Technical Support Bulletin 2019-01	RAS Pump Test Procedures	January 11, 2019

Alert Level: **INFORMATIONAL**

Instruments: RAS-500

Software Versions: N/A

Hardware Version: N/A

Subject: Micropump Testing Procedures to Verify RAS-500 Micropump Operation

Summary: This Bulletin contains test procedures that confirm micropump operation before deployment.

Technical Details: Verifying proper RAS micropump operation is a pre-deployment best practice. Steps for confirming plumbing, testing pump volume, and performing a backfill test are included in this document.

Confirming Correct Tubing Attachments

Before performing micropump tests, ensure that RAS plumbing is correct by visually checking that all top and bottom tubing is correctly matched to the numbered ports. Incorrect plumbing will cause a backfill test failure. When correct plumbing is confirmed, proceed to the Pump Volume Test procedure.

Performing Pump Volume Test

Purpose and Setup

The purpose of this procedure is to verify proper RAS micropump volume delivery. Correct top and bottom tubing connections are also verified, as a sample will not collect correctly if the plumbing is wrong.

Required for Test

- RAS-500 micropump.
- RAS-500 controller.
- Tubing and fittings from the RAS toolkit.
- Computer with USB/RS-232 converter and McLaneTerm software.
- Graduated cylinder with at least 500 mL measuring capacity.
- Clean water container with more than 500mL of water.

Procedure

The micropump can be tested while installed on the RAS baseplate or stand-alone.

1. Using tubing and fittings from the RAS toolkit, connect the intake to a clean water container and the outlet to a graduated cylinder (Figure 1).
2. Connect the pump to the controller housing bulkhead.

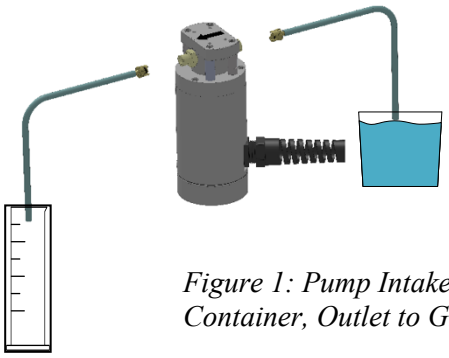

Figure 1: Pump Intake to Clean Water Container, Outlet to Graduated Cylinder

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3. Using McLaneTerm, at the RAS-500 Main Menu, select <3> Manual Operations.

```
_____________________________________________________________
Configuration: RAS-125M500              CF2 V3_08 of Jan 23 2017
               McLane Research Laboratories, Inc.
                     Remote Access Sampler
                           ML99999-99

               ________________________________
                           Main Menu
               ________________________________
                   Wed Jan  9 13:41:55 2019
                        Port=99 unknown

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

                Selection [] ? 3
```

Figure 2: Select Manual Operations

4. Select <7> Run Pump : Programmable.
5. Enter the volume desired, typically 500 ml and <F> for Pump Forward.

```
_____________________________________________________________
Configuration: RAS-125M500              CF2 V3_08 of Jan 23 2017

                ________________________________
                      Manual Operations Menu
                ________________________________
                    Wed Jan  9 13:42:04 2019
                         Port=99 unknown

              <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
              <8> System Flush  : programmable

              <M> Main Menu

                Selection [] ? 7

Enter volume per sample [ml] (10-500) [500] ? 500
Forward or Reverse pumping [F] ?

Counts | Hall Count | Hall Avg | Volume Pumped | FlowRate | Elapsed Seconds | Batt. V | Pump Current

    1743 h    108 I_Hz     27 A_Hz    0.8 ml        45.2 ml/min     1 secs         31.8      63 mA
    1756 h    173 I_Hz     70 A_Hz    2.0 ml        72.3 ml/min     2 secs         31.7      68 mA
    1728 h    193 I_Hz    118 A_Hz    3.3 ml        80.7 ml/min     3 secs         31.7      54 mA
    1715 h    186 I_Hz    165 A_Hz    4.6 ml        77.8 ml/min     4 secs         31.7      52 mA
    1716 h    179 I_Hz    182 A_Hz    5.8 ml        74.8 ml/min     5 secs         31.8      49 mA
    1719 h    178 I_Hz    184 A_Hz    7.1 ml        74.4 ml/min     6 secs         31.7      56 mA
    1720 h    179 I_Hz    180 A_Hz    8.3 ml        74.8 ml/min     7 secs         31.7      56 mA
    1716 h    181 I_Hz    179 A_Hz    9.6 ml        75.7 ml/min     8 secs         31.7      53 mA
    1717 h    179 I_Hz    179 A_Hz   10.8 ml        74.8 ml/min     9 secs         31.8      53 mA
    1716 h    180 I_Hz    179 A_Hz   12.1 ml        75.3 ml/min    10 secs         31.8      56 mA
```

Figure 3: Run Pump Programmable: Type volume and Forward Pumping

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6. Measure the delivered volume in the graduated cylinder. The measured volume should be within 490 – 510 ml.
7. If the desired volume is not achieved it is not necessary to test all ports, or perform the back-fill test. Contact mclane@mclanelabs.com for technical support. If the desired volume is reached, proceed to the Backfill Test procedure below.

Performing a Backfill Test

Purpose and Setup

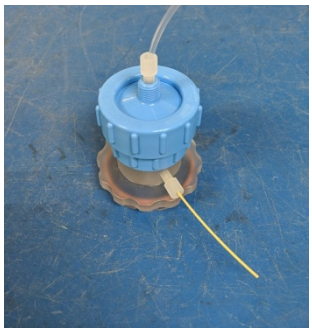
The purpose of this procedure is to verify proper and repeatable RAS micropump operation. The backfill test is a wet operation that takes about 6 hours to complete. Perform in an area with a floor drain or similar setup.

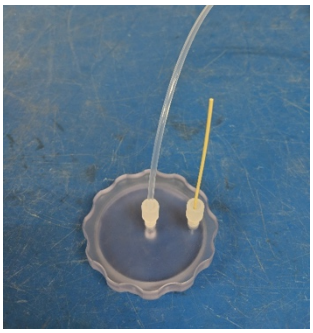
Required for Test

- Fully assembled RAS system with controller, installed and connected battery pack.
- Sample tubes emptied of any water (it is not necessary to prime any of the tubing).
- Computer with USB/RS-232 converter and McLaneTerm software.
- Clean container of tap water with a capacity of at least 25L.

1. Ensure that compensation tubes are installed on each sample cap.

Filter Cap





Flat Cap

Figure 4: Compensation Tube on Filter and Flat Caps

2. Reverse connections on the micropump so pumping in the forward direction flows from the water source, into the micropump and into the bottom of the multiport valve to fill the sample tubes from the bottom.

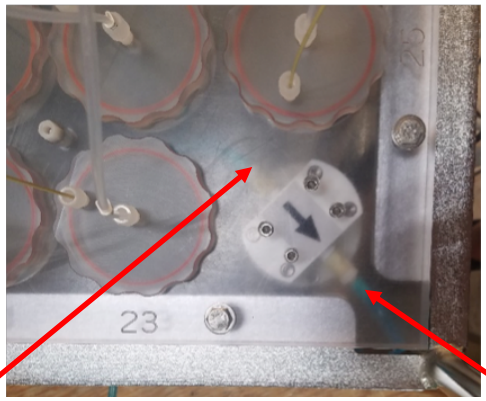


Figure 5: Plumbing Changes for Backfill Test – Top View

Forward intake goes to water source

Forward outflow to bottom of the valve

Figure 6: Plumbing Changes for Backfill Test – Side View

3. Connect a tube to the intake port on the top of the valve and place tube in a collection reservoir or drain. There will be very little exhausted water – only water that is leftover in the top side tubing.

Note – Keep the filled water container at about the same level as the intake. Do not attempt to draw water into micropump from any level below the sampler as this will likely result in valve leakage and lower than expected pumped volumes due to the added resistance and operation in air.

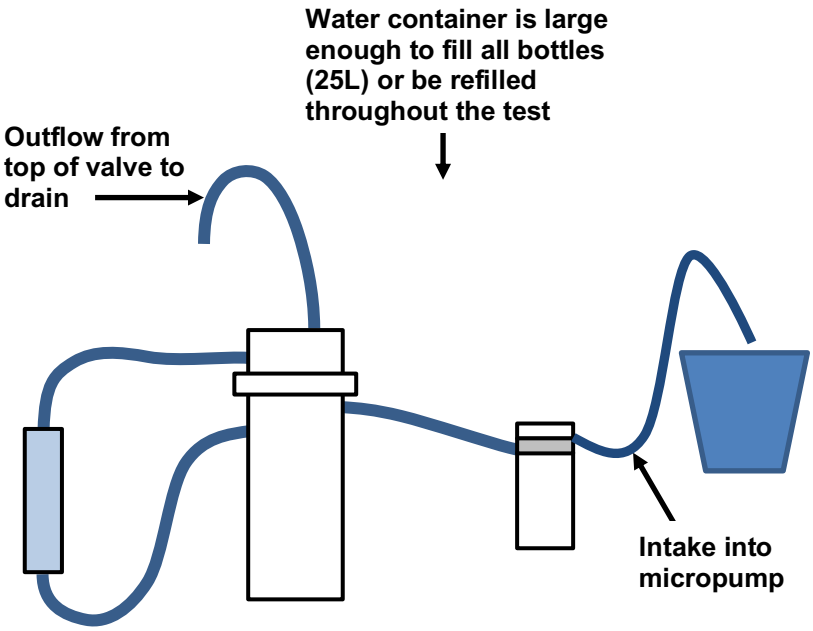


Figure 7: Micropump with Reversed Connections and Water for Test

3. Connect the COM cable to a computer and run McLaneTerm and start a capture file to record the session.

Figure 8: Run File Capture in McLaneTerm

4. In the terminal, press [CTRL]- [C] three times in quick succession to wake up the RAS. The Main Menu should appear. If not, make sure the correct COM port is selected not in use by another program.
5. From the Main Menu, select <6> to deploy the system.
6. Set the time if incorrect
7. Set the number of events to 48.
8. Set up deployment schedule. Select option 2 for start time and interval. The start time can be left as the current time to start immediately. Set an interval for 5 minutes as the minimum time required between samples.
9. Make sure the sample volume is 500ml and that the acid flush is disabled.

```
Header  A| backfill volume test
        B|
        C|
 Acid   D| Pre-sample acid flush:    Disabled
        E| Flushing volume     =       NA  [ml]
        F| Flushing time limit =       NA  [min]
        G| Exposure time delay =       NA  [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    =       15  [sec]

        V| Verify and proceed.

         Selection  [D] ?
```

Figure 9: Deployment Settings

10. Verify and continue with the deployment. A warning may display that events are overlapping and the next event will start as soon as possible. This is acceptable for the backfill test, as the time of the sample does not need to be exact. Continue and deploy the system. Wait for the system to complete its deployment.

11. After the RAS completes all 48 samples, visually inspect the water levels inside the sample tubes. The water should be fairly close in all 48 bottles. Using a graduated cylinder, measure the amount of water in any sample tube that appears to be low. Confirm the volume falls within a range of 480-520 ml.

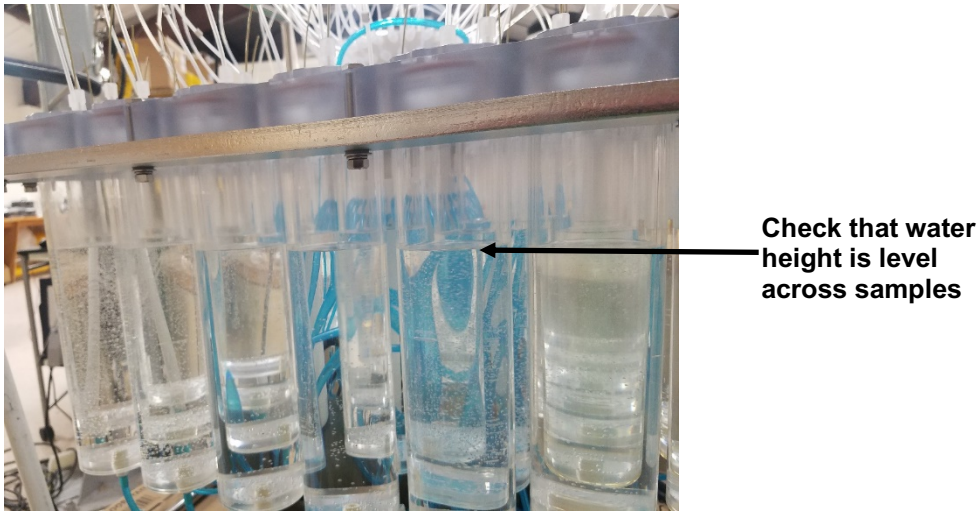


Figure 10: Check for Level Water Height Across Samples

12. From the Main Menu, select <7> to offload data to the capture file. Choose option 1 for all data and wait for offload to be completed.

13. After all data is offloaded, close the capture file. If water volumes are not within acceptable ranges in all samples, contact mclane@mclanelabs.com for technical support.