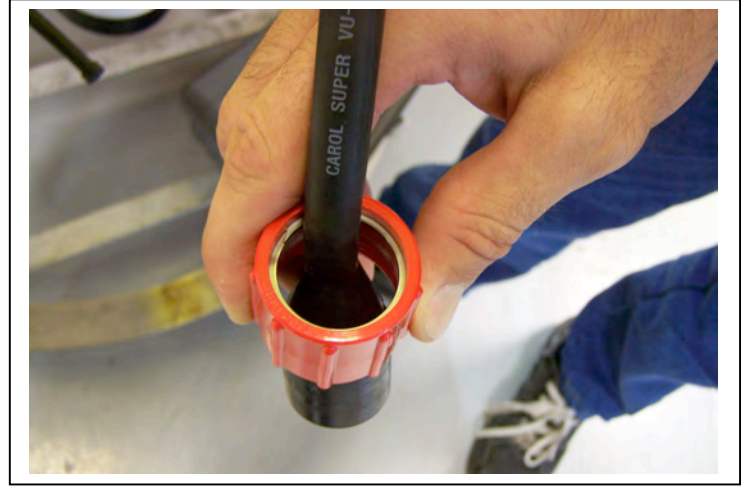
Figure E-2: Unscrew Locking Collar and Unplug Bulkhead Connector

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Remove Locking Ring ⟶
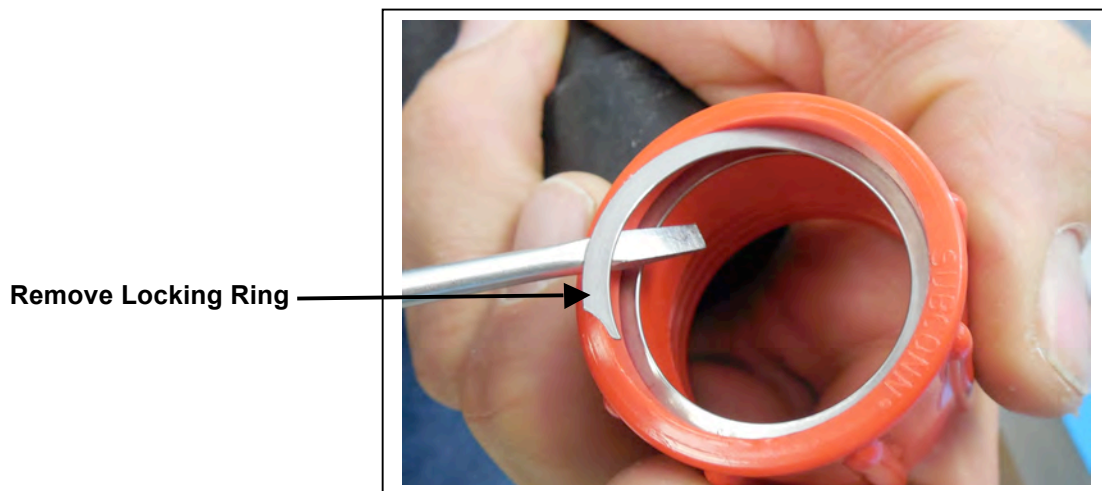
Figure E-3: Lift to Release Tab of Silver Locking Ring

2. Using a screwdriver or other flat tool such as pliers, lift the silver locking ring by the groove and pull up onto top of locking collar. Continue pulling locking ring until the ring releases from groove inside the locking collar.

3. Remove the red locking collar from the motor cable.

4. Twist the locking ring off of the motor cable to remove.

Figure E-4: Slide Locking Collar Off Motor Cable and Twist Off Locking Ring

5. Remove the motor cable by fitting the motor cable through the hole in the rotator.

Figure E-5: Fit Motor Cable Down Through Hole in Rotator Plate

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Re-attaching Penetrator Locking Collar and Locking Ring

Complete the following steps to re-attach the locking collar, locking ring and reconnect the motor cable.

1. Slide the motor cable up through the rotator plate.

2. Twist the locking ring sideways onto the motor cable and slide the locking collar back onto motor cable. Face the grooves in the locking collar towards the bulkhead connector.
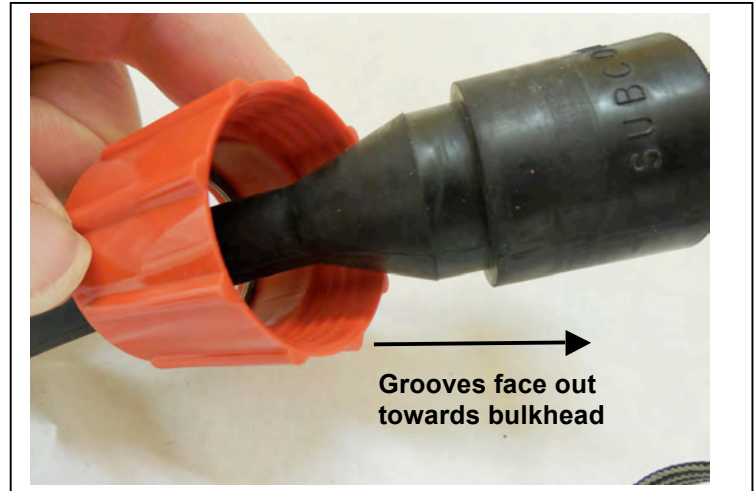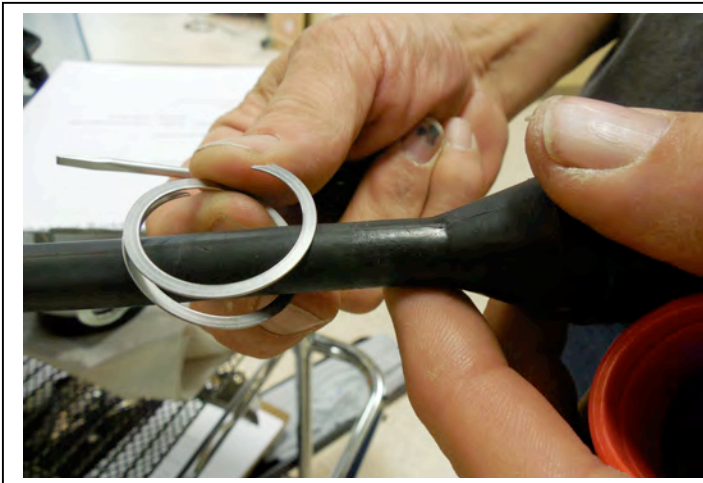
Figure E-6: Twist Silver Locking Ring onto Motor Cable and Slide Red Collar onto Cable

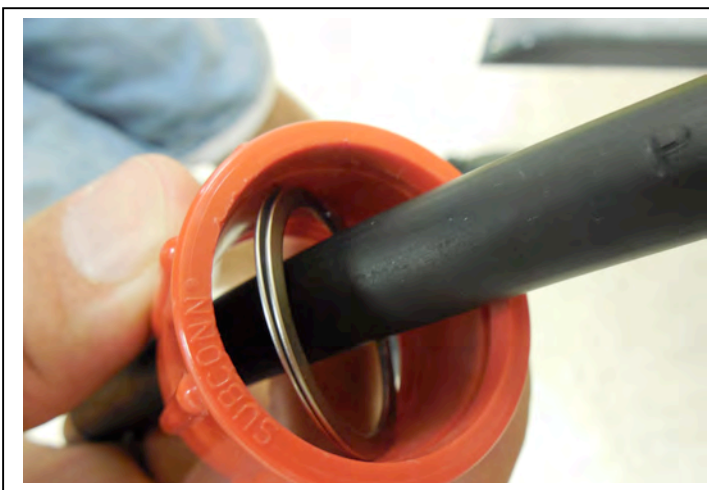3. Turn the locking ring to the side to fit into the groove inside the locking collar.
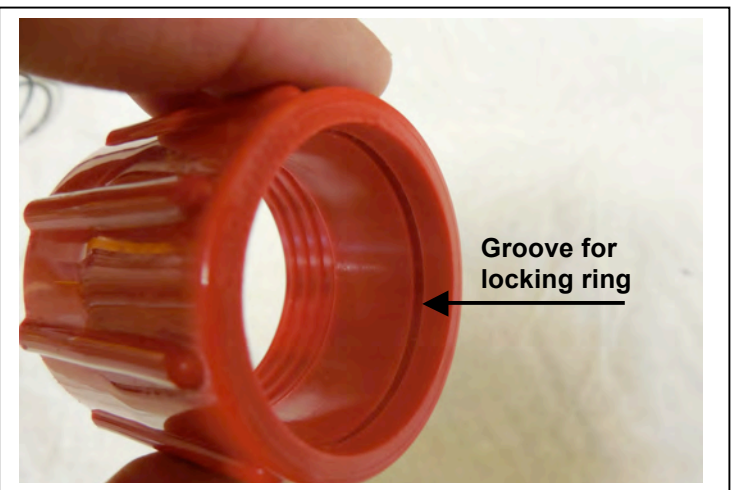
Figure E-7: Fit Silver Locking Ring Inside Locking Collar Groove

4. With thumb secured on bottom of red collar, push forward towards bulkhead. This motion should push the locking ring inside the groove. The locking ring is secure when you hear it snap into place with a 'click'.
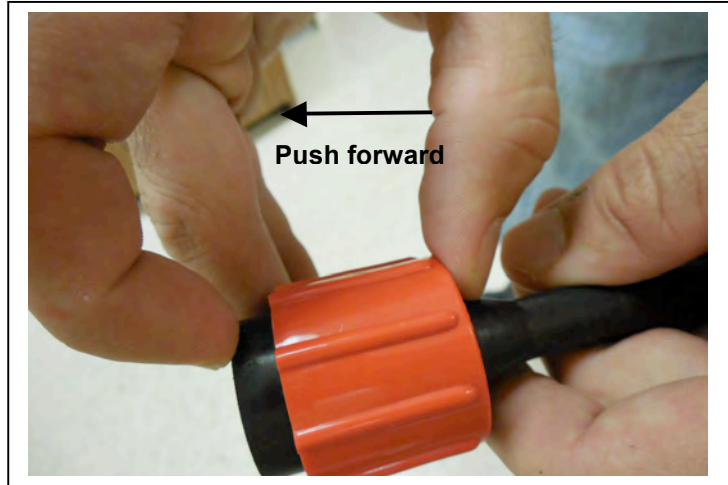

Figure E-8: Push Red Collar Towards Bulkhead

COM Cable Wiring

The cable connecting the controller to the computer must be wired correctly for proper communications. A wiring diagram for the COM cable is included below. The M3854 cable converts the MCBH to IL-5.
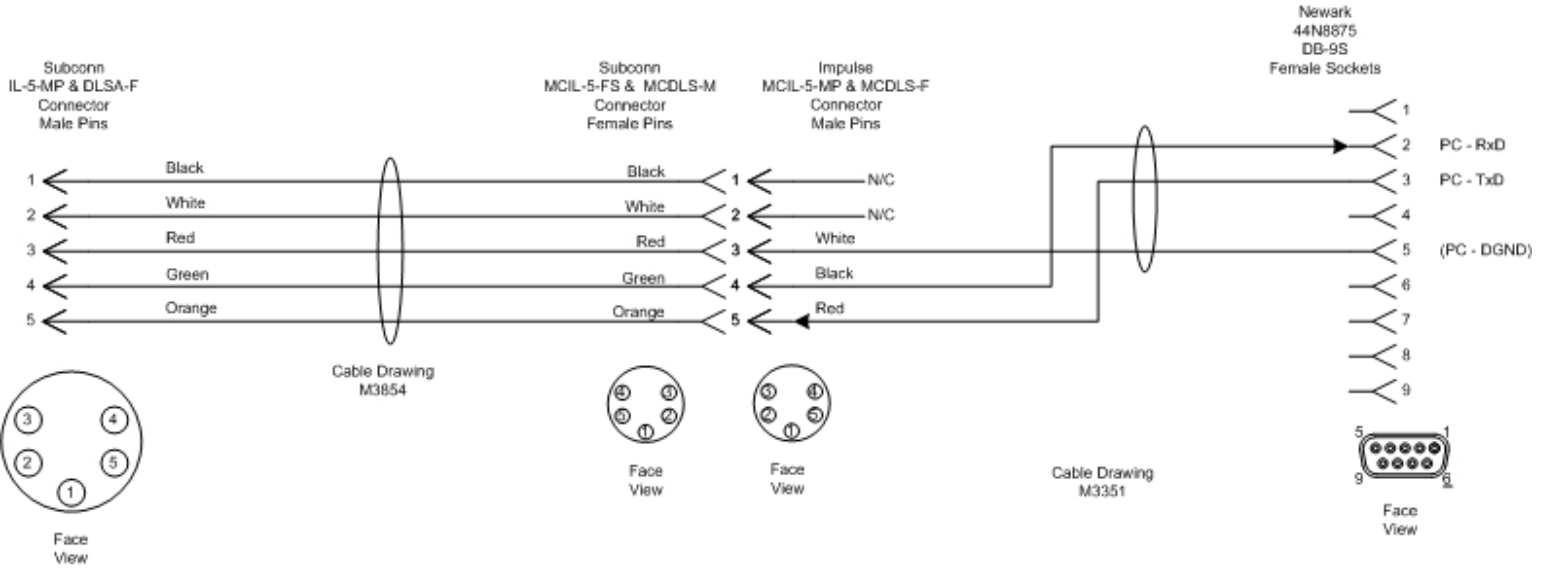

Figure E-9: COM Connector Diagram

Notes