McLane Remote Access Sampler (RAS) - 500

SHIPPED FROM:
McLane Research Laboratories, Inc.
Falmouth Technology Park
121 Bernard E. St. Jean Drive
East Falmouth, MA 02536 USA

How to contact us:

- **E-mail: mclane@mclanelabs.com**
- **Fax: +1 508-495-3333**
- **Phone: +1 508-495-4000**
- **Internet: http://www.mclanelabs.com**

RAS-500 User Manual Revision History:

July 2009	Rev F
June 2008	Rev E
June 2004	Rev D
June 2000	Rev C
December 1999	Rev B
October 1997	Rev A

RAS-500 User Manual Table of Contents

RAS-500 User Manual List of Figures

Chapter 1
Introduction

McLane RAS 3-48-500 Sampler (RAS-500)

This manual describes the operation and maintenance of the McLane Remote Access Sampler (RAS-500), a time-series sampler that autonomously collects up to 48 individual 500ml *in situ* water samples. Before first-time use of the RAS-500, complete the following:

- Become familiar with the RAS-500 by reading the Overview in this chapter, and reviewing chapters 2 and 3 in this User Manual
- Connect the battery (the RAS-500 is shipped and stored with the battery disconnected)
- Install the water flush filter
- Install the sample bags (and optionally the filters)
- Prime to release any air trapped in the tubing or filters
- Fill the acid flush bag
- Establish communications between the RAS-500 and a PC, and see Chapter 7,"RAS-500 User Interface", in this User Manual to program the deployment

Using this Manual

This manual is organized into several chapters. Chapter 2, "Mechanical Description" and Chapter 3, "Electronic Description" detail the mechanical and electrical components of the RAS-500. Chapter 4, "Maintenance and Storage" describes how to clean and store the RAS-500. Chapter 5, "Operations" describes the steps to prepare the RAS-500 for deployment, including priming and provides instrument current consumption information. Chapter 6, "Launch and Recovery" describes launch and recovery steps including mooring configurations. Chapter 7, "RAS-500 User Interface" and Chapter 8, "Data Offload and Processing" show the user interface, explain how to program the RAS-500 for deployment, and provide steps for offloading deployment data.

RAS-500 Overview

The RAS-500 is a time-series sampler that can collect up to 48 individual 500ml water samples in 0º to +50ºC water at depths up to 5,500m. Deployment duration can be short (such as hours), or continuous (up to 18 months). Pre and post sample acid cleaning cycles remove bio-fouling and other contaminants to keep samples pure. These cycles are available in an

acid/sample/acid pattern. The RAS-500 user interface controls the multi-port valve and displacement pump, directs the acid wash, cleaning cycles and fluid volume, and programs the sampling schedule. During the deployment, the system logs data such as electrical parameters, sample timing, volume, rate and flow. This data is offloaded after the RAS-500 is recovered. All of the RAS-500 components are mounted inside a 316 stainless steel frame (a titanium frame is also available as an option). Major components are:

- Controller housing
- Pump assembly
- Multi-port valve
- Sample containers

The RAS-500 frame can be deployed as an in-line package on a high-tension ocean mooring and provides extra mounting space for other instruments. Deployment modes include:

- A bottom-tethered array
- Ocean floor placement in a stand alone bottom lander
- Tethered profiling from a ship (as done with a CTD sensor and Rosette sampler)

RAS-500 Line Drawing

The RAS-500 line drawing in Figure 1-1 and the Specifications List that follows illustrate the major components and mechanical design of the RAS-500 sampler.

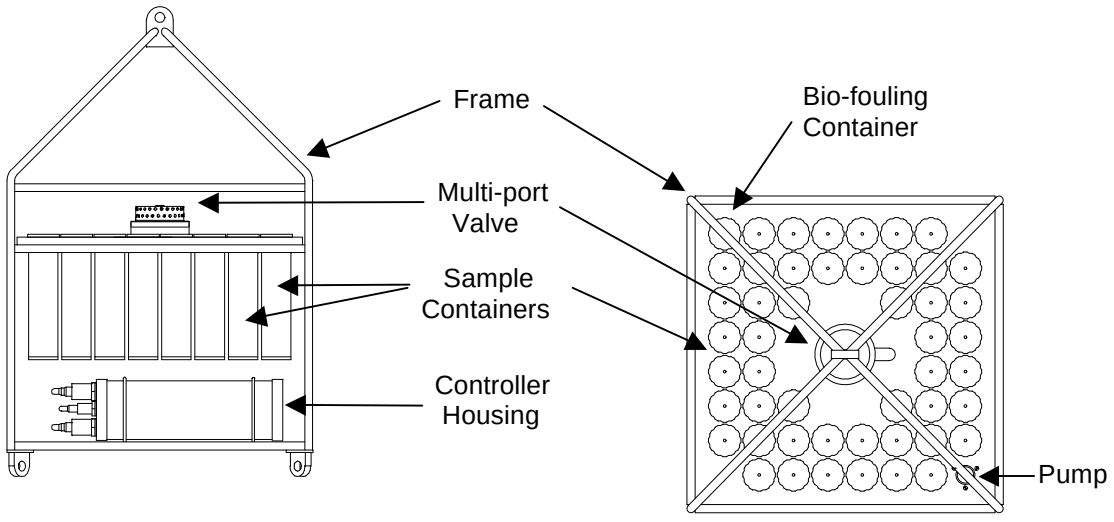

Figure 1-1: RAS-500 Line Drawing – Overall View

RAS-500 Specifications

Dimensions	Height	128 cm
	Width	73 cm
	Length (body)	73 cm
Weight	In air, sample containers empty	110 kg (240 lbs)
	In air, sample containers filled	148 kg (325 lbs)
	In water	57 kg (125 lbs)
Multi-port Valve	Material (50 Ports)	HYDEX valve stators
	Drive	High torque stepper motor
	Gear head	100:1 planetary
	Positioning	Optical sensor with slotted disk
Sample Bags (48)	Material	Acrylic with Polycarbonate caps
Pump	Flow rate / Flow rate error	75 ml/min fixed / rate error ±3% average
	Type	Gear pump; not effected by dilute acid
	Drive	Brushless 3 phase DC motor
Controller	Housing Material	Aluminum, 6061-T6 hardcoat anodized
	Power Supply	31.5 VDC Alkaline battery pack
	Current consumption	3500 mAh (1 year deployment)
	Communications	Serial (RS-232)
Frame	Material	316 electro-polished stainless steel (titititanium option available)
	Structure & bridle configuration	In-line mooring, weldment, 4 in-line
	Frame & bridle eyes	19 mm diameter, insulated
	Max. in-line tension	2,300 Kg (5,000 lbs)
Operation Conditions	Maximum depth	5,500 meters
	Min. / Max deployment time	10 minutes per sample / 18 months
	Operating temperature	0 to 50°C (Electronics tested to –10°C)

RAS-500 Components

The RAS-500 components are further described below.

Component	Description
Controller Housing	The controller housing is a sealed pressure housing tested to a depth of 5,500 meters. The housing contains a battery pack, a micro-controller, a 3-phase pump-motor driver, and a stepper-motor driver for the multi-port valve.
Communications	The communication link between the RAS-500 and a PC is a standard, 3-wire, full duplex, RS-232 connection.
Pump Assembly	A positive displacement gear pump draws seawater through small disc filters in the sample containers at a fixed rate of 75 ml/min. A brushless DC 3-phase servo-motor is magnetically coupled to the pump head. The motor is in a pressure compensated housing filled with Dow Corning 200 fluid (5 cSt.). Hall-effect encoders provide feedback to control shaft speed.
Multi-port Valve	A multi-port valve directs the seawater to the sample bags. The multi-port valve can be programmed to flush old water from the tubes and valve before each sample is collected to help prevent sample contamination and reduce accumulated bio-fouling. A small 25 mm disc filter with a pore size from 3 to 20 microns is placed in-line with the water port to protect the pump from potential damage by large particles.
Sample Bags	Each sample bag is connected in series between the intake head (top half of valve) and the exhaust head (lower half of valve). The pump draws water out of the sample container in which the collapsed sample bag is mounted. This pumping creates a pressure gradient that drives the flow of ambient seawater through the intake and into the sample bag. After each sample is taken, the multi-port valve returns to the Home Port (0), sealing the sample in the bag.

RAS-500 Toolkit

Each RAS-500 comes with a Toolkit that contains tools, software, and spare parts including:

- 9V Backup battery
- Wrenches, screwdrivers, and hex drivers sized for the RAS hardware
- Spare o-rings, nylon and stainless steel screws and bolts
- Spare polyurethane tubing
- Micropump service kit
- Communications cable for serial port connection to a PC
- CD with the Crosscut software and documentation
- DVD with priming instructions

Figure 1-2: RAS-500 Toolkit

Contacting McLane Research Laboratories

McLane Research Laboratories can be accessed via the Web at http://www.mclanelabs.com or reached by email at mclane@mclanelabs.com. The RAS-500 user interface software also displays McLane's contact information.

Engineers are available by phone at +1 508 495-4000 from 1300 to 2200 (GMT), 0800 to 1700 (Eastern Standard Time).

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

Tel:    (508) 495-4000
Fax:    (508) 495-3333
Email:  mclane@mclanelabs.com
WWW:    http://www.mclanelabs.com

 Software version:  Ras500_9.c
 Compiled:          Oct 13 2006 11:42:00
 Electronics S/N:   ML12222-02

 Press any key to continue
```

Chapter 2
Mechanical Description

Frame

RAS-500 components are secured in an electro-polished stainless steel welded frame (a titanium frame is optional). The frame was designed to be an inline component on a high-tension (up to 2,200 kg) ocean mooring and has a built-in top bridle and four mooring eyes at the bottom for a chain or cable bridle. Each mooring eye accommodates a 5/8" shackle, and has an insulator to protect the frame from corrosion. The frame provides extra mounting space near the controller housing for other instruments.

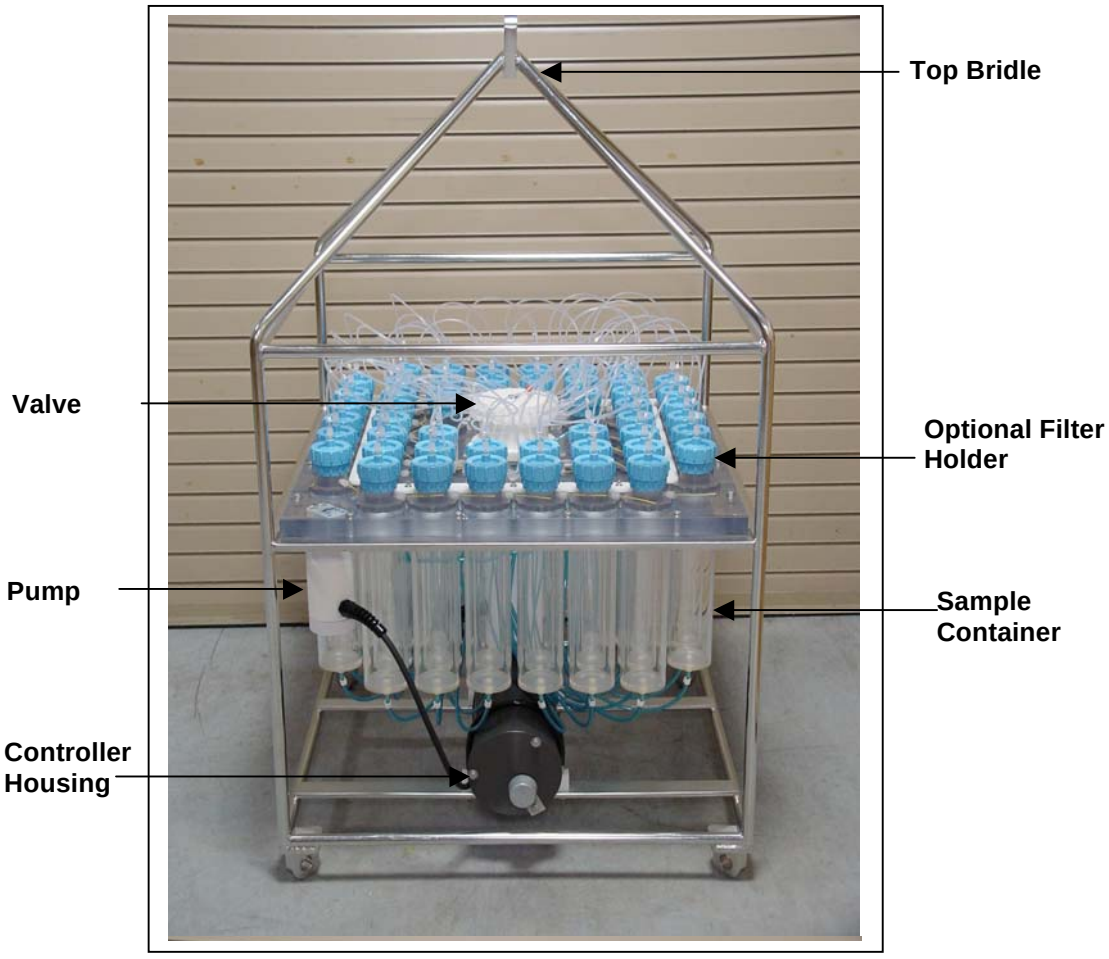

Figure 2-1: RAS-500 Full View

NOTE
Attach zinc or steel anodes to the frame when deploying the RAS-500 in a highly corrosive environment.

Controller Housing

The controller housing, which is pressure resistant to 5,500 meters, is a cylindrical pressure housing fastened to the RAS-500 frame by two latex rubber-insulated 316 stainless steel U-bolts. The battery pack, a micro-controller, a 3-phase pump-motor driver and a stepper-motor driver (for the multi-port valve) are contained in the controller housing. Two sacrificial zinc anodes (one attached to each end of the controller housing) provide galvanic protection from corrosion.

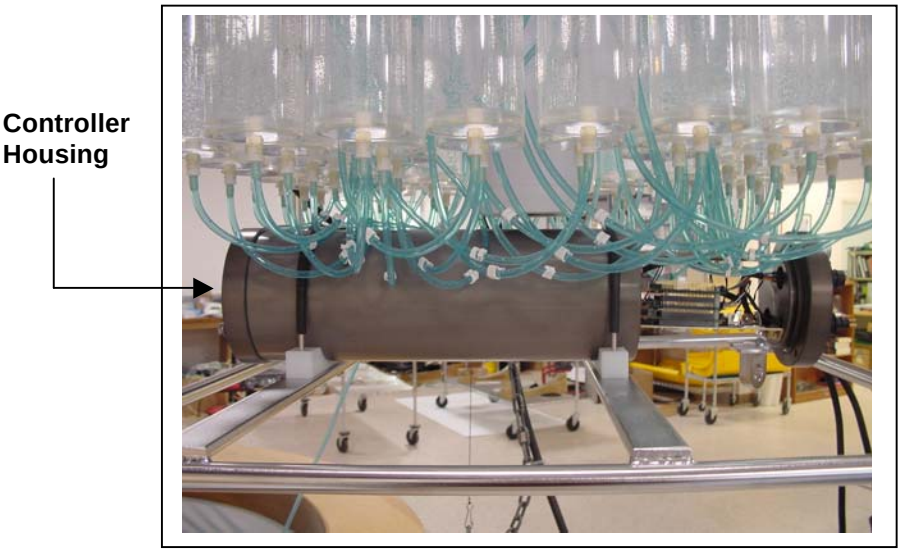

Figure 2-2: Controller Housing

The micro-controller, which starts automatically when the main or backup battery is connected, directs the programmed sampling settings and controls the pump and valve actions. The RAS-500 firmware on the microcontroller allows system testing, entry of deployment schedules and offloading recovered data.

Top and Bottom End Caps

The electronics and battery pack are fastened to the inside of the top end cap (the end cap with bulkhead connectors). Both top and bottom end caps seal the controller housing against water intrusion with a face o-ring and a radial o-ring (with a radial back-up ring).

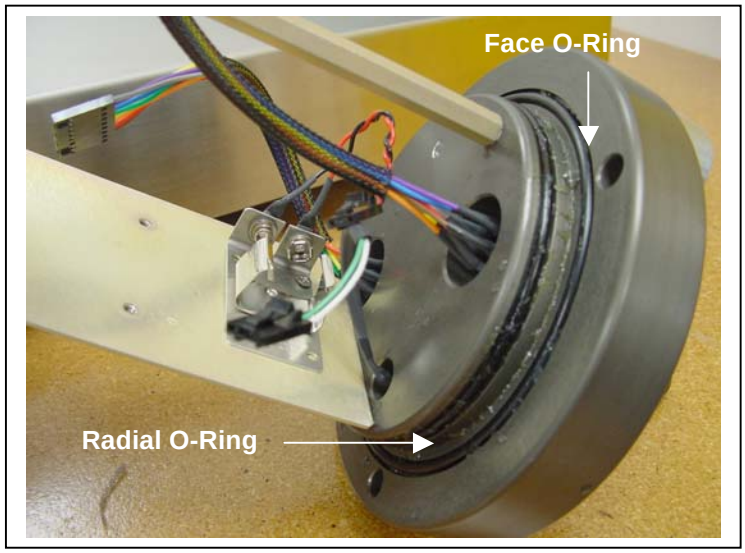

Figure 2-3: Controller Housing Top End Cap with O-Ring Seals

End Cap Bulkhead Connectors

The bulkhead connectors in the RAS-500 end cap have a different number of pins for each connection (Multi-Port Valve, Pump, and Com Port). Additionally, the connectors are labeled 'P' ('Pump'), 'V' ('Multi-Port Valve') and 'C' ('Com Port').

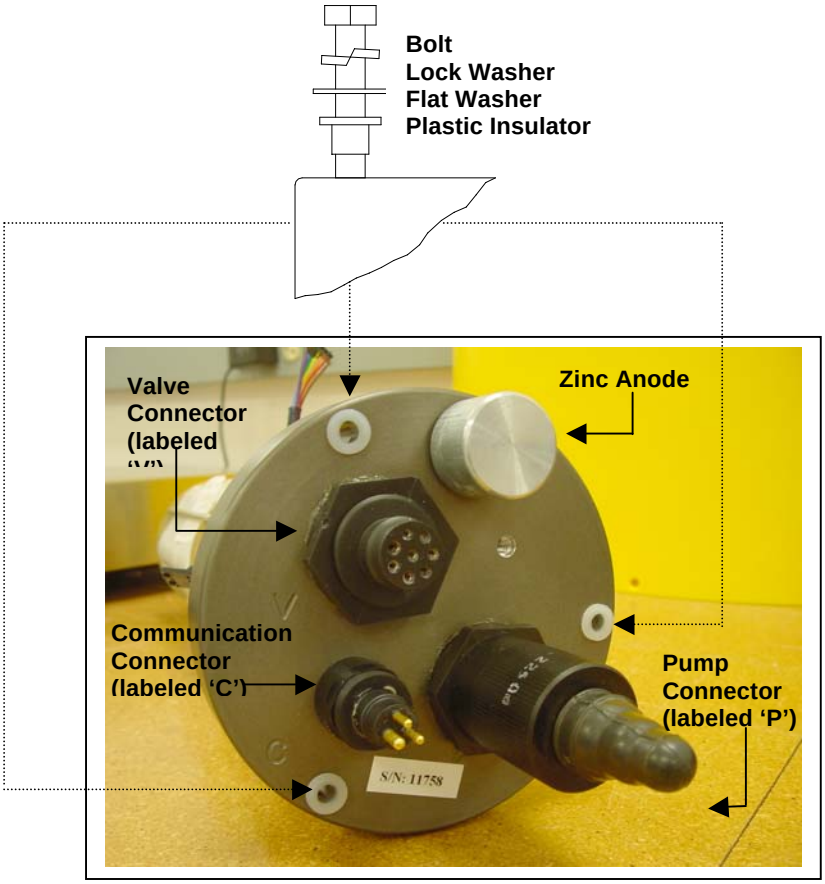

Figure 2-4: Controller Housing End Cap Bulkhead Connectors

IMPORTANT
Do not cross-connect the pump and valve cables. Cross-connected cables will damage the pump, valve and electronics.

The “thumb bump” on the cable connector should always be aligned with the thick pin on the bulkhead connector.

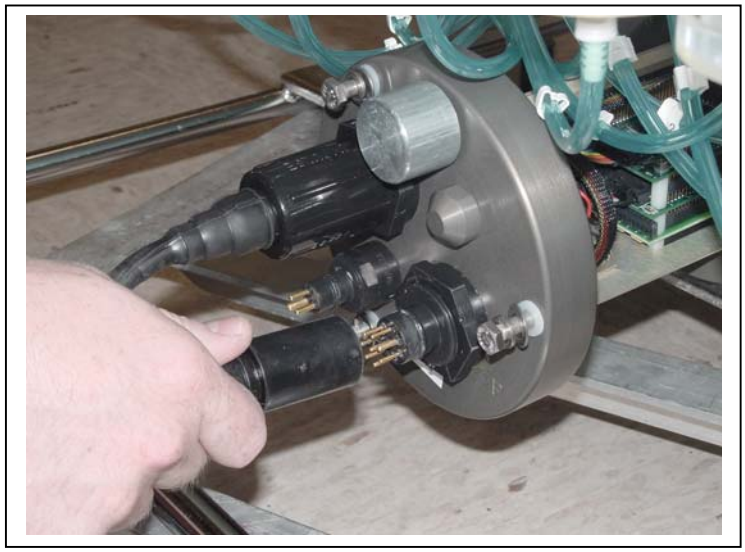

Figure 2-5: Aligning Cable Connectors with Thumb Bump

IMPORTANT
Start the PC and Crosscut before connecting the RAS-500 COM cable to the PC.

End Cap Bolts, Plastic Inserts and Screw Holes

Three bolt/washer assemblies hold the controller housing end cap in place (see Figure 2-4). The bolts should be tightened until the lock washers become flattened (20 in./lb.). A white plastic insert first goes into the screw hole of the controller housing, then a flat washer, spring (lock) washer, and lastly, the bolt. All hardware is stainless-steel-type 316 (do not replace with any other type of material). A 7/16” nut driver is included in the Toolkit.

NOTE
Do not over- tighten the end cap bolts.

Sample Tubes and Sample Bag Types

The RAS-500 holds 48 individual CAST acrylic sample tubes. A bleed hole in the tube cap releases air during priming and provides pressure compensation during deployment. Each sample tube is connected in series between the intake head (top half of valve) and the exhaust head (lower half of valve). Each sample tube holds a 500ml bag attached to the tube cap.

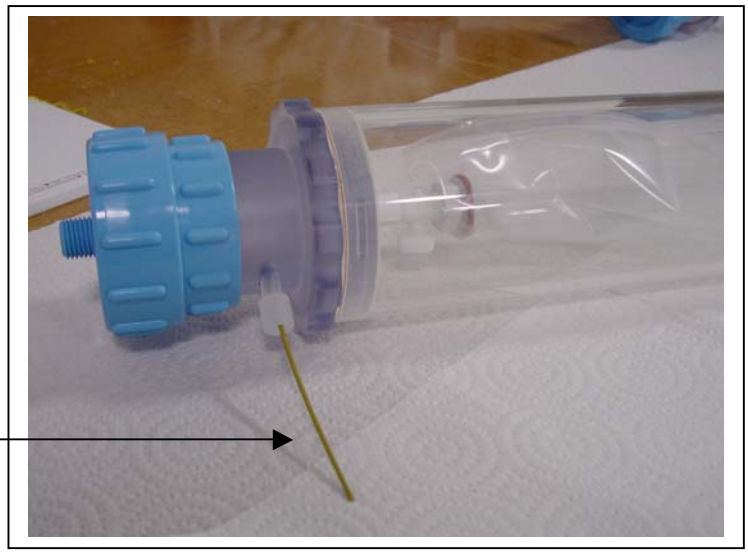

Figure 2-6: Sample Tube with Luer Bag Installed

Standard sample bags have a JACO fitting, ferrule, short tubing and threaded male connector (Figure 2-7). Sample bags with Luer Locking valves and no ferrule can also be used (Figure 2-8). The pump draws water out of the sample tube holding the collapsed sample bag the pressure gradient drives the flow of ambient seawater through the intake and into the sample bag. After sampling, the multi-port valve returns to Home Port (0) sealing the sample in the bag.

Figure 2-7: JACO Fitting

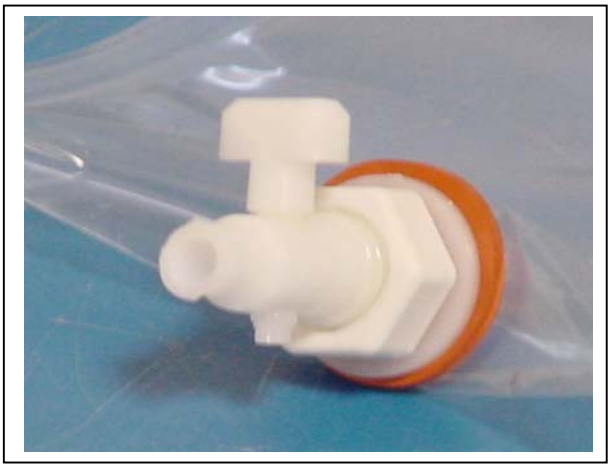

Figure 2-8: Luer Locking Valve

Pumping and Flushing System

The valve heads are a HYDEX plastic stator and a Kynar plastic rotor. The stator is held stationary, while a stepper motor with a 100:1 planetary gear head turns the rotor. An optical sensor and slotted disk determine rotor position. The motor, gear head, and optical sensor are in a pressure compensated PVC plastic housing filled with Dow Corning 200 fluid (20cSt.).

Gear Pump

A positive displacement gear pump creates the pressure gradient for sampling. The pump head is type 316 stainless steel and the motor housing is white PVC plastic. The pump head has user replaceable carbon gears and a replaceable magnet. A brushless DC 3-phase servo-motor is magnetically coupled to the pump head. Hall-effect encoders provide feedback to the controller for shaft speed control.

Figure 2-9: Pump Head Gear and Replaceable Magnet

NOTE
After pumping 100 L of seawater, examine the pump head carbon gears and replace if worn.

A dual-head, 50-port rotary valve directs seawater to each sample bag. The top head has a single intake port and 50 exhaust ports; the bottom head has 50 intake ports and a single exhaust port. The valve top shows the port numbers and the tubing is also tagged with numbers to further identify the port and valve connections. The sample containers and water flush option are connected between the two heads of the valve. Only one port is open on each head at one time.

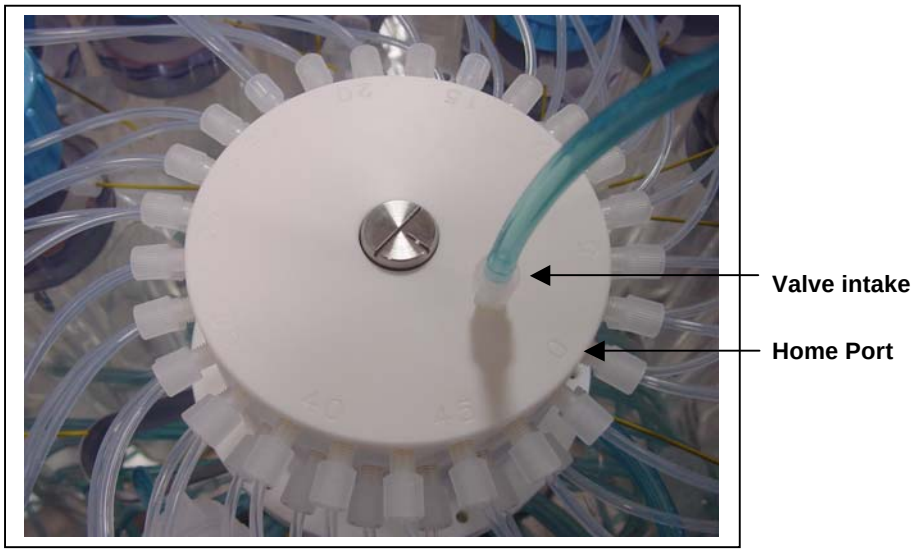

Figure 2-10: Multi-Port Valve

Port Assignments

The Port/Designation table shown next illustrates how the water flush and acid flush keep the intake path clear of contaminants. Sample collection occurs in an acid flush/water flush/sample/acid flush order.

Port #	Designation
0/Home	Water Flush
1	Sample #1
2	Sample #2
. . .	. . .
47	Sample #47
48	Sample #48
49	Acid Flush

Acid Flush Assembly

Pre-and post sample acid cleaning cycles occur at Port 49. Acid cleaning loosens bio-fouling growth along the intake path for removal by the water flush. The acid flush reservoir is located in the corner of the sample tube assembly as shown in Figure 2-9. The reservoir contains a sample bag filled with acid or other bio fouling cleaner.

Figure 2-11: Acid Flush Reservoir

Acid cleaning cycles are user programmable as shown in Figure 2-10. The Pre-sample acid flush can include an acid exposure time delay to leave the acid standing in the valve intake. For details about sampling and flushing parameters, see Chapter 7, RAS-500 User Interface. For details about filling the acid reservoir, see the RAS-500 Priming video.

```
Acid   D| Pre-sample acid flush:    Enabled
       E| Flushing volume     =       10  [ml]
       F| Flushing time limit =        1  [min]
       G| Exposure time delay =        1  [min]

Water  H| Flushing volume     =      100  [ml]
       I| Flushing time limit =        5  [min]

Sample J| Sample volume       =      500  [ml]
       K| Sample time limit   =       25  [min]

Acid   L| Post-sample acid flush:   Disabled
       M| Flushing volume     =       NA  [ml]
       N| Flushing time limit =       NA  [min]

Timing P| Pump data period    =        1  [min]

       V| Verify and proceed.
```

Figure 2-12: Sampling and Flushing Parameters

As illustrated by Figure 2-11, the samples and the pump are isolated from each other.

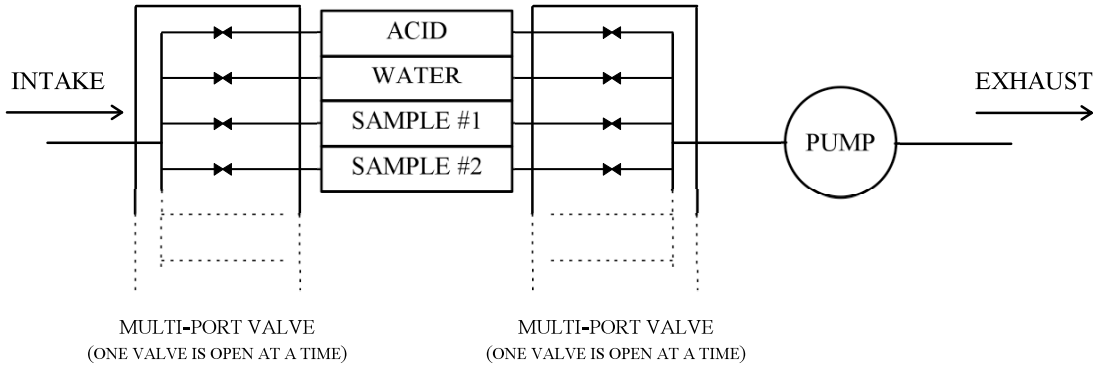

Figure 2-13: Pumping Operation Schematic

Water Flush Assembly

The water flush occurs at Port 0 before the sample is pumped. This is a forward pumping event. The water flush assembly consists of a 25mm filter holder (for a filter with pore size between 3 and 20 microns) connected to 'Home' port (Port 0) of the multi-port valve. The filter prevents large particles from entering the pump during flushing. Water is flushed from the intake tube, through the top valve stator, 25mm filter, bottom valve stator and pump.

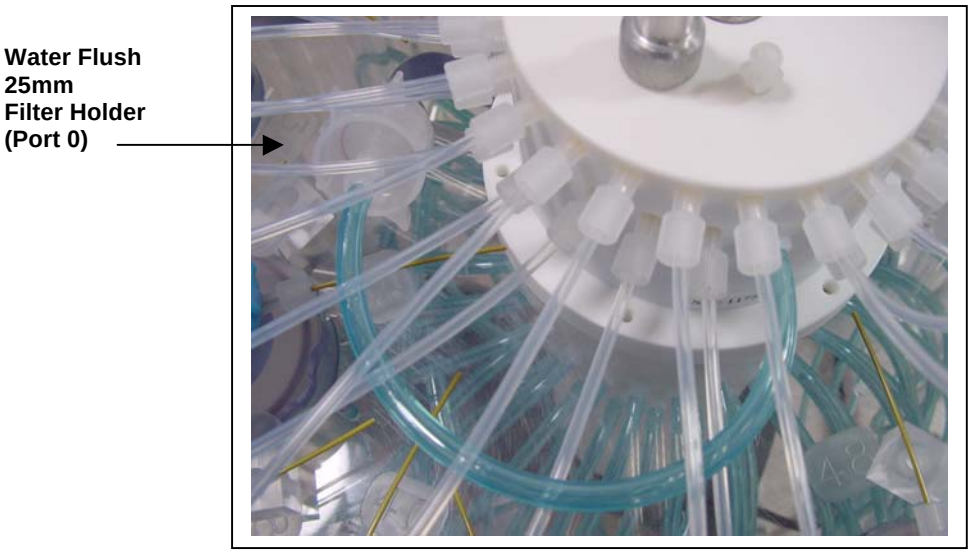

Figure 2-14: Water Flush Filter Holder

Serial Number

The RAS-500 polycarbonate base plate contains a serial number label. The controller housing end cap, pump assembly, valve assembly and system menu also display this information.

Figure 2-15: RAS-500 Serial Number Label

Notes

Chapter 3
Electronic Description

Controller Electronics Stack

The RAS-500 controller is a three board stack mounted on the chassis plate between the controller housing end cap and the main battery cage.

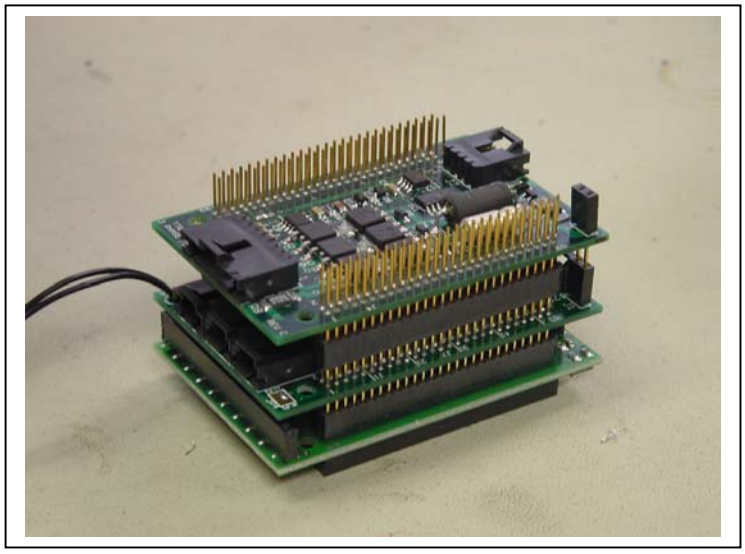

Figure 3-1: RAS-500 Controller Stack

IMPORTANT
McLane recommends that you take standard electrostatic discharge (ESD) precautions when handling the electronics.

The top circuit board in the controller stack is a 3-Phase circuit which accepts a serial control command from the pump software and converts it to an analog control voltage to drive the pump motor. Power to the motor is routed through the chip set from the main battery. The chip set also monitors Hall effect sensors in the motor housing and sends a pulse train to the TT8, to monitor the actual pump speed. The pump software completes a tight Proportional-Integral (PI) control loop around the pump and tracks the programmed flow rate independent of battery voltage and other environmental forcing. The pumped volume is monitored and limited to the capacity of a sample bag to protect the integrity of each sample.

The middle circuit board contains an AUX circuit and a Stepper circuit. The AUX circuit generates regulated voltages from the main and auxiliary battery inputs and distributes voltages to the rest of the system under the control of the RAS-500 software. The AUX circuit includes access to the RS-232 serial communications port of the TT8 and an on-board thermistor used to monitor temperatures inside the controller pressure housing. Optionally, an external thermistor can be installed to record temperature (see Appendix B "External Temperature Sensor"). The Stepper circuit drives the stepper motor of the multi-port valve under the direction of the system software. The Stepper circuit also monitors an optical switch in the motor housing to determine rotor position and precisely align the valve to each port.

The bottom circuit board is a TattleTale 8 (TT8) version 2 micro-controller manufactured by Onset Computer Corporation (www.onsetcomp.com). The TT8 is a single board computer with large and varied I/O capacity that controls hardware operation including serial communication ports, digital, analog and timing interfaces, a PIC 16C64 microcontroller (serving as a programmable clock), non-volatile flash memory, and RAM storage of the deployment data file with non-volatile EEPROM backup.

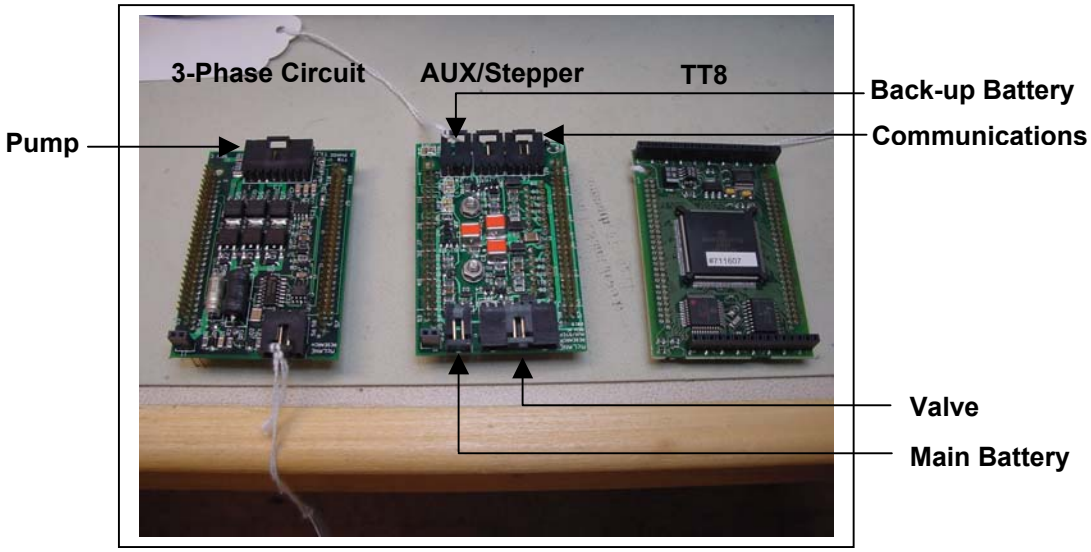

Figure 3-2: Three Boards of Electronics Stack

Battery Connection

Connecting and disconnecting the main battery is the only way to switch the RAS-500 on and off. The main and back-up battery connectors are keyed to prevent misconnection.

NOTE
Disconnect the battery before shipping the RAS-500 to prevent electrical system damage during transit. Before disconnecting power, press [CTRL]-[C] to return to the Main Menu or Sleep.

To connect the main battery, complete the following steps:

1. Boot the operator PC and start the communications software.
2. Open the controller housing and connect the main battery to the 2-pin connector on the middle board of the electronics stack.

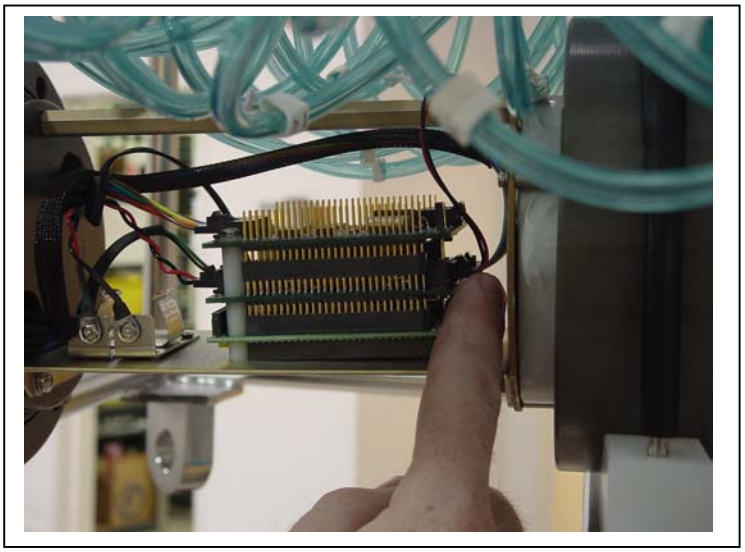

Figure 3-3: Connecting the Battery

3. Install the 9-volt backup battery into the holder.
4. Remove the dummy plug from the communications connector and attach the supplied communication cable between the main battery communications connector on the controller housing and the PC serial port.

IMPORTANT
Make and break the COM connection at the bulkhead not the PC serial port to prevent a crash.

Notes

Chapter 4
Maintenance and Storage

Several maintenance procedures before and after each deployment provide smooth operation and long instrument life for the RAS-500. Rinsing the entire instrument assembly with clean fresh water after every deployment is critical to prevent corrosion. Also clean and flush the valve, tubes, and pump as described in Chapter 5 "Operations". Before and after each deployment inspect the following:

- O-rings
- Pump gears
- Pressure compensation tubes on each sample container
- Bolts
- Fluid lines and sample containers

Cleaning and Inspecting the Controller Housing

Controller Housing

Inspect and, if necessary, replace the zinc anodes prior to each deployment. Ensure that the insulated bushings are installed properly and that all hardware is 316 stainless steel. Keep hard objects such as tools and shackles from coming in contact with the controller housing, as scratches that penetrate the anodized aluminum hard coating will localize galvanic action and can lead to deep crevices or pits.

O-Rings

The RAS-500 ships with a set of o-rings in the end caps at both ends of the controller housing. Each set includes 3 o-rings, 2 round-section o-rings (BN70-2-244/BN70-2-240) and one back up ring (BN90-8-240). O-rings must be installed properly and kept in place at all times.

Positioning the larger o-ring (2-244) in the axial groove provides a seal against the face end of the pressure housing. Fit the smaller o-ring (2-240) and the backup ring (8-240) in the radial groove. Position the backup ring on the low pressure side of the radial groove (toward the interior of the controller housing). The backup ring concave side faces toward the round o-ring. The accompanying o-ring is seated on the concave side (high pressure side) of the backup ring.

Inspect o-rings for signs of wear and the presence of any foreign material (which can cause leaks). Look for small cracks and feel for grit, sand, or hair. O-rings should be cleaned with alcohol and lubricated with a thin coating of o-ring grease as necessary.

IMPORTANT
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.

Pump Gears

Periodically examine the graphite pump gears and replace them if there are any visible signs of wear or cracks. To inspect the gears, complete the following steps:

1. Remove the pump from the RAS-500.
2. Remove the four screws that hold the pump head to the pump housing.
3. Lift the pump head up off the pump housing (the gears are mounted on the bottom of the pump head).

IMPORTANT
Never remove the metal magnet cavity from the pump motor housing (the area under the metal cavity is filled with oil).

Pressure Compensation Tubes

The pressure compensation tube assembly in each sample container must be kept clean and clear of obstructions to remain effective. This assembly allows a small exchange of fluid volume between the sample cylinders and the seawater to prevent the sample containers from cracking in deep deployments. The ID of the compensation tube is ~0.18mm which is sufficient for effective pressure compensation without compromising the volume accuracy of the pump.

Battery Maintenance

The capacity of a standard RAS-500 new alkaline battery pack (A21-1000) is 10,000 mAhr. The 31.5 volt battery will last up to 18 months. This is a mildly conservative figure assuming a low temperature environment and standard current drain.

NOTE
It is strongly recommended that fresh Duracell batteries be used for each deployment.

Battery Replacement

Running Option <2>, Diagnostics, from the RAS-500 Main Menu displays battery voltage. A warning message will display after Diagnostics is run and immediately before a deployment commences if the battery voltage is below 28 volts. The battery should be replaced when the voltage falls below 28 volts if a full deployment is planned.

IMPORTANT
Before replacing the battery, offload all data from the RAS-500. Unless a working 9V auxiliary battery is in place, removing the main battery erases all the deployment data stored in memory.

Backup Battery

The backup battery is a 9 volt alkaline battery. The backup battery will sustain the controller memory for approximately 3 months in the event of a main battery failure.

IMPORTANT
Making contact with the battery terminals reversed can seriously damage the controller. Install the backup battery such that the terminals of the battery correctly correspond to the terminals on the holder.

Storage

The RAS-500 shipping crate is a reusable international freight container. The crate is intended for both shipping and storing the RAS-500 and meets the requirements for international transport by ground, ocean, or air freight carriers.

NOTE
To avoid instrument damage, do not leave the RAS-500 sampler in direct sunlight for prolonged periods of time and avoid excessive vibration.

There are several procedures to prepare the RAS-500 for storage longer than a month:

- Offload all data from memory.
- Rinse all instrument components with fresh water.
- Remove both batteries. If the main battery is still usable, first cover the connector with insulation tape and then store the battery in a refrigerator.
- Reassemble the main battery holder and insert the electronics package back into the housing.
- Replace all bolts.
- Apply a small amount of anti-seize to the threads.

Chapter 5
Operations

Several operational steps that must be completed prior to deployment are explained in this chapter. One of these steps is priming, which removes trapped air that could damage the sample tubes during deployment. Information for estimating instrument current consumption (to confirm sufficient deployment battery life) is also provided.

Connecting the Electronics

Before priming, the RAS-500 must be powered on and connected to a PC (the RAS-500 is shipped and stored with the main battery disconnected inside the controller housing). Complete the following steps to power on and connect to a PC:

1. Open the controller end cap by removing the three bolts using the supplied nut driver.
2. Gently slide out the controller to access the electronics stack.
3. To power on the system, connect the 2-pin battery connector to the middle circuit board.
4. Close and re-seal the controller housing end cap to protect the electronics from moisture or spills.

Priming the RAS-500

Priming is critical to ensure successful sample collection. This process is sequential and starts at Port 1. Steps are provided in this section and a training video detailing RAS-500 priming is also included in the toolkit.

- Step 1 – Preparing for priming
- Step 2 – Installing the water flush filter
- Step 3 – Installing sample bags and removing excess air from sample tubes
- Step 4 – Preparing and priming the acid reservoir
- Step 5 – Preparing for deployment

IMPORTANT
Priming is a wet process. Ensure the electronics housing is sealed to protect the electronics.

5. Power up the PC and start Crosscut, and then plug the RAS-500 COM cable into the PC serial port (power up the PC before connecting to the RAS-500 to prevent a possible crash of the RAS-500 firmware).
6. Press [Enter] or [CTRL]-[C] to display the Main Menu.

Priming Step 1 – Preparing for Priming

Complete these steps to prepare for priming.

1. Prepare a container of clean water.
2. Using the syringe and exhaust tube supplied in the toolkit, inject clean water into the pump to prime it for operation.
3. After the pump cavity and exhaust are filled with clean water, remove the syringe and submerge the exhaust tube in the clean water container.
4. Check the Port position displayed on the Main Menu. A value of '99' as shown in Figure 5-1, indicates that the firmware has not been referenced to the Home Port, Port 0. From the Main Menu select <3>, Manual Operation and select <1> Find port: home to move the valve to Home Port (Port 0) and initialize the port setting. A message displays once the port is located.

```
                    Manual Operation
                  Thu Jan 6 00:01:48 2005
                         Port = 99
          <1> Find port : home
          <2> Find port : J
          <3> Next port : advance
          <4> Next port : retreat
          <5> Run pump  : forward (100 ml)
          <6> Run pump  : reverse (100 ml)
          <7> Run pump  : programmable
          <M> Main Menu

Selection  ?
```

Figure 5-1: Manual Operation Menu

Priming Step 2 – Installing the Water Flush Filter

The water flush filter is placed inline to Home Port (Port 0) and holds a 25mm disc filter with a pore size from 3 to 20 microns. The filter protects the pump from damage by large particles. To install the water flush filter, complete the following steps:

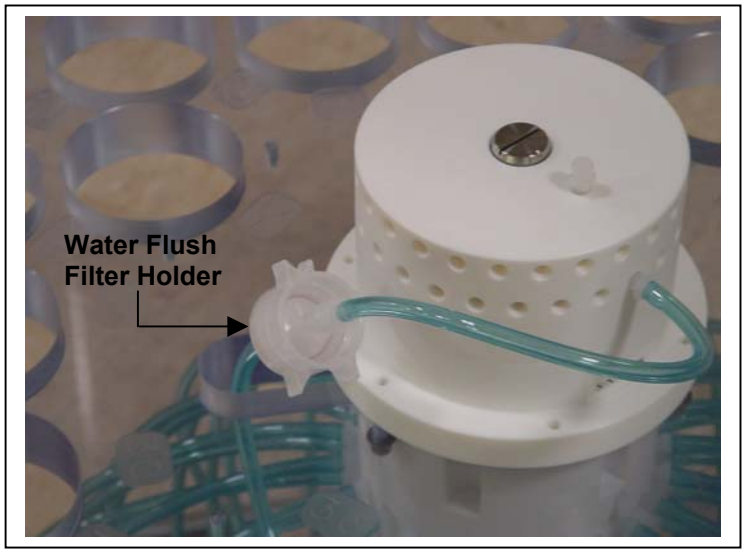

Figure 5-2: Water Flush Filter Holder

1. Disconnect the Luer Lock fittings at both ends of the water flush filter holder and remove the filter holder.
2. Unscrew the locking ring to disassemble the filter holder halves.
3. Wet the bottom frit of the filter holder and install a 25mm disc filter (nominal pore size from 3 to 20 microns).
4. Wet the filter with clean water using a wash bottle and replace the top half of the filter holder and locking ring.
5. Reinstall the filter holder by connecting the Luer Lock connectors at both ends.
6. Remove the cap from the valve intake and replace with the supplied intake tube.
7. Place the end of the intake tube into the container filled with clean water.
8. If necessary, from the Manual Operation menu select <1> Find port: home (if the valve is already at Home Port, skip this Step).

9. From the Manual Operation menu select <6> Run pump: reverse to draw in clean water and remove air bubbles from Home Port and the associated plumbing.
10. Run the pump in reverse until water flows through the water flush filter holder, removing any remaining air bubbles.
11. When pumping is finished, remove the intake tube and replace the intake plug.

IMPORTANT
Remove the intake plug from the valve intake just prior to launching the RAS-500 so that the pump can operate.

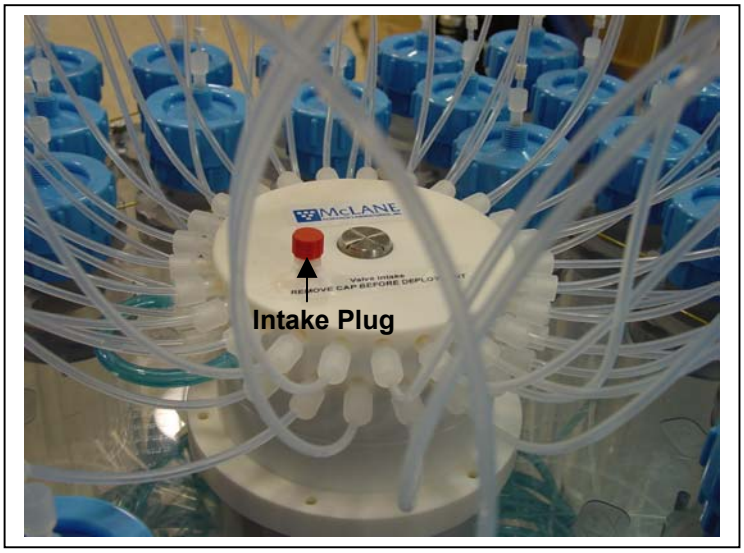

Figure 5-3: Intake Plug

Priming Step 3 – Installing Sample Bags and Priming Sample Tubes

Sample tubes can be installed with or without filter holders as shown in Figures 5-4 and 5-5. The priming steps in this section shows photos of sample tubes with and without filter holders installed.

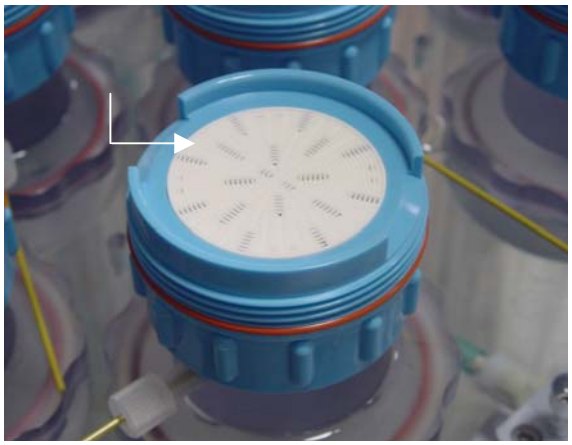

Figure 5-4: Sample Tube with Filter Holder

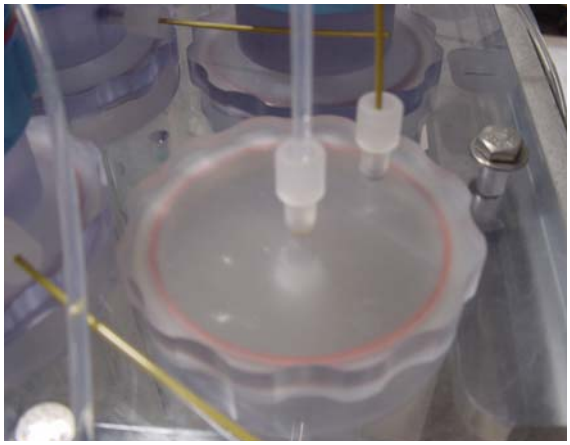

Figure 5-5: Sample Tube without Filter Holder

1. For each sample tube, confirm that the bottom and top tubing is securely connected in the correct order. Tubing is labeled by sample number and should match the numbers on the clear base plate.

2. Remove the four hold-down brackets by removing the screws and sliding the brackets out from in between the sample tube caps. This step provides access to the sample tubes for bag installation.

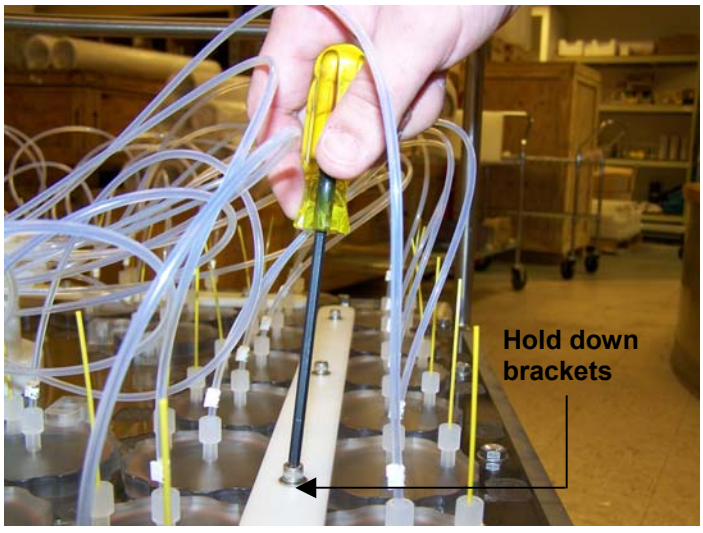

Figure 5-6: Removing Hold Down Brackets

3. Access the four innermost tubes by removing the 8 individual hold-down clamps that secure them.

4. Beginning at Port 1, remove the locking ring and separate the top half of the filter holder (if filters are used). Also, remove the pressure compensation tube and set it aside.

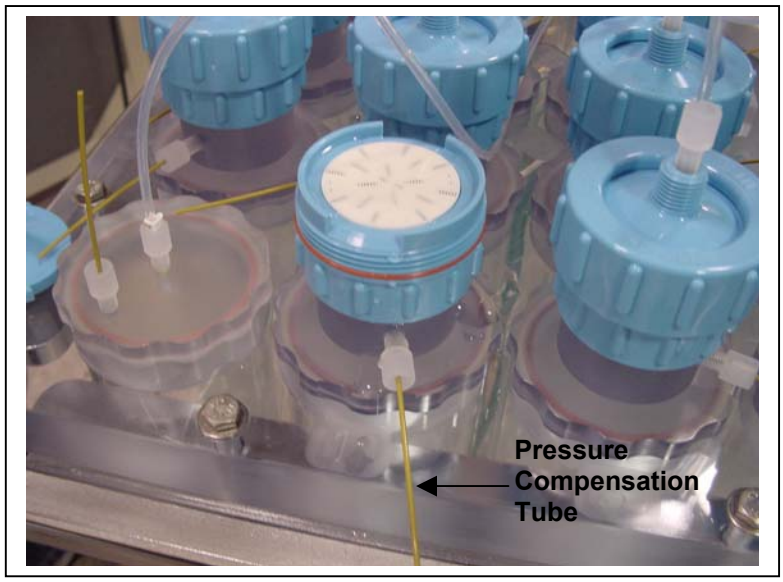

Figure 5-7: Pressure Compensation Tube

5. Remove the top half of the filter holder if filters are installed.

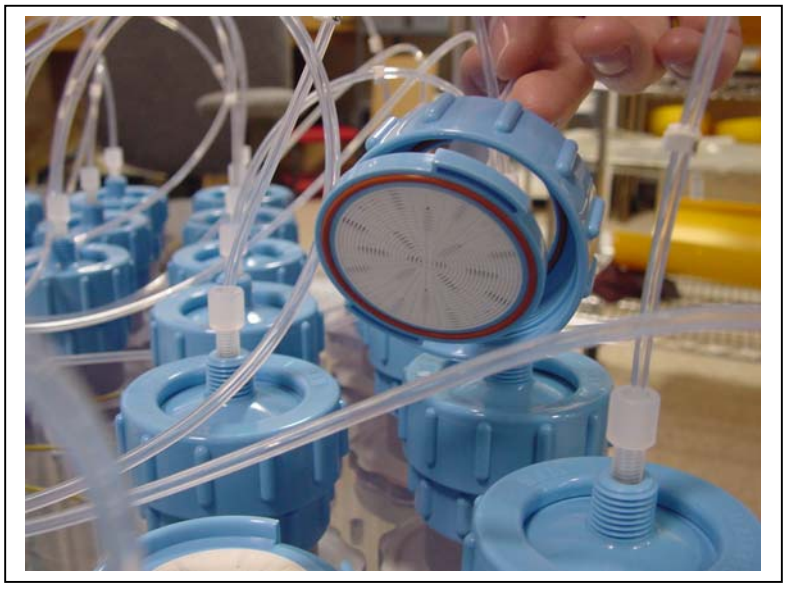

Figure 5-8: Removing Filter Holder Tops

6. Each standard RAS-500 sample bag is shipped with a JACO fitting, ferrule, short length of tubing and threaded male connector (see Figure 5-9). If the ferrule is missing, place a new ferrule onto the tubing before use. Sample bags are also available with Luer Locking valves which do not have a ferrule (see Figure 5-10).

Figure 5-9: JACO Fitting

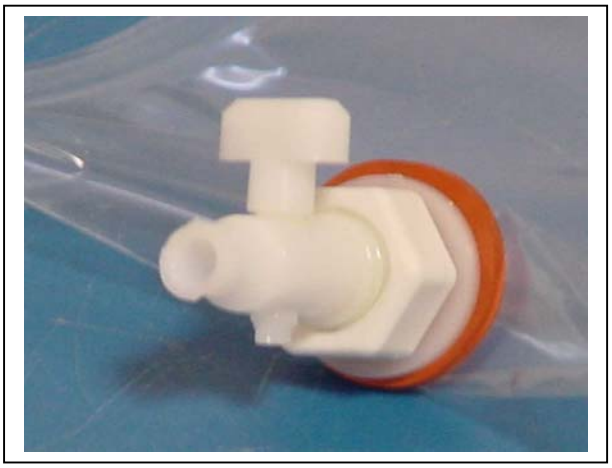

Figure 5-10: Luer Locking Valve

7. Prepare a new sample bag by removing the cap and attaching an empty syringe using the fittings supplied in the toolbox.
8. Extract excess air from the sample bag using the syringe (for sample bags with Luer Lock fittings, close the valve).
9. If using a preservative, use a separate syringe to inject the preservative into the bag before installing the bag into the sample tube.

NOTE
Before adding preservative, check the "RAS-500 Specifications" section in Chapter 1 of this User Manual to confirm chemical compatibility .

10. Remove the sample tube cap and attach the prepared sample bag.

Figure 5-11: Attaching a Sample Bag

11. Gently fold the sample bag and slide it into the sample tube.
12. Using clean water, fill the sample tube until almost full and secure the cap.
13. Select <3> Manual Operation from the Main Menu.
14. From the Manual Operation menu select <6> Reverse pump, and reverse pump into the sample tube to purge the remaining volume of air.
15. When water drips from the bleed hole stop pumping by pressing [CTRL]-[C].
16. After pumping has stopped, reinstall the pressure compensation tube (the fitting can be tightened using the supplied wrench but do not overtighten).
17. If using filter holders, force water into the frit holes with a wash bottle to remove air bubbles from beneath the filter holder frit.
18. Install a 47mm filter onto the frit and wet with clean water.

19. Remove the plug from the valve intake and attach a syringe of clean water.

20. Inject clean water into the valve intake until it fills the tubing and the filter holder top (if filter holders are installed as shown in figure 5-12). If filter holders are not installed inject clean water until the top tubing is filled.

Figure 5-12: Injecting Water into the Valve Intake

21. Carefully secure the top half to the filter holder using the locking ring and push down on filter cap to displace air bubbles.

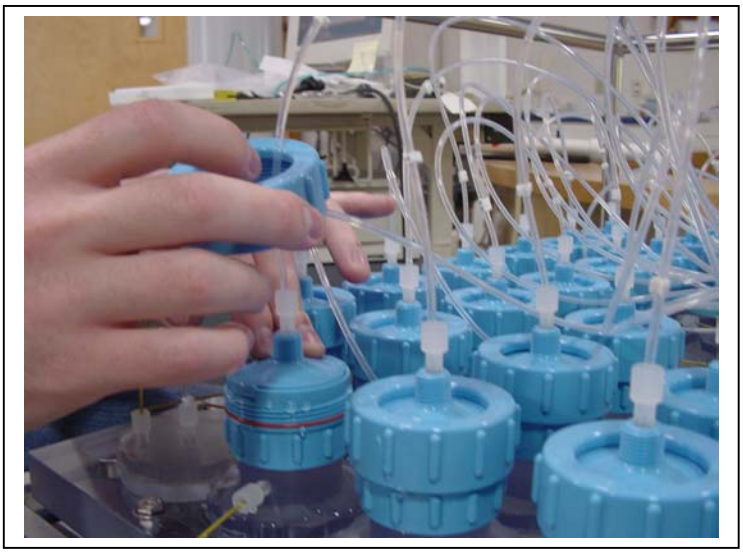

Figure 5-13: Closing the Filter Holder Cap

22. Select <3> Next port: advance from the Manual Operation menu to move to the next port. Repeat steps 4 through 22 for all sample tubes, ending at port 48.

Priming Step 4 – Priming and Preparing the Acid Reservoir

Once the sample bags are installed and all the sample tubes are primed, the acid reservoir can be filled and primed for deployment. Acid provides a bio-fouling flush that further cleans the intake tube. Port 49 is the valve position used for acid cleaning. To add acid, complete the following steps:

1. From the Manual Operation manual select <3> and advance to Port 49.
2. Remove the pressure compensation tube and top tubing from the acid reservoir cap.
3. Remove the acid cap and attach a new sample bag.
4. Gently fold the bag, slide it into the reservoir and secure the cap.
5. Install the supplied Luer Lock fitting to the acid cap.
6. Fill a clean syringe with an acid solution and inject acid into the bag. The acid bag will hold just over 500ml of acid, so filling will require multiple injections from the syringe. Keep track of the volume of acid injected. Overfilling could cause the bag to burst.
7. Remove the Luer Lock fitting and reconnect the top tubing.
8. Remove the clean water syringe from the valve intake and replace the intake cap.
9. From the Manual Operation menu, select <6> Run pump: reverse and reverse pump to fill the remaining volume of the acid reservoir with clean water.
10. Filling the entire volume may require a few restarts of the pumping routine.
11. Press [CTRL]-[C] to stop the pump manually when water emerges from the bleed hole at the top of the acid cap.
12. Reinstall the pressure compensation tube onto the acid cap.
13. Remove the intake cap and attach a syringe of acid solution.

14. Disconnect the top tubing from the acid cap and inject acid into the intake until the top tubing is filled.
15. Reattach the top tubing to the acid reservoir cap.
16. Remove the acid syringe from the intake and replace the intake cap.

Priming Step 5 – Preparing for Deployment

After priming is complete, complete these additional steps to prepare the RAS-500 for deployment.

1. Reinstall all hold-down brackets and individual clamps to secure all sample tubes.
2. From the Manual Operation menu select option <1> to locate the valve to the Home Port.
3. From the Main Menu, select option <4> to put the system into low power sleep.

IMPORTANT
Remove the intake plug just prior to deployment so that pumping can occur.

NOTE
The system is now ready to be programmed for a deployment. See Chapter 7, "RAS-500 User Interface" for details about deployment programming.

Instrument Current Consumption

The values for pumping or moving the valve include the current drain of the controller, which is awake during valve rotation and pumping. Battery life from the proposed deployment schedule can be estimated using the instrument current consumption values provided here. An example of an estimate for a one-year deployment is shown next.

Controller unit	3.0 mA
Controller unit in low power mode	0.30 mA
Pumping	160 mA
Moving the valve from one port to the next	0.23 mAh (2.7 seconds)

Example of Determining Battery Life – RAS-500 One Year Deployment

Pre-deployment (loading sample bags)	
Controller unit (3 hours)	3 h x 3.00 mA = 9.0 mAh
Moving valve (twice around)	100 ports x 0.23 mAh = 23.0 mAh
Running the pump (1.0 hour)	1.0 h x 160 mA = 160.0 mAh
	Subtotal = 192.0 mAh
Deployment	
Controller (1year)	8760 h x 0.30 mA = 2628.0 mAh
Move valve (48 samples)	1300 ports x 0.23 mAh = 299.0 mAh
Pumping (8 minutes per port)	6.4 h x 160 mA = 1024 mAh
	Subtotal = 3951 mAh
Recovery (offload data/remove samples)	
Controller unit (2 hours)	2 h x 3.00 mA = 6.0 mAh
Move valve (once around)	50 ports x 0.23 mAh = 11.5 mAh
	Subtotal = 17.5 mAh
Total Current Consumption	**3951 + 3183 + 17.5 = 4160.5 mAh**

In the previous example, the total energy consumed is less than the 10,000 mAh capacity of the battery and the proposed deployment plan will not exceed battery life.

Chapter 6
Launch and Recovery

Attaching to a Mooring

The RAS-500 can be deployed on different mooring types for deployment durations of up to 18 months. As a stand-alone mooring, the RAS-500 requires 140 kg of positive flotation. As part of a complex mooring array, the RAS-500 can be used as a bottom tethered or floating "in-line" instrument. For profiling applications in depths less than 5,500m, the RAS-500 can be lowered from a ship by winch.

Simple Mooring

An example of a simple RAS-500 mooring setup is below. Mooring components are listed from top to bottom (sea floor):

Top

- 250 kg of positive flotation (140 kg for the RAS-500 sampler and 110 kg for the other mooring hardware).
- A 3 m piece of 5/8" stainless steel chain attached to the top eye of the RAS-500 frame, with a 3/4" shackle through the white Acetal insert (insulator).
- A four-to-one bridle connection (see Figure 6-1) attached to the bottom mooring eyes of the RAS-500 frame, through the white Acetal inserts (insulators).
- 3 m of 5/8" stainless steel chain.
- An acoustic release.
- A 200 kg weight.

Bottom

NOTE
If possible, do not deploy or recover the RAS-500 through an oil slick (oil can damage the pump and valve). If this condition is unavoidable, pour clean, fresh water over the spot where the RAS-500 will enter or break the water surface through the slick, and rinse the instrument thoroughly after recovery.

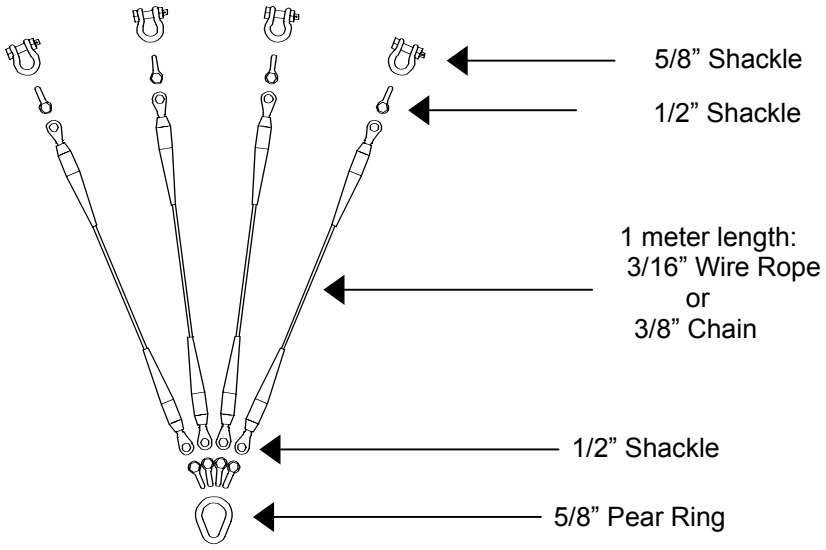

Figure 6-1: Four-to-One Bridle Connection

NOTE
If necessary, the RAS-500 can be removed from its frame and mounted on a special purpose instrument rig or a bottom-lander using longer cables to connect between parts. Contact McLane to use this configuration.

Launch Preparation

Preparing and launching the RAS-500 deployment requires the following (in order of completion):

- Connect the battery.
- Close the end cap.
- Connect the RAS-500 COM cable.
- Program the deployment (as documented in Chapter 7 of this User Manual).
- Disconnect the COM cable and attach the dummy plug.
- Deploy the RAS-500.

IMPORTANT

Remove the intake plug that was used during Priming just prior to deploying the RAS-500. If the plug remains in place during the deployment, the RAS-500 will not sample properly.

Recovery Procedure

After the deployment is completed, the required steps are:

- Remove the sample bags for storage and later analysis.
- Offload the deployment data (using steps in Chapter 8, "Data Offload and Processing" in this User Manual).

Removing the Sample Bags

To remove the sample bags complete the following steps:

1. Remove the bag from Port 1 by twisting the sample tube cap counter-clockwise through one third of a revolution (do not remove the bag by pulling on the cap or the intake tube on the bag).

IMPORTANT

Disconnect the tubing at the bottom of the acrylic sample tube to reduce the force required to remove a full sample (pressure on the bag can cause some of the sample to flow back through the intake tube valve, potentially contaminating the sample).

2. Lift the cap gently and firmly grasp the sample bag just below the bag's intake tube using the thumb and index finger.
3. Gently pull the bag out of the sample container by gripping the bag just below the intake tube.
4. Disconnect the sample bag from the cap and install a 1/4-28 threaded female cap on the tubing. Store the sample safely and replace the cap on the acrylic sample tube.
5. Repeat steps 1-4 for all sample bags.
6. Reassemble the RAS-500 and perform any necessary maintenance (see Chapter 4, "Maintenance and Storage" in this User Manual for maintenance procedures).

Notes

Chapter 7
RAS-500 User Interface

This chapter describes the RAS-500 firmware menus, commands, and screens.

Power-Up Sequence

Connecting the RAS-500 battery automatically loads the TT8 RAM. A screen prompt displays to set the time and date (press [ENTER] to accept the default time and date).

NOTE
If the time and date screens do not display and the battery has been connected for some time, press [CTRL]-[C] three times to wake the system from Low Power Sleep (LPS). If the screens still do not display, confirm the COM port connection and communication protocol settings (9600 baud, 8 data bits, 1 stop bit, and no parity).

The Main Menu – Operating the RAS-500

The RAS-500 Main Menu provides the user interface to control all system operations. To select an option, type the appropriate alphanumeric character and press [ENTER].

```
                    McLane Research Laboratories, USA
                       500 ml  Remote Access Sampler
                  Version: Ras500_9.c   S/N: 11733-01

                            Main Menu

                        Thu Feb 14 10:31:52 2008
                                Port = 99

                  <1> Set Time           <5> Create Schedule
                  <2> Diagnostics        <6> Deploy System
                  <3> Manual Operation   <7> Offload Data
                  <4> Sleep              <8> Contacting McLane

      Selection  ?
```

Figure 7-1: Main Menu

<1> Set Time

This option sets the real time clock (RTC).

IMPORTANT

McLane recommends that the RTC be set during the power-up sequence. When the RAS-500 is powered on, the clock defaults to January 1,1970, 00:00:00. The operator can set the clock to any date and time in the allowed range and the count will continue from the new value.

```
Clock reads 01/01/70  00:48:21
Change time & date (Yes/No) [N] ? y

(Note: Year 2000=100, 2001=101, etc.)
Enter correct time  [01/01/70 00:48:24] ? 11 15 07 20 30 55

Clock reads 11/15/07  20:30:55
Change time & date (Yes/No) [N] ? n
```

Figure 7-2: Set Time

<2> Diagnostics

Diagnostics is a scrolling display of system status including date, time, battery voltage (in Vb), temperature (in °Celsius), and valve status. A sample diagnostics display is shown in Figure 7-3. Type [X] or [CTRL]-[C] to exit from Diagnostics and return to the Main Menu. Toggle the scrolling on and off without exiting by pressing any other alphanumeric key.

```
 01/30/2007  20:50:03   32.1 Vb    25.2 °C  PORT = 00
 01/30/2007  20:50:04   32.1 Vb    25.4 °C  PORT = 00
 01/30/2007  20:50:05   32.1 Vb    25.4 °C  PORT = 00
 01/30/2007  20:50:06   32.1 Vb    25.2 °C  PORT = 00
 01/30/2007  20:50:07   32.1 Vb    25.3 °C  PORT = 00
```

Figure 7-3: Diagnostics

Low battery voltage triggers operator warning messages. If the voltage of the main battery pack is below 28 V, a message displays during the exit from the diagnostic routine, suggesting battery replacement before deployment.

```
Battery voltage is abnormally low.  Check/replace
main battery pack before deploying system.

Press any key to continue.
```

Figure 7-4: Low Battery Voltage

If the voltage of the main battery pack is below 18 V, only one status line will be printed, the diagnostic routine will terminate, and the program will return to the Main Menu.

```
Main battery is extremely low and should be replaced
before running diagnostics.
```

Figure 7-5: Critically Low Battery Voltage

If a critically low battery is detected and a data file exists in memory that has not been offloaded, an additional warning will be displayed before returning to the Main Menu.

```
A data set exists in memory that has not been offloaded.
Offload the data now, before replacing battery, or the
data may be lost.
```

Figure 7-6: Critically Low Battery Voltage - Offload Data

IMPORTANT
The firmware can detect only that the *Offload Data* option was successfully executed from the Main Menu and cannot check the successful data file logging by your terminal emulator. Confirm that offloaded data is accurate before disconnecting the battery.

<3> Manual Operation

The Manual Operation option allows direct control of the valve and pump.

NOTE
Port 99 indicates an unknown valve position. The valve must first find the Home Port.

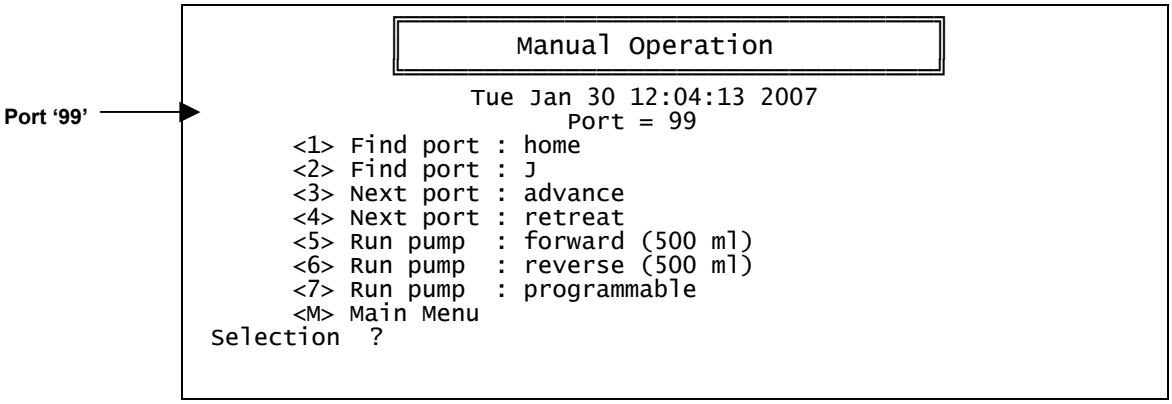

Figure 7-7: Manual Operation Menu

Option <1> Find Port: home

This option moves the valve to a reference position located at the water flush port, also known as the Home Port or Port 0.

Option <2> Find Port:

This option moves the valve to a specified port.

Option <3> Next port:advance

This option moves the valve forward one port position (for example, from Port 3 to Port 4).

Option <4> Next port:retreat

This option moves the valve backwards one port position (for example, from Port 3 to Port 2).

Option <5> Run pump: forward

This option pumps 500 ml of water at 75 ml/min. in the forward direction. The pump can be stopped at any time before the operation is complete by pressing [CTRL]-[C]. Each row of the display shows the pump speed control value; the instantaneous pump speed in Hertz, the average pump speed in Hertz, the cumulative volume pumped, the instantaneous flow rate in ml/min, and the elapsed time in seconds.

```
1676 h  401 I_Hz  100 A_Hz    1.4 ml  83.8 ml/min     1 secs
1582 h  286 I_Hz  171 A_Hz    2.7 ml  78.8 ml/min     2 secs
1695 h  183 I_Hz  217 A_Hz    4.0 ml  76.3 ml/min     3 secs
```

Figure 7-8: Run Pump Forward

Option <6> Run pump: reverse

This option pumps 500 ml of water at 75 ml/min. in the reverse direction. The pump can be stopped at any time before the operation is complete by pressing [CTRL]-[C].

Option <7> Run pump: programmable

This option allows the operator to enter the volume, time limit and direction for pumping. The pump can be stopped at any time before the operation is complete by pressing [CTRL]-[C].

The various software features controlling and safeguarding pump operation are in effect whenever the pump is running.

<4> Sleep

This option places the RAS-500 in Low Power Sleep (LPS) mode to conserve battery power. When the RAS is not running a schedule, LPS automatically triggers after 20 minutes of inactivity.

Prior to LPS, the current time will display. During LPS, the system will wake every 20 minutes to check system status, display the time and then return to LPS. This is also the operation mode after the last event of a schedule is completed and during the intervals between events. To wake the system and return to the Main Menu, press [CTRL]-[C] three times.

```
01/30/2007 12:29:14 Sleeping . . .
Enter <CTRL-C> now to wake up?
```

Figure 7-9: Low Power Sleep

<5> Create Schedule

This option allows creation of a sampling schedule in advance of the actual deployment. The schedule consists of preprogrammed dates and times that will trigger pumping events, and specifies the number of samples to be taken (from 1 through 48). Scheduling is Year 2000 compliant and properly accounts for leap years.

IMPORTANT
Creating a new schedule makes data in memory inaccessible.

NOTE
Confirm that the real time clock and the scheduled events refer to the same time zone, e.g., GMT or local time.

Select <5> 'Create Schedule', and enter the number of desired sampling events. This prompt will be preceded by warnings if previous deployment records (a data file) or a deployment schedule exist.

```
Enter the number of events to program  (0 to 48) ? 48
```

Figure 7-10: Create Schedule

```
                Schedule Menu

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

           Selection  ? 2

 Enter START date and time [01/30/2007 12:01:21] ? 2/1/07 08:00:00
 Enter interval

        Days     (0 to 365) ? 0
        Hours    (0 to  23) ? 0
        Minutes  (0 to  59) ? 2

 Schedule Verification

 Event   1 of  48 = 01/16/2007 15:18:11
 Event   2 of  48 = 01/16/2007 15:20:11
 Event   3 of  48 = 01/16/2007 15:22:11
 Event   4 of  48 = 01/16/2007 15:24:11
…
 Event  47 of  48 = 01/16/2007 16:50:11
 Event  48 of  48 = 01/16/2007 16:52:11
 Press any key to continue.
```

Figure 7-11: Schedule Menu

There are several options for creating a sampling schedule of events.

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.

Option <2> Enter start date & interval

This option enters a start date and a desired interval between the event start times. The interval is entered in units of days, hours and minutes.

Option <3> Enter start date & end date

This option schedules events at regular intervals between the entered start and end dates.

<6> Deploy System

This option prepares the RAS-500 for a deployment. Select 'Deploy System' to redisplay Main Menu options and verify deployment settings. Prompts allow the operator to:

- Offload existing data (warning to offload occurs if an unloaded data file exists).
- Check and reset the time.
- Create a new schedule or check (change) an existing schedule.

The next screens show the prompts displayed after selecting 'Deploy System'.

IMPORTANT
Use the Crosscut file capture utility to log communication with the RAS-500 (including pre-deployment bench testing). Refer to Appendix A in this User Manual for more information.

Deployment Initialization

The system first confirms that the valve is aligned with Home Port (0).

```
Searching for home port . . . done
```

Figure 7-12: Confirming Home Port Alignment

If the valve cannot be aligned with Home Port, the warning message shown next is displayed, the deployment is terminated, and the firmware returns to the Main Menu.

```
WARNING -- Unable to find home port!!!
           This problem must be resolved before deploying the system.
           Begin by checking external connections and exercising
           the multiport filter valve using the tools found in the
           "Manual Operation" menu.
```

Figure 7-13: Unable to Locate Home Port

Once the valve is aligned, the firmware checks to see if a data set that has not been offloaded exists in memory. Select 'Yes' or 'No' as appropriate.

```
A data set exists in system memory that has
not been offloaded.  Existing data will be lost
if a deployment schedule is defined.

Continue (Yes/No) [N] ?
```

Figure 7-14: Data Set Exists in Memory

IMPORTANT
The firmware cannot detect whether "Capture to File" (in Crosscut) is active during the offload operation. Confirm that "Capture to File" is ON during offload.

Next, the real time clock date and time display. To change the time, select 'Y'. If the time is correct, select 'N'. Press any key to continue.

```
Clock reads 01/16/2007 15:21:35
Change time & date (Yes/No) [N] ?
```

Figure 7-15: Real Time Clock

If there is deployment data still in memory, the message below is displayed. Select 'Y' to delete the deployment data, 'N' to return to the Main Menu.

```
Previous deployment records will be erased.  Continue (Yes/No) [N] ? y
```

Figure 7-16: Previous Deployment Data in Memory

If a schedule is already in memory, the message below is displayed. Select 'Y' to delete the current schedule or 'N' to keep the schedule.

```
Enter new schedule (Yes/No) [N] ? y
```

Figure 7-17: Enter New Schedule

Enter the number of events to program.

```
Enter the number of events to program  (0 to 48) ? 48
```

Figure 7-18: Enter Number of Events to Program

Entering or Changing a Pumping Schedule

The Schedule Menu is displayed next and allows creation or modification of an event schedule. To enter the start data and interval, from the Main Menu select <2>, 'Schedule Menu' and then select <2> 'Enter start date & interval'.

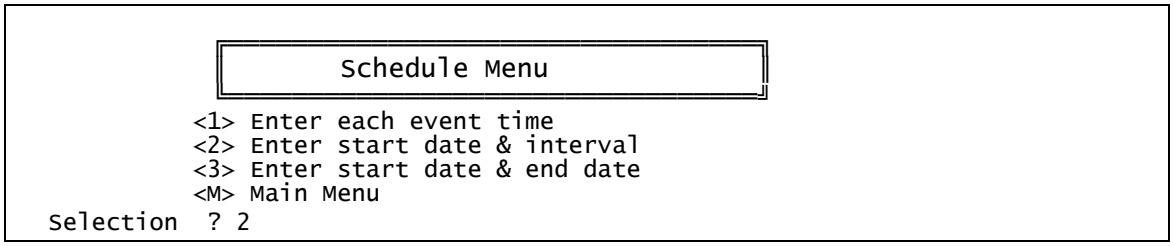

Figure 7-19: Schedule Menu

Enter the start date and time for the RAS-500 to begin pumping the first sample. Then, enter the interval between the start time of one sample and the start time of the next sample.

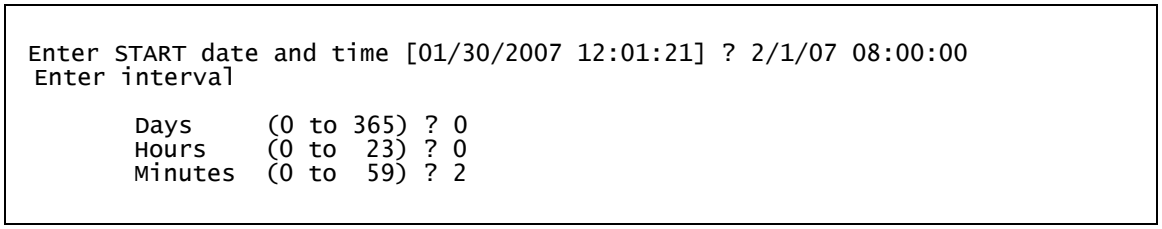

Figure 7-20: Pumping Start Date & Time

NOTE

Date and time information can be separated by [SPACE], [/], or entered using the display format [MM/DD/YY HH:MM:SS].

A schedule of the event times will appear on the screen in blocks of 16 events. Verify the dates and times and respond to the 'Modify an event' prompt. To review the next/remaining block, press any key.

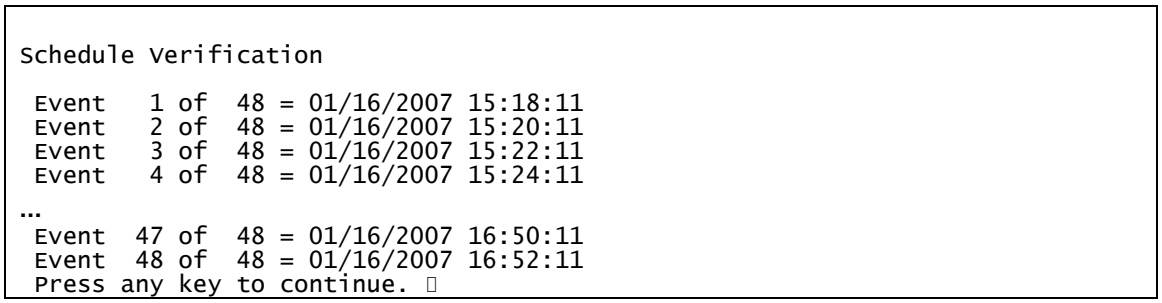

Figure 7-21: Event Verification

To change an event type ‘Y’ at the ‘Modify an event’ prompt. Select the event to change, and enter a new date and time for that event. If the schedule is acceptable, type ‘N’ or press [ENTER] to proceed with the deployment.

Programming Sampling Parameters

When deployment initialization and scheduling is completed, a menu is displayed for entering the sampling parameters. After entering the parameters described below, select ‘D’ to continue with the deployment. The parameters are divided by general function into five groups: Header, Acid, Water, Sample, and Timing.

```
Header A|
       B|
       C|

Acid   D| Pre-sample acid flush:    Enabled
       E| Flushing volume     =       10  [ml]
       F| Flushing time limit =        1  [min]
       G| Exposure time delay =        1  [min]

Water  H| Flushing volume     =      100  [ml]
       I| Flushing time limit =        5  [min]

Sample J| Sample volume       =      500  [ml]
       K| Sample time limit   =       25  [min]

Acid   L| Post-sample acid flush:   Disabled
       M| Flushing volume     =       NA  [ml]
       N| Flushing time limit =       NA  [min]

Timing P| Pump data period    =        1  [min]

       V| Verify and proceed.
```

Figure 7-22: Sampling Parameters

A Quick Reference overview of each sampling parameter is provided next. More detailed descriptions of the deployment parameters follow the Quick Reference.

RAS-500 Sampling Parameters

Quick Reference

Header: Three lines of file header text (up to 65 characters per line), offloaded with the data.

Pre–sample acid flush: Status of pre-sample flush (Enabled or Disabled).

Pre-sample flushing volume: Amount of acid flushed through the intake, determined by the number of samples, post-acid flush volume and acid bag volume (480 ml). Example: 48 samples, no post-acid flush equals maximum allowed pre-sample flush volume of 10 ml.

Pre–sample flushing time limit: Time limit for flush before the pump is turned off.

Exposure time delay: Time delay during which acid remains in the valve intake removing growth. Automatically set to zero when the acid flushing volume is set to zero.

Water Flushing Volume: Amount of water flushed through the water port before sampling to remove bio-growth loosened by the acid flush.

Water Flushing Time Limit: Maximum time for the system flush prior to sampling. Allowed value depends on the flushing volume and maximum and minimum flow rates (75 ml/min and 20 ml/min). Defaults to maximum value, and allows a smaller value.

Sample Volume: Amount of water to be sampled before the pump is turned off. Adjust flow rate with the control system to reduce differential pressure across the sampling apparatus.

Sample Time Limit: The maximum sample time limit before pumping stops. Allowed value depends on the sample volume and the maximum and minimum flow rates (75 ml/min and 20 ml/min). Defaults to maximum value, and allows a smaller value.

Post–sample Acid Flush: Status of post-sample flush (Enabled or Disabled).

Post–sample Flushing Volume: Amount of acid flushed through the intake, determined by the number of samples, pre-acid flush volume and acid bag volume (480 ml). Example: 48 samples, no pre-acid flush equals maximum allowed pre-sample flush volume of 10 ml.

Post-Sample Flushing Time Limit: Maximum time for the acid flush prior to sampling. Allowed value depends on flushing volume and the maximum and minimum flow rates (75 ml/min and 20 ml/min). Defaults to maximum value, and allows a smaller value.

Pump Data Period: Sampling period stored during each event (pump flow rates / volumes).

Detailed Descriptions of Sampling Parameters

Option <A>, <B>, and <C> Header

Enter a header or a personalized title for each deployment. Each header line may contain up to 65 characters.

Option <D> Pre-sample Acid Flush

This option enables or disables the pre-sample acid flush.

Option <E> Acid Flushing Volume

This option specifies the volume of acid (or other bio-fouling fluid) to flush through the valve intake before taking a sample. Acid flushing loosens any bio-fouling growth along the intake path so that it can be removed by the water flush. The maximum volume is the capacity of the nominally 500 ml acid reservoir (the actual volume is assumed to be 480 ml) divided by the number of samples in the schedule.

Option <F> Acid Flushing Time Limit

This option specifies the acid flush time limit. The maximum time limit is determined from the selected flushing volume and the fixed minimum flow rate of 20 ml/min.

Option <G> Acid Exposure Time Delay

This option specifies a time delay during which the acid will be left standing in the valve intake. This allows the acid sufficient time to act upon any growth that may be present. The acid will be removed by the water flush. If the acid flushing volume is zero, the delay cannot be set to a value other than zero and will not be executed. The exposure delay is automatically set to zero when the acid flushing volume is set to zero. Exposure time delay is unnecessary for the post-sample acid flush because the acid remains in the valve and tubing until the next sample event.

Option <H> Water Flushing Volume

This option specifies the volume of water to flush through the valve before taking a sample. This is done to clear out any debris in the valve and intake hose, and to ensure that the sample is taken entirely from current ambient water.

Option <I> Water Flushing Time Limit

This option specifies the water flush time limit. The maximum time limit is determined from the selected flushing volume and the fixed minimum flow rate of 20 ml/min.

Option <J> Sample Volume

This option specifies the volume of water to be pumped for each sample.

Option <K> Sample Time Limit

This option specifies the time limit for the samples. The maximum time limit is determined from the selected flushing volume and the fixed minimum flow rate of 20 ml/min.

Option <L> Post-Sample Acid Flush

This option enables or disables the post-sample acid flush.

Option <M> Acid Flushing Volume

This option specifies the amount of water flushed through the water port before sampling.

Option <N> Post-Sample Acid Flushing Time Limit

This option specifies the post-sample acid flush time limit. The maximum time limit is determined from the selected flushing volume and the fixed minimum flow rate of 20 ml/min.

Option <P> Timing Pump Data Period

This option establishes the instantaneous flow rates and volumes for each sample, that are logged in the data file at a user selectable interval.

Option <V> Verify and Proceed

Select this option when finished changing the pumping parameters. Prompts will display to change parameters that are in conflict with other parameters.

Checking Available Acid Flush Volume

If more acid is requested than available, a warning message displays after 'V' is selected.

NOTE
The total acid volume available is 480ml (the amount of acid in the sample bag). Press [N] to change the parameters and [Y] to continue with the deployment.

```
WARNING: The total acid requested for pre & post sample flushes
         exceeds the total acid volume available

 Proceed with the deployment (Yes/No) [N] ? n
```

Figure 7-23: Pre & Post Sample Flush Exceeds Available Acid Volume

Checking for Event Overlap

After a schedule is accepted, the RAS-500 firmware checks for potential problems, such as expired or overlapping events.

NOTE
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).

Event overlap is calculated after the sampling parameters have been entered and is based on the acid exposure delay and the duration of the combined flushing and sample volumes at their minimum flow rates. The system compares the time limit of each event to the scheduled start time of each subsequent event.

NOTE
The warning message indicates that an overlap could occur, not that it will. 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.

```
The following event(s) overlap previous event(s):

       2   3   4   5   6   7   8   9  10
  11  12  13  14  15  16  17  18  19  20
  21  22  23  24  25  26  27  28  29  30
  31  32  33  34  35  36  37  38  39  40
  41  42  43  44  45  46  47  48

 The listed events may begin later than their scheduled start.
 Any events that are actually delayed will start as soon as
 earlier events are completed.

 Press any key to continue.
```

Figure 7-24: Overlap Reminder

A message will display as a reminder to offload data written to the EEPROM backup during a previous deployment. Disregard the message if the data has already been recovered. The data offload reminder will be followed by one line of system status information and a prompt to proceed with or terminate the deployment (a final chance to check the settings prior to deployment). Select 'Y' to proceed or 'N' to return to the Main Menu and change settings.

```
Caution:  Deployment will overwrite the
           EEPROM data backup cache.

 System status:

  01/16/2007 15:22:25   31.5 Vb  21.8 øC  PORT = 00


 Proceed with the deployment (Yes/No) [N] ? y
```

Figure 7-25: Data Offload Reminder

Low battery output voltage triggers operating warning messages.

NOTE
The voltage levels generating the two warning messages are 28 V and 18 V.

If the main battery is below 28 V, a warning message displays the system status information and suggests battery pack replacement before deploying the RAS-500 (see Figure 7-4).

Battery output below 18 V triggers a caution message to replace the battery before running diagnostics. If there is deployment data in system memory that has not been offloaded, a reminder to offload the data before replacing the battery is displayed (see Figures 7-5 and 7-6).

Proceeding with the Deployment

Select 'Y' at the 'Proceed with the Deployment' prompt and the RAS-500 enters a low power sleep (LPS) mode until the time of the first scheduled event.

NOTE
If conducting a bench test, leave the communications cable attached to the RAS-500 electronics to observe the operation of the instrument in the Crosscut window (do not touch the keyboard).

During an actual deployment, disconnect the communications cable from the controller housing. Reconnect the dummy plug to the communications connector on the controller housing and deploy the RAS-500.

```
 Remove communication cable and attach dummy plug.
            System is ready to deploy.


 <01/16/2007 15:22:28> Waiting for event 01 of 48 @ 01/16/2007 15:30:00
01/16/2007 15:22:30 Sleeping . . .
```

Figure 7-26: Deploy System

The RAS-500 program enters a monitor mode where no further user entries are allowed (except [CTRL]-[C]).

<7> Offload Data

This option works with the "Capture to file" feature of Crosscut. After recovering the RAS-500, and re-establishing the communications link with the PC, select <7> Offload Data to process the binary data and offload to a disk drive.

IMPORTANT
Offload data before disconnecting the battery, otherwise the data will be lost.

1. Start Crosscut on the PC.

IMPORTANT
Turn on the PC and start Crosscut before connecting to the electronics to avoid crashing the TT8. Only data stored in EEPROM can be recovered after such a crash.

2. Within Crosscut, specify a "Capture file" for the offloaded data.
3. From the Offload/Display Data File menu select option <1>, <2>, or <3> to display recorded data as a scrolling ASCII text file on the screen (Option 1 shows all the data in a single scrolling display, Options 2 and 3 display the two main portions of the data file separately). The Offload/Display Data File Menu is shown in Figure 7-27.

```
          Offload/Display Data File
                    Fri Feb 15 09:47:41 2008
<1> Display ALL data
<2> Display event summary data
<3> Display pump data
<4> EEPROM data backup cache
<M> Main Menu

  Selection  ? 1
```

Figure 7-27: Offload/Display Data File Menu

As shown in Figure 7-28, Option 1 shows a summary of data recording start and end times and then lists sample parameters, schedule times and the deployment data.

```
                Offload/Display Data File

        Selection  ? 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.

Software version:  Ras500_9.c
Compiled:          Oct 13 2006 11:42:00
Electronics S/N:   ML12269-02
Temperature probe:     Internal

Data recording start time = 02/14/2008 10:33:59
Data recording stop time  = 02/14/2008 18:39:48

HEADER
______

SAMPLE PARAMETERS
_________________

Pre-sample acid:
Acid flush volume       [ml]      = 0
Acid flush time limit   [minutes] = 0
Acid exposure delay     [minutes] = 0
Water Flush:
Water flush volume      [ml]      = 50
Water flush time limit  [minutes] = 3
Sample:
Sample volume           [ml]      = 500
Sample time limit       [minutes] = 25
Post-sample acid:
Acid flush volume       [ml]      = 0
Acid flush time limit   [minutes] = 0

SCHEDULE
________

Event  1 of 48 @ 02/14/2008 10:40:00
Event  2 of 48 @ 02/14/2008 10:50:00
Event  3 of 48 @ 02/14/2008 11:00:00
. . .
Event 46 of 48 @ 02/14/2008 18:10:00
Event 47 of 48 @ 02/14/2008 18:20:00
Event 48 of 48 @ 02/14/2008 18:30:00

DEPLOYMENT DATA
_______________

  1  02/14/2008 10:40:00  30.7 Vbat  19.7 øC  PORT = 00
     Pre-sample acid flush         0 ml        0 sec  LB  0.0 V   . . .
     Flush port = 00
     Intake flush      50 ml       41 sec  LB 30.1 V   Volume reached.
     Flush port = 00
     Sample           500 ml      400 sec  LB 30.0 V   Volume reached.
     Sample port = 01
     02/14/2008 10:47:30  30.3 Vbat  21.3 øC  PORT = 01
     Post-sample acid flush         0 ml        0 sec  LB  0.0 V   . . .
     Flush port = 00
```

Figure 7-28: Offload/Display Data File – Display All (screen 1 of 2)

```
PUMPING DATA
____________

Sample interval = 1 [minutes]
 [event#]  [ml/min]    [ml]     [Vbat]
     1         76        75      30.1
     1         75       150      30.1
     1         76       225      30.0
     1         75       300      30.0
     1         75       375      30.0
     2         75        75      28.9
     2         75       150      28.9
     2         75       225      28.9
     2         75       300      28.8
     2         75       375      28.8
     2         74       450      28.8
     3         75        75      28.9
     3         76       150      28.9
     3         75       225      28.8
     3         74       300      28.8
     3         75       375      28.8
     3         75       450      28.8
```

Figure 7-29: Offload/Display Data File – Display All (screen 2 of 2)

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 capture file.

```
 Selection  ? 4
During deployments a backup copy of the most important
information in the datafile is also written to EEPROM.

The EEPROM data cache contains the start and stop time for
each sampling event that occurred, the volume of water pumped
through the filter during the event, and the port number of
the valve.

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.

Start time:      02/14/2008 10:40:42
Volume pumped:   500 ml
Elapsed time:    400 sec
Volume reached.
Lowest battery:  30.0 V
Start temp:      19.7 C
Port used:       01
Stop time:       02/14/2008 10:47:29
...
Start time:      02/14/2008 18:30:42
Volume pumped:   500 ml
Elapsed time:    400 sec
Volume reached.
Lowest battery:  28.2 V
Start temp:      23.9 C
Port used:       48
Stop time:       02/14/2008 18:37:32

End of EEPROM data backup cache.
Terminate file logging operation now
and press any key to continue.
```

Figure 7-30: EEPROM Data Backup Cache

<8> Contacting McLane

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

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

Tel:    (508) 495-4000
Fax:    (508) 495-3333
Email:  mclane@mclanelabs.com
WWW:    http://www.mclanelabs.com

 Software version:  Ras500_9.c
 Compiled:          Oct 13 2006 11:42:00
 Electronics S/N:   ML12222-02

 Press any key to continue
```

Figure 7-31: McLane Contact Information

Notes

Chapter 8
Data Offload and Processing

After the RAS-500 is recovered and rinsed, and the sample bags are removed for storage and analysis, complete these steps to run the Offload Data option and print the data file to the screen (to also create a permanent log file, use the "Capture to file" feature within Crosscut).

IMPORTANT
After running the Offload Data option, confirm that data is successfully offloaded by checking the Crosscut files before disconnecting the battery (data is erased when the battery is disconnected).

To offload the deployment data, complete the following steps:

1. Place the RAS-500 in a dry area, power on the PC and start Crosscut.

IMPORTANT
Powering on the PC and starting Crosscut before connecting the RAS-500 serial cable to the PC prevents a possible crash of the RAS-500 firmware.

2. Remove the dummy plug from the RAS-500 COM connector.
3. Connect the RAS-500 serial cable to the PC.
4. From the Main Menu select <7>, Offload Data.

```
        Offload/Display Data File

              Fri Feb 15 09:47:41 2008

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

  Selection  ? 1
```

Figure 8-1: Offload/Display Data File Menu

5. From the Offload/Display Data File menu select <1>, Display ALL Data. The system displays the screen shown in Figure 8-2.

```
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.
```

Figure 8-2: All Data

6. Start "Capture to file" within Crosscut.

7. Press any key to offload the data and display to the screen (the data is sent to the specified capture file). An example data offload file is shown in Figure 8-3.

```
Software version:  Ras500_9.c
Compiled:          Oct 13 2006 11:42:00
Electronics S/N:   ML12269-02
Temperature probe:     Internal

Data recording start time = 02/15/2008 15:35:19
Data recording stop time  = 02/19/2008 07:11:38

HEADER
______

SAMPLE PARAMETERS
_________________

Pre-sample acid:
Acid flush volume       [ml]      = 5
Acid flush time limit   [minutes] = 1
Acid exposure delay     [minutes] = 1
Water Flush:
Water flush volume      [ml]      = 100
Water flush time limit  [minutes] = 6
Sample:
Sample volume           [ml]      = 500
Sample time limit       [minutes] = 25
Post-sample acid:
Acid flush volume       [ml]      = 5
Acid flush time limit   [minutes] = 1

SCHEDULE
________

Event  1 of 48 @ 02/15/2008 16:00:00
Event  2 of 48 @ 02/15/2008 17:51:03
Event  3 of 48 @ 02/15/2008 19:42:06
...
Event 47 of 48 @ 02/19/2008 05:08:18
Event 48 of 48 @ 02/19/2008 06:59:21

DEPLOYMENT DATA
_______________

   1  02/15/2008 16:00:00  29.6 Vbat  17.0 øC  PORT = 00
      Pre-sample acid flush         5 ml        5 sec  LB 28.9 V   Volume
reached.
      Flush port = 49
      Intake flush     100 ml       80 sec  LB 28.8 V   Volume reached.
      Flush port = 00
      Sample           500 ml      401 sec  LB 28.7 V   Volume reached.
      Sample port = 01
      02/15/2008 16:09:34  29.2 Vbat  19.5 øC  PORT = 01
      Post-sample acid flush         5 ml        4 sec  LB 28.7 V   Volume
reached.
      Flush port = 49
```

Figure 8-3: Data Offload File (screen 1 of 2)

```
   2  02/15/2008 17:51:03  29.6 Vbat  16.5 øC  PORT = 00
      Pre-sample acid flush         5 ml        5 sec  LB 28.9 V   Volume reached.
      Flush port = 49
      Intake flush     100 ml       80 sec  LB 28.8 V   Volume reached.
      Flush port = 00
      Sample           500 ml      401 sec  LB 28.7 V   Volume reached.
      Sample port = 02
      02/15/2008 18:00:39  29.2 Vbat  19.3 øC  PORT = 02
      Post-sample acid flush         5 ml        5 sec  LB 28.6 V   Volume reached.
      Flush port = 49
...

47  02/19/2008 05:08:18  29.1 Vbat  16.4 øC  PORT = 00
      Pre-sample acid flush         5 ml        5 sec  LB 28.3 V   Volume reached.
      Flush port = 49
      Intake flush     100 ml       80 sec  LB 28.2 V   Volume reached.
      Flush port = 00
      Sample           500 ml      400 sec  LB 28.0 V   Volume reached.
      Sample port = 47
      02/19/2008 05:17:57  28.6 Vbat  19.1 øC  PORT = 47
      Post-sample acid flush         5 ml        4 sec  LB 28.0 V   Volume reached.
      Flush port = 49

  48  02/19/2008 06:59:21  29.1 Vbat  16.4 øC  PORT = 00
      Pre-sample acid flush         5 ml        5 sec  LB 28.3 V   Volume reached.
      Flush port = 49
      Intake flush     100 ml       80 sec  LB 28.2 V   Volume reached.
      Flush port = 00
      Sample           500 ml      401 sec  LB 28.1 V   Volume reached.
      Sample port = 48
      02/19/2008 07:08:58  28.6 Vbat  19.1 øC  PORT = 48
      Post-sample acid flush         5 ml        4 sec  LB 28.0 V   Volume reached.
      Flush port = 49
 PUMPING DATA
 _____________
 Sample interval = 1 [minutes]
  [event#]  [ml/min]    [ml]     [Vbat]

      1         75        75      28.9
      1         75       150      28.9
      1         75       225      28.9
      1         75       300      28.9
      1         75       375      28.8
      1         75       450      28.8
...
      2         75        75      28.9
...
     47         75       450      28.2
     48         76        75      28.2

 End of instrument data file.
 Terminate file logging operation now
 And press any key to continue.
```

Figure 8-4: Data Offload File (screen 2 of 2)

8. After the data is offloaded, stop the Crosscut "Capture to file".

NOTE
The Offload option can be executed again if necessary (the data file remains in memory until a new deployment schedule is created or the batteries are disconnected).

Notes

Appendix A
Operating Crosscut and Crosscut for Windows

You can use file logging during all of your interactions with the RAS-500 to create a log of operations, deployment settings, and recovery procedures. There are two standard file capture programs that McLane recommends. Both programs are freely distributed by Onset Computer (www.onsetcomp.com) for TT8 communication. Crosscut is a DOS-based program that runs on a PC, and Crosscut for Win is Windows-based. McLane recommends using file capture for all deployments.

To download compressed archives of Crosscut and Crosscut for Win software, go to:

www.mclanelabs.com/downloads/crosscut.zip

www.mclanelabs.com/downloads/crosscut-win.zip

Using Crosscut

Crosscut is a DOS-based program that runs on a PC. Crosscut will run without modification or difficulty under DOS, Windows (up to Windows 98, 1st edition), and Windows NT (up to Version 4.0, Service Pack 5). Later releases of these operating systems commonly require a change to the PC registry to disable power management of the serial port. Modifications may also be required to enable the mouse. Detailed instructions for the registry change can be found below and at www.mclanelabs.com/laptops_and_crosscut.html. Contact McLane or Onset Computer (www.onsetcomp.com) for additional information.

First Time Crosscut Use

To use Crosscut for the first time, complete the following steps:

1. Place the six Crosscut files from the disk provided in the Toolkit into a directory on the PC (or create a new directory). Alternatively, create a Crosscut directory and place the six Crosscut files there. If you operate Crosscut from the directory that contains the files, changes to the path are unnecessary.
2. Type *crosscut* at the DOS prompt or click on the Crosscut icon to run the program (a short cut can also be created from the desktop). Do not connect the PC to the TT8 yet.

3. Select ‘CommPort’ from the menu bar at the top of the Crosscut window and then select ‘Port setup’ from the submenu (use a mouse or the keyboard combination [ALT]-[P]).

4. Use the mouse or [TAB] and arrow keys to set the COM port being used to 9600 baud, 8 data bits, 1 stop bit, no handshaking, and no parity (9600, 8, N, 1). The copy of Crosscut on the floppy disk should have these values preset.

5. Click ‘OK’ to store these values in the configuration files and they will be used whenever Crosscut is started again.

6. Connect the RAS-500 serial cable to the PC.

Editing the Registry to Enable Crosscut

1. On the desktop of a PC running a recent version of Windows, click START and select RUN from the pop up menu.

2. In the prompt box type *regedit* and click ‘OK’ to start the registry editor window.

3. The editor will display a Windows directory tree in the left half of the window and a folder contents display in the right half of the window. Click through the directory tree following this path:

   HKEY_LOCAL_MACHINE / SYSTEM / CurrentControlSet / Services / VxD / VCOMM

4. Click on the VCOMM folder and its contents will be displayed in the right half of the window.

5. Double-click ‘ENABLE POWER MANAGEMENT’ in the right half of the window and change its value from *01 00 00 00* to *00 00 00 00* using the editing tool that pops up.

6. After the value has been changed, go back through the directory tree and exit the registry editor.

7. Exit all programs, restart the PC, and try Crosscut again.

Capturing Data Files Using Crosscut

Once the steps for first-time Crosscut use are complete, use the steps provided next to capture data files.

1. To start Crosscut type *crosscut* at a DOS prompt or click on the Crosscut icon (the Crosscut directory must be in the directory path for this step).

2. To capture a data file after a deployment, select 'CommPort' from the menu bar and 'Capture to File' from the submenu.
3. Select a directory and a name for the file.
4. The 'Open file' window will appear in the Crosscut window. [ALT]-[Z] brings up the 'Open file' window from the keyboard.
5. Type the path and name of the file in the *Name* field or use the [TAB] and [ENTER] keys to select the directory and enter the name in the *Name* field.
6. Once the capture is started, everything that appears in the Crosscut window, whether from the instrument or the keyboard, is written to the file. Run the offload utility and the data unpacked from the flash card will be captured in the named log file. Note that Crosscut always overwrites the information in an existing log file.
7. Terminate file logging by selecting 'CommPort' and 'Capture to File' again or by typing [ALT]-[Z].
8. To exit Crosscut select 'File' from the menu bar and 'Quit' from the submenu or type [ALT]-[Q].

The format of the captured data file is ASCII text (use the extension .TXT for the file name). ASCII text files can be loaded and edited by all of the common word and text processors.

Crosscut assigns a default file name of CAPTURE.TXT to log files. The operator can, as described above, change the name before logging begins. That name becomes the default during that Crosscut session. Alternatively, the file can be renamed once captured to the hard disk of the PC. In either case, Crosscut does not append (each log file must eventually have a unique name and path or it will be overwritten).

Using Crosscut for Win

Crosscut for Win is a Windows-based program that runs on a PC. Crosscut for Win will run without modification or difficulty under all currently available versions of Windows, including 95, 98, Me, NT, 2000 and XP. Contact McLane or Onset Computer (www.onsetcomp.com) for additional information.

First-Time Crosscut for Win Use

To use Crosscut for Win for the first time, complete the following steps:

1. Create a Crosscut for Win directory and copy into it the two Crosscut for Win files from the disk provided in the Toolkit.
2. Click on the Crosscut for Win icon to run the program (or establish a short cut from the desktop). Do not connect the COM cable to the RAS-500 yet.
3. Select 'CommPort' from the menu bar at the top of the Crosscut for Win window and then 'Setup' from the submenu.
4. Select the COM port and set the port parameters to 9600 baud, 8 data bits, 1 stop bit, and no parity (9600, 8, N, 1).
5. Click 'OK'. The system stores these values and they will be used whenever Crosscut for Win is started in the future.
6. Connect the COM cable from the PC to the RAS-500 serial port.

Capturing Data Files with Crosscut for Win

1. Start Crosscut for Win.
2. To capture a data file after a deployment select 'Terminal' from the menu bar and 'Capture Setup' from the submenu.
3. Enter a *Capture file name* in the box and select *Overwrite* or *Append*. Overwrite replaces any information in an existing log file. Append adds new information to an existing file (select carefully)!
4. Click 'OK'.
5. Start 'File → Capture'. Everything that appears in the Crosscut for Win window is written to the file.
6. Toggle file logging by selecting 'File' and 'Capture' again.
7. To exit Crosscut for Win select 'File' from the menu bar and 'Exit' from the submenu.

The format of the captured data file is ASCII text (you should use the extension .TXT for the file name). ASCII text files can be read by word processors and text editors.

Crosscut for Win requires a name for the log file the first time the capture utility is called during a Crosscut for Win session. That name then becomes the default for the remainder of the session. The file can be renamed after capture on the hard disk of the PC.

Connecting the RAS-500 to a PC

Connecting a DB-9 or DB-25 connector to a PC serial port by rocking the connector back and forth can cause a Com Port Crash in the TT8. If a crash occurs, remove the connector and then restore power to recover control of the RAS-500. The crash is caused by signals or apparent signals on the receive pin of the communications port if they arrive when the TT8 is in low power sleep and if the ground connection between the TT8 and the PC is intermittent.

To connect and disconnect the communications cable complete the following steps:

1. Always boot the PC and start Crosscut before connecting the communications cable to the RAS-500.
2. Connect the communications cable first to the PC and then to the RAS-500.
3. Disconnect the communications cable first from the RAS-500 and then from the PC.
4. Connect to and disconnect from the RAS-500 as smoothly as possible. Try to prevent repeated intermittent contacts.
5. Leave the PC and Crosscut running until the COM cable is disconnected from the RAS-500.

Additional Documentation

A more detailed and complete description of Crosscut operations can be found in the file crosscut.doc, which is included with the Crosscut program. Crosscut for Win also has a help utility which can be viewed by selecting 'Help' from the menu bar.

Notes

Appendix B
External Temperature Sensor

The RAS-500 internal Thermistor temperature sensor can optionally be extended from its standard location on the electronics card to a specially-manufactured aluminum block mounted into the top end cap. External temperature readings are recorded in RAM and EEPROM and reported to one-tenth degrees.

Figure B-1: Thermistor External Temperature Sensor

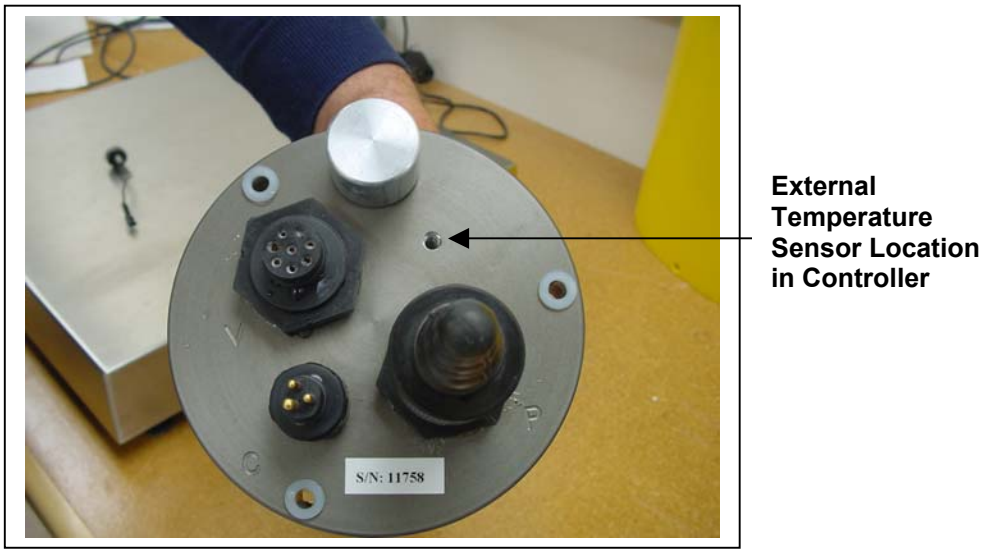

Figure B-2: External Temperature Sensor Installed in Controller Housing

Configuring to External Temperature Mode

If using the external temperature probe, the firmware must be configured accordingly. To configure the probe, complete the following steps:

1. From the Main Menu type 'C' and type the password to display the Configuration menu.

```
                    Main Menu

                Tue Aug 30 10:31:39 2005
                       Port = 00

            <1> Set Time          <5> Create Schedule
            <2> Diagnostics       <6> Deploy System
            <3> Manual Operation  <7> Offload Data
            <4> Sleep             <8> Contacting McLane

 Selection  ? c   Password:

Configuration

<1> Internal temperature probe:     Enabled
<2> External temperature probe:     Disabled
<X> Exit
        Selection  ? 2

Enable external temperature probe (Yes/No) [N] ? Y
Disabling internal temperature probe.
Configuration

<1> Internal temperature probe:     Disabled
<2> External temperature probe:     Enabled

<X> Exit
        Selection  ? x
```

Figure B-3: System Configuration Menu – Temperature Configuration

2. Select <2> to enable an External (12.4K) Temperature Probe (selecting <1> enables the Internal (10K resistor) Temperature Probe).
3. Type 'Y' at the 'Enable Temperature Probe?' prompt and type 'X' to exit and save the change.

The Temperature Probe configuration is stored in EEPROM, and used the next time the firmware is started.

Appendix C
Heavy Duty Frame Packing Crate and Stand

The RAS-500 with heavy-duty frame is shipped in a custom-designed crate with extra structural support and an integrated stand.

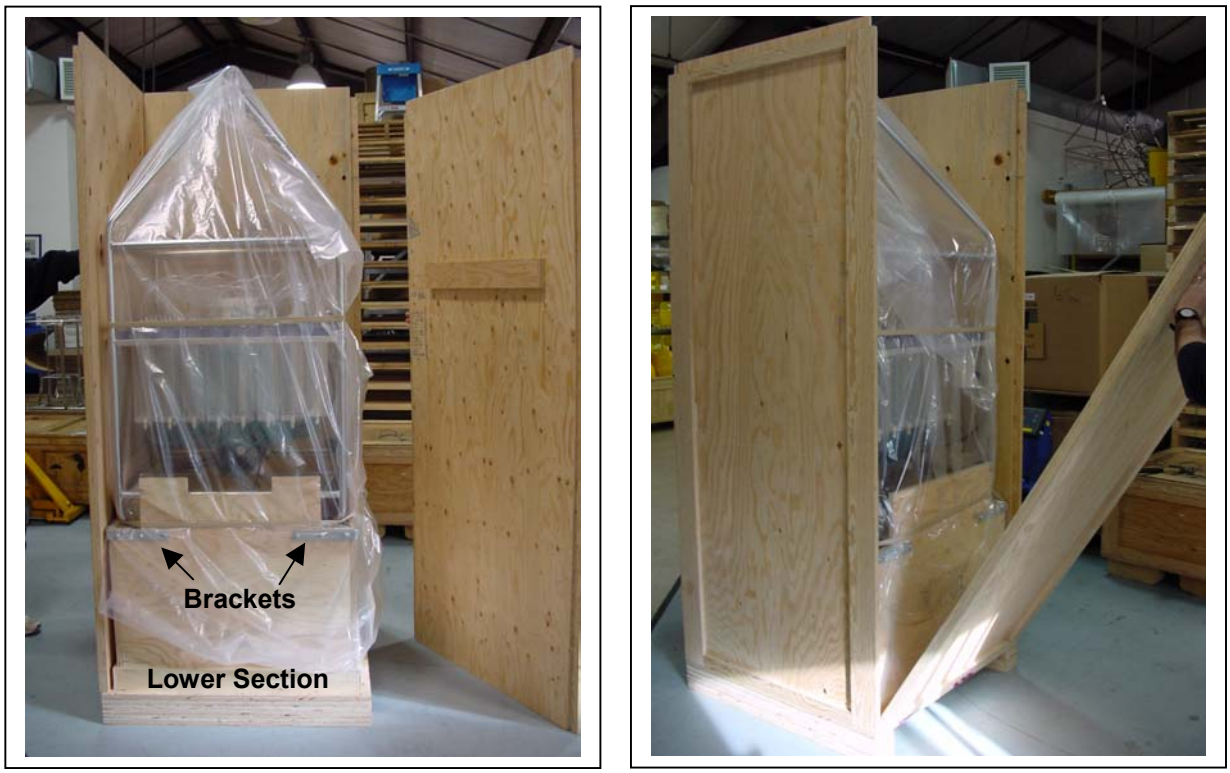

Figure C- 1: RAS-500 with Heavy-Duty Frame in Custom Crate

For reusability, the top and side panels are secured with screws. Remove the screws to open the crate.

Do not remove the metal brackets or disassemble the lower section of the crate.

The integrated stand includes a reinforced plywood base with a notch for sliding out the controller housing while leaving the RAS-500 frame upright in the crate for stability.

Figure C-2: Controller Housing Notch in Stand

When the RAS-500 is re-packed for shipment, place the controller housing facing towards the notch as shown in Figure C-2.

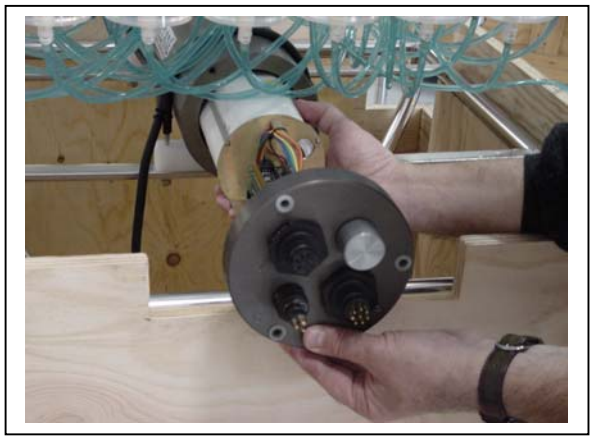

Figure C-3: Remove Controller Housing through Notch in Stand