Assembly Instructions

ROCKLAND SCIENTIFIC

VMP-500LP

Revision 0

2013 September 11

REVISION HISTORY

	Date	Description
0	2013 September 11	First Release

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1 INTRODUCTION

This document describes how to assemble the Rockland Scientific International (RSI) Vertical Microstructure Profiler 500 Low Power (VMP-500LP) oceanographic instrument.

The VMP-500LP is a free-falling tethered instrument. Its standard maximum depth is 500 meters. Power is supplied to the instrument via the Tether Cable. Data is transmitted in real-time up the Tether Cable and displayed and logged on a computer on the support ship. Accessories and sensors are mounted on the VMP Pressure Tube. It has a Fin attached at the rear for mounting the Drag Brushes and cable termination.

The Rockland Scientific website download section contains many application notes as well as copies of the ODAS-RT software and the Matlab Processing software library.

2 TOOL LIST

To assemble the VMP-500LP prior to deployment the following tools are required:

- 1 1/16 socket on 6 inch extension and ratchet (for pressure tube sealing nuts)
- 1 1/2 inch socket and ratchet
- 1 1/2 inch wrench (for 5/16 nuts/bolts that secure tail fin mounting brackets)
- 1 7/16 inch wrench or socket/ratchet (all 1/4 inch bolts and nuts)
- 1 3/8 inch wrench (#10 nuts)
- 1 7/64 Hex Key (#6 Socket Head Cap Screws)
- 1 5/32 Hex Key (#10 Socket Head Cap Screws)
- 1 3/16 Ball End Hex Driver (1/4-20 Socket Head Cap Screws – brush bumpers)
- 1 5/16 Nut Driver (hose clamps)
- 2 28.3 inch releasable cable ties for securing cables on pressure case
- A/R 6 inch cable ties (to secure tether and SBE3/4 cable to tail fin)
- A/R 4 inch cable ties (to secure eddy brush to nose guard ring and to tie down excess length of 28 inch releasable cable ties)

3 SOFTWARE TO INSTALL

The ODAS-RT package must be installed on your data acquisition computer. The ODAS-RT Oceanographic Data Acquisition System Software User Guide provides a full description of the installation and usage of the software. All registered users can download the latest software and manual from the Rockland Scientific web site. To register, go to www.rocklandscientific.com, click on “Downloads” and fill out the required information under “New User Registration”.

4 MATLAB LIBRARY SOFTWARE INSTALLATION

Data viewing and processing requires the Matlab ODAS Library of functions. The software and its User Guide can be downloaded from the Rockland Scientific Web Site by all registered users.
The Matlab ODAS Library, which is common to all instruments made by RSI, provides the functions needed for routine processing of data files including, but not limited to, file conversion to Matlab format, conversion to physical units, data visualization, spectral estimation and examples of the calculation of the rate of dissipation of kinetic energy.

The Matlab Library should be installed within your search path so that the functions are available in all directories of the computer used for data processing.

5 ASSEMBLY OVERVIEW

The VMP-500LP typically is shipped in two crates. One crate contains the main instrument as seen in **Figure 1**; the other contains the Winch and other ancillary equipment.

Figure 1: Main unit in shipping crate

The assembly of the VMP is usually completed in the following order:

1. Confirm instrument communicates.
2. Attach Nose Guard.
3. Attach Tail Fin.
4. Attach Brushes to Fin.
5. Attach Sea-Bird Brackets to Pressure Tube.
6. Connect Cables.
7. Secure hoses and cables.
8. Install Probes and Sensors.

6 UNPACKING

Remove the main instrument from the shipping crate. Inspect the VMP-500LP and parts for damage or missing items.

Figure 2: Main instrument removed from shipping crate

7 CONFIRM INSTRUMENT COMMUNICATES

Before proceeding, it is prudent to confirm the instruments ability to communicate with the computer. To do this you will need:

- VMP-500LP
- Deck Cable and Power Supply
- UTrans (USB Transceiver)
- Computer with a USB port

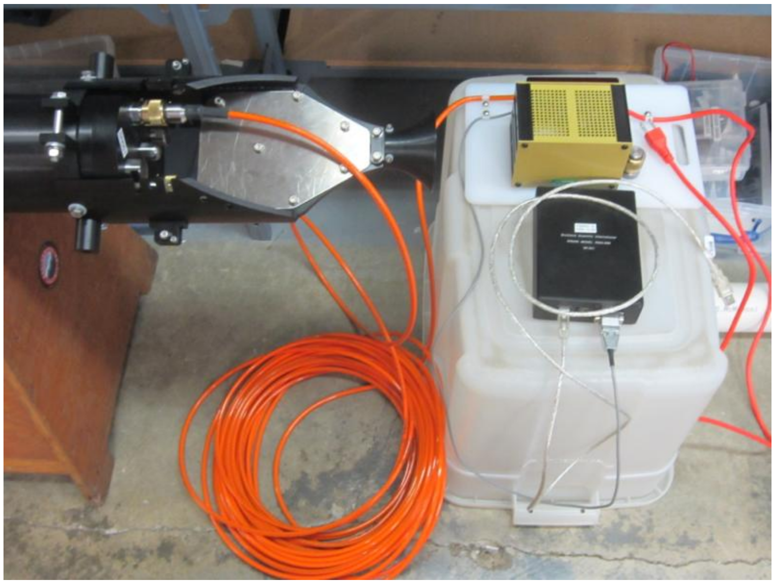


Figure 3: Deck Cable Connected to VMP

Verify communication by following these steps:

1. Turn on computer.
2. Attach the USB cable to computer with the USB-A Connector.
3. Plug the USB-B Connector into UTRANS. Listen for 3 rings to confirm UTRANS is functioning.
4. Remove the Cap from the 4-pin MHDG marked “I/O” on the VMP Rear Bulkhead. CAUTION: Ensure that the O-ring stays in the Cap.
5. Plug MHDG end of Deck Cable to the 4-pin MHDG marked “I/O” on the VMP Rear Bulkhead.
6. Plug the 9-pin “D” connector end of the Deck Cable to UTRANS. Figure 3 shows the deck cable connected to the VMP and to UTRANS.
7. Start ODAS-RT on your computer.
8. Load the setup file for your instrument.
9. Plug the AC power connector end of the Deck Cable into the AC power supply.
10. NOTE: The VMP-500LP will turn on as soon as power is applied.
11. Go to the “Calibration” sub-menu of ODAS-RT, and “calibrate” channel 0. The mean value should be small (±10 counts) and the standard deviation should also be small (~0.5 counts).
12. Now “Calibrate All” Channels. All channels should have a “green” response.
13. Look for the green YES in the Active column. If all are not green, do not proceed any further. Take any required corrective action.
14. Return to the main menu and press “Connect”. Certain channels such as pressure and ground should be displaying small but non-zero values that change slightly every second. This completes the communications check.
15. Continue with assembly of the unit.

Assembly can be carried out aboard ship from this point forward.

NOTE: Before deployment confirm the instrument's ability to communicate with the computer through the Tether Cable and winch connections. This is done by the same procedure as above, except that:

1. The tether cable on the winch is connected to the rear bulkhead of the VMP-500LP

2. The deck cable is connected to the slip ring on the winch.

8 INSTRUMENT ASSEMBLY

8.1 Nose Guard

The bottom ring of the Nose Guard sheds eddies which will interfere with the shear probe signals. To eliminate these eddies it is necessary to attach a brush. **Figure 4** shows the brush mounted on the Nose Guard. The supplied brush is 1 meter long with a 13 mm diameter. It is secured to the trailing edge of the ring using 8 or 9 4-inch zip ties. This is sufficient to break up the eddies and give a clean signal in the data.

Figure 4: Eddy Shedding Brush on Guard Ring.

Carefully slide the Nose Guard over the Nose Cone and the Front Bulkhead (**Figure 5**). Note that the Nose Guard has a layer of plastic tape on the inside diameter of the mounting ring to protect the anodized aluminum pressure case from scratching.

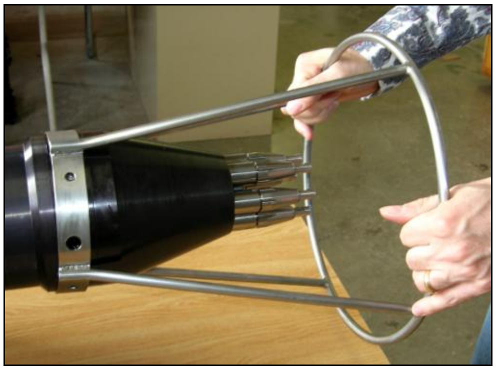


Figure 5: Sliding Nose Guard over Nose Cone.

Align the holes in the guard mounting ring to the Pressure Port and mounting holes on the Front Bulkhead. Use ¼-28 x ½" bolt, lock washers, and flat washers to secure the Nose Guard to the Front Bulkhead.

NOTE: Apply thread lubricant (e.g. Never-Seez) to the bolts before installing (**Figure 6**). This will minimize the chance of galling and help protect the threads.

Figure 6: Installing bolts with Never-Seeze on threads.

8.2 Termination Mounting Clamps

Install the tail fin mounting bracket clamps to the tail end of the pressure case using 5/16 X 2-1/2” bolts with Nylon Flat washers, lock washers and nuts.

NOTE: Ensure the chamfered ends of the Termination Mounting Clamps face the chamfered end of the pressure case. Slide the clamps up against the pressure case chamfer.

Align the clamping ears so that they are at 45° to the underwater connectors on the Rear Bulkhead as shown in **Figure 7**. Tighten the Termination Mounting Clamps so that there is about a 1” (25 mm) gap between the faces and ensure that the faces are parallel.

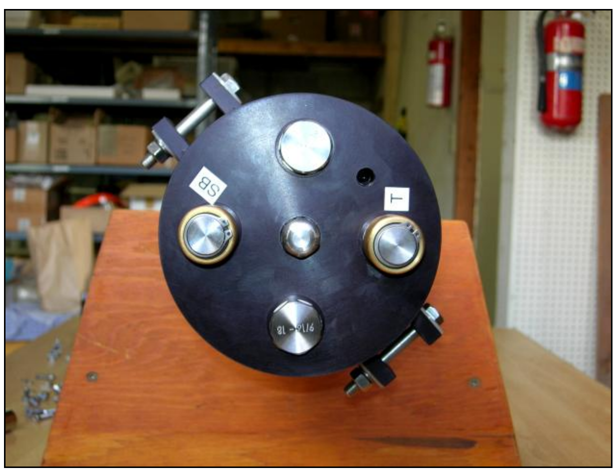


Figure 7: Termination Mounting Clamps on Pressure Case.

8.3 Termination Tail Fin

Slide the Tail Fin over the rear bulkhead and Mounting Clamps (**Figure 8**).

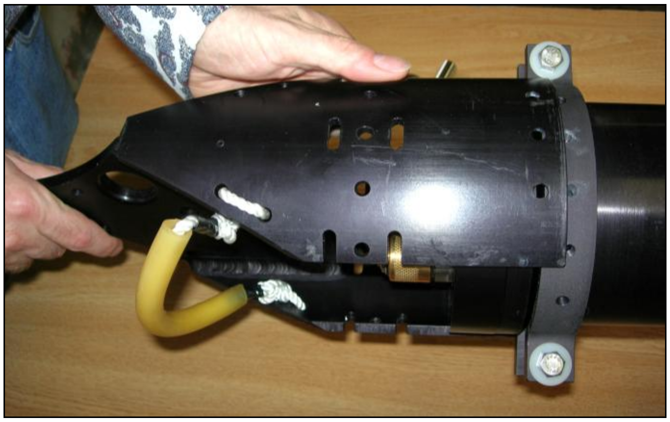


Figure 8: Sliding Tail Fin over Rear Bulkhead/Mounting Clamps.

Align the three mounting holes on each side of the Tail Fin with the holes in the Mounting Clamps. Orient the Tail Fin so that the groove-less side aligns with the Tether end cap connector "I/O" (**Figure 9**).

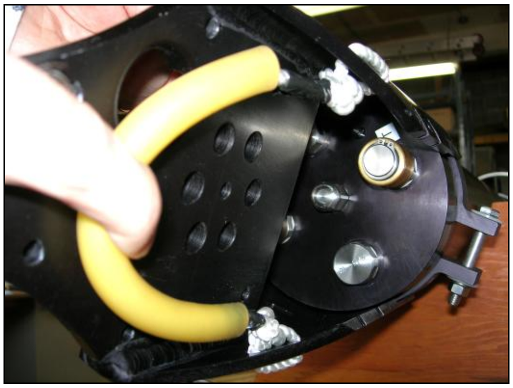


Figure 9: Groove-less side of Tail Fin aligned with Tether "T" connector.

Refer to **Figure 10** and secure the Tail Fin to the mounting clamps using one (1) 1/4-28 X ½" socket head cap screws through the "brush bumpers" in the center mounting hole and two (2) 1/4-28X1/2" bolts with a lock washer and nylon flat washer on each side of the tail fin.

NOTE: use Never-Seeze or a similar thread compound on the threads. This will help protect the threads in the aluminum Mounting Clamps from being corroded. Grease will work if Never-Seeze (or equivalent) is not available.

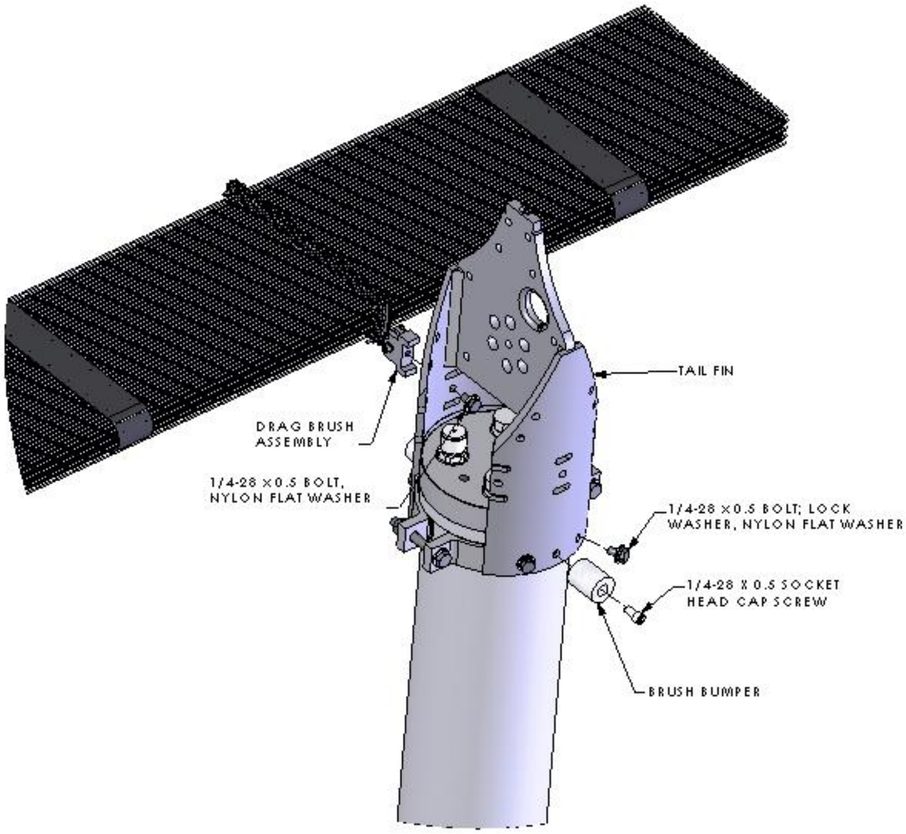


Figure 10: Tail Fin Assembly

8.4 Brushes

Attach the two Brushes to the Tail Fin using 1/4-28 X 1/2" bolt with nylon flat washers as shown in **Figure 10** and **Figure 11**.

NOTE: Ensure the brushes fold down towards the nose. The brushes can be installed prior to mounting the Tail Fin.
NOTE: Ensure the brushes move freely and verify that the pivot screw and stop screw are secure.

Figure 11: Brush installed on one side.

NOTE: There are three mounting positions on the Tail Fin side plates. Any position can be used. Mount the brushes so that they are oriented 180° to each other. See **Figure 12**.

Figure 12: Brushes installed 180° to each other.

8.5 Sea-Bird Brackets

The mounting brackets for the SBE3/4 are pre-assembled. They are a two piece assembly held together with two 1/4-20x1" Flat Head Socket Drive Cap Screws. Check to ensure these are tight using a 5/32" Hex Drive.
Take the Sea-Bird SBE-3 Temperature and SBE-4 Conductivity Sensors and mount them on the mounting bracket (**Figure 13**). Loosely secure in place with the #64 hose clamps and adjust their orientation. Then secure the hose clamps. There is plastic tape on the SBE-3 and SBE-4 to protect the aluminum cases from being damaged by the hose clamps.

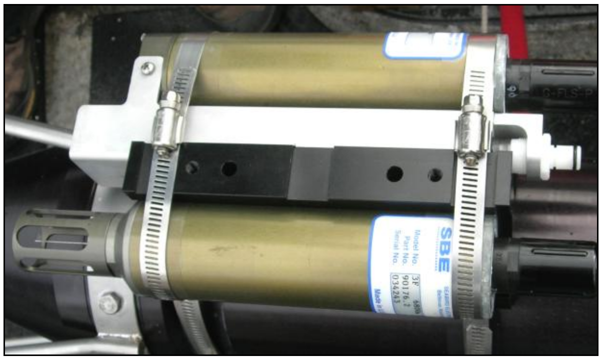


Figure 13: Sea-Birds attached to bracket assembly.

Mount the SBE3/4 bracket assembly onto the Pressure Tube so that it is roughly in-line with the SB connector on the rear bulkhead. Secure using #96 hose clamps (**Figure 14**). The sensing elements must face towards the Nose Cone.

NOTE: The pressure case has clear UHMW plastic tape wrapped around the tube where the #96 hose clamps are clamped. This tape is to protect the anodized aluminum tube from damage by the hose clamps. Inspect the tape for cuts and damage. Replace if necessary.

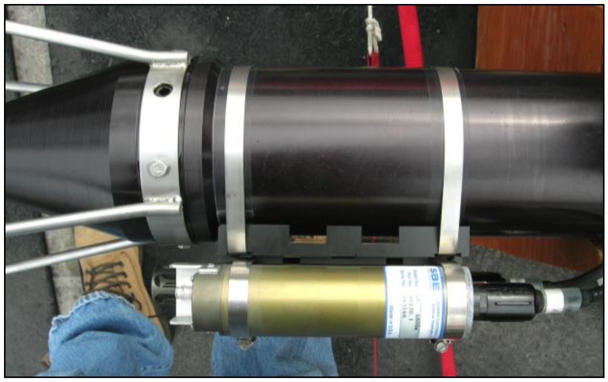


Figure 14: Mounted SBE3/4 Bracket Assembly.

8.6 Tether Cable

Use a cable tie to secure a 6 inch long piece of split 5/16-inch internal diameter Tygon around the Tether Cable approximately 32 inches from the MHDG-4 Underwater Connector end. The Tygon cable sleeve will protect the cable from abrasion at the bellmouth.

Feed the Tether Cable through the bellmouth. See **Figure 15**.

Attach the bellmouth mounting bracket to the funnel using two 6-32 x 3/8" SHCS and nylon flat washers. See **Figure 16**.

Figure 15: Tether Cable routed through bellmouth.

Figure 16: Funnel bracket attached to bellmouth.

Route the cable through the big hole in the Tail Fin from the groove side to the smooth side as shown in **Figure 17**, so that the latex cable termination passes through the hole.

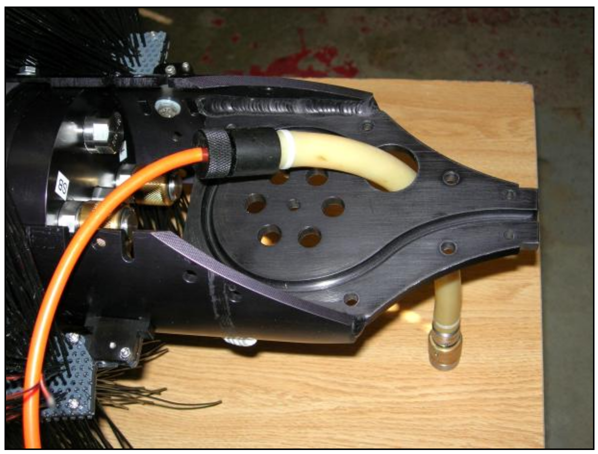


Figure 17: Tether cable through hole in Tail Fin.

Push the cable into the groove with your fingers, it should seat itself and route smoothly as seen in **Figure 18**. Mount the funnel by using two 10-32 x 1" SHCS, 2 nylon FW, 2 nylon shoulder washers and two Nylok nuts to bolt the funnel bracket to the Tail Fin. The Tygon cable sleeve should just touch the end of the Tail Fin where the cable exits the groove.

NOTE: The slot in the bellmouth bracket fits over the cable in its groove.

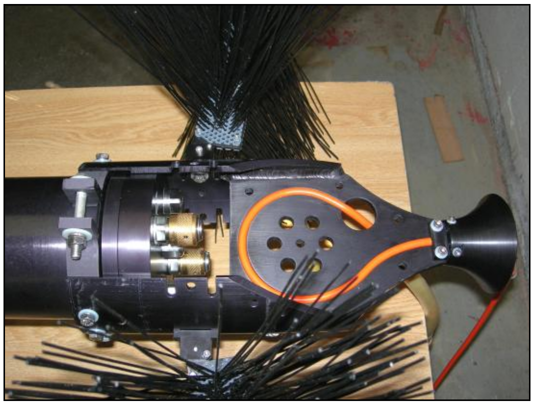


Figure 18: Cable in groove and funnel mounted to tail fin

Connect the Tether Cable to the 4-pin underwater connector marked “I/O” on the rear bulkhead. Route cable and secure using 6” cable ties as shown in **Figure 19**.

CAUTION: Verify the cable connector has its 2-017 O-Ring installed at the bottom of the brass housing.

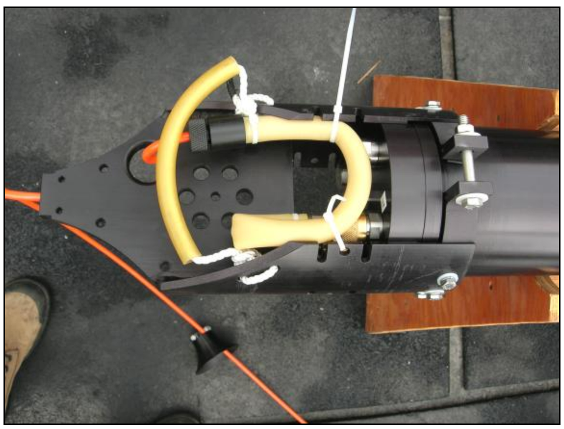


Figure 19: Tether Cable connected to VMP-500LP

Clamp the cable into the groove with the stainless steel clamp using seven (7) 10-32 x 1” SHCS with one nylon FW, one nylon shoulder washer, and one Nylok nut. See **Figure 20** for assembled plate image.

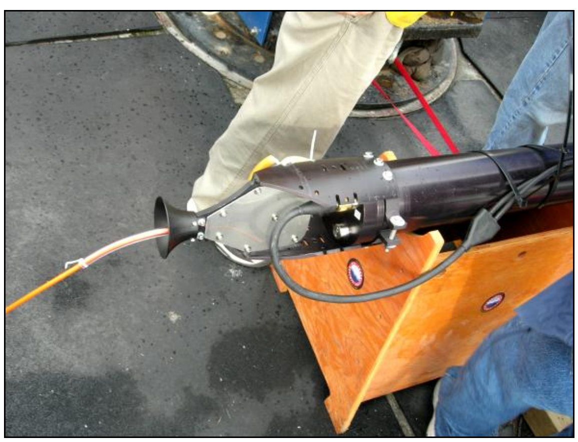


Figure 20: Tether clamp plate installed

8.7 Sea-Bird Temperature, Conductivity Sensors Cable

Remove dummy plugs from the SBE3/4 sensors and from the mating cable ends. Apply a small amount of grease to the cable connector end and connect to the sensor. Squeeze the connector ends to release any trapped air from the connectors (**Figure 21**).

CAUTION: The SBE3 and SBE4 have the same connector. Each cable is marked for its sensor. Verify that the correct cable is attached to its sensor.

Figure 21: Connecting SBE3/4 Cables.

Secure SBE3/4 Cable to the Pressure Tube using two 28” re-usable cable ties. See **Figure 22**. Secure the extra length of the big cable ties with small 4” cable ties (see **Figure 23**).

Figure 22: SBE3/4 Cable secured to Pressure Tube.

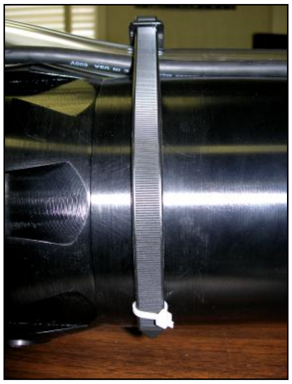


Figure 23: Extra length secured.

NOTE: Route the cable as straight as possible along the Pressure Tube. Any curves or angles could cause the VMP to rotate while profiling which could result in kinks and damage the Tether Cable.

Connect the SBE3/4 Cable to the 8-pin underwater connector labeled SB on the endcap. The cable is longer than required so it is necessary to loop the cable around to make it tuck neatly into the space on the Tail Fin. Route the SBE3/4 Cable similar to the routing shown in **Figure 24**. The goal is to make a tidy routing without bending any cable too tightly. Ensure there are no loose ends of cable by securing with cable ties.

CAUTION: Verify that the 8-pin connector on the cable (MHDG-8) has its 2-017 O-Ring installed at the bottom of the brass housing.

Figure 24: Typical SBE3/4 Cable routing.

8.8 Microstructure Sensors

Figure 25 shows the typical microstructure sensor layout relative to the pressure port.

CAUTION: When probes are installed on the instrument while it is sitting exposed (on a ship's deck for example), ensure the probes are protected with either the Nose Guard or the PVC tube.

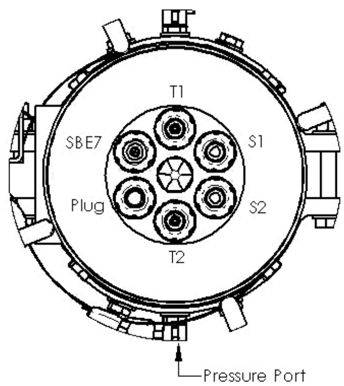


Figure 25: Typical Sensor Layout

Install microstructure sensors as follows (Note: if replacing a sensor or installing a dummy probe, follow these instructions):

i. Loosen the holder cap of the dummy probe. Usually a half to three-quarter turn is enough. CAUTION: When tightening or loosening an SMC connector, rotate either the probe or the end of the connector while preventing the cable from rotating. Allowing the cable to twist will damage the cable and connector over time.

Figure 26: Wrench on Holder - Tight

Figure 27: Wrench on Holder - Loosened.

ii. Gently pull out the dummy probe. Disconnect the SMC cable and leave it hanging out of the probe holder. Please note that the dummy probes are labeled (T1, T2, S1, S2, C1, for temperature, shear and conductivity, respectively) and these identifications must match the tags on the SMC cables attached to these dummy probes.

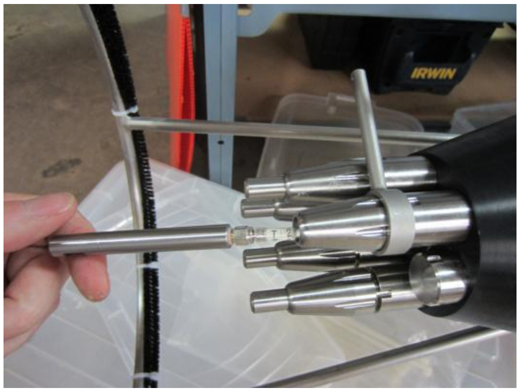
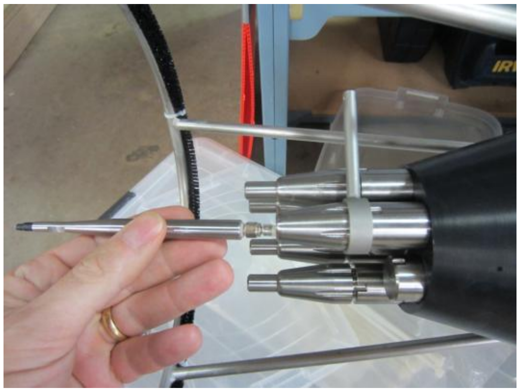


Figure 28: Dummy Probe Removed

Figure 29: SMC Cable

iii. Inspect the SMC cable on each probe port. A layer of clear heat shrink tubing should cover all exposed metallic components on the connector, electrically isolating the connector from the front bulkhead. Care should be exhibited when inserting or removing probes to ensure the heat shrink tubing remains intact. In the event that the heat shrink tubing is cut/damaged, contact RSI. Note: Check for any tarnishing or corrosion around the connector and the exposed cable section. If there is discoloration in the label of the cable, this is likely due to water ingress in the sensor port. If this occurs, you may have irreparably damaged your sensor cable. Contact RSI.

iv. Connect and tighten the temperature, shear, and the optional micro-conductivity probes into their appropriate cables. Insert the sensors into the probe holders. Make sure the probes are fully seated. You should be able to hear a "click" sound of the metal base of the probe contacting the base of the probe port. If the probe does not easily seat, try rotating the probe and reseating. Note: make sure the probe holder caps are loosened so that the o-ring is not being squeezed around the probe. If you are still having difficulty seating the probe, contact RSI.



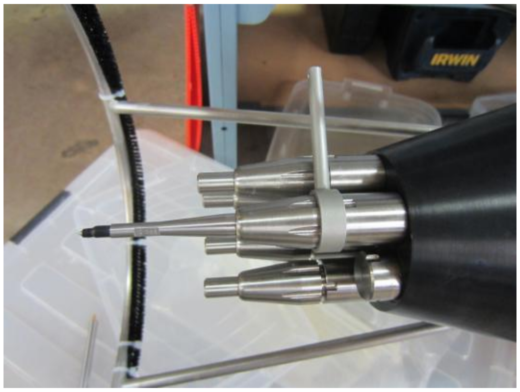


Figure 30: Probe on SMC Cable **Figure 31:** Probe Seated in Holder

v. Orient the shear probes to their proper axes and tighten the probe holders. Typically, one shear probe is aligned with the instrument's x-axis (that is, the pressure port), and the other with its y-axis. The sensitivity on a shear probe is in the direction normal to the flat section of the sensor's serial number.

vi. Note: In some cases, while tightening the probe holder cap, the shear probes will want to rotate with the cap. This is because of the friction from the o-ring inside the probe holder hole. If this occurs, make sure that the o-ring is properly lubricated. In some cases this does not fix the problem and the probes will need to be rotated before tightening so that after they are secured, they have the proper alignment.

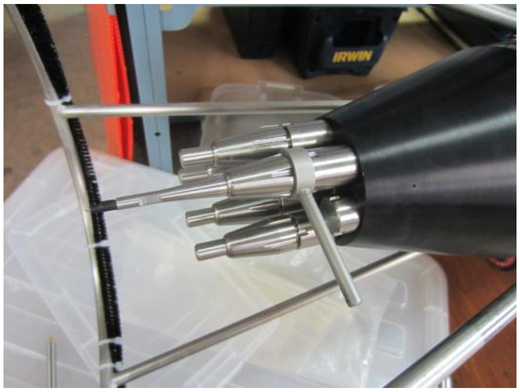


Figure 32: Probe Seated and Holder Tightened.

CRITICAL: The probe holders should not be over-tightened – tighten to the point where the probe holder caps can no longer be rotated by hand, then use the probe wrench to tighten the caps an additional 1/4 or 1/2 turn. At the proper tightness, it should be difficult to rotate the probes by hand. Over-tightening the probes will deform the plastic ferrule and affect the integrity of the o-ring seal

CAUTION: Insert the Temperature Probes last and be very careful because they are the most fragile.

CAUTION: When the Probes are installed on the ship deck, ensure the probes are protected.

9 OPERATIONS

With two brushes and the SBE3/4 installed the VMP-500LP has a fall rate of about 60 cm/sec. To increase the fall rate, either add a bit of weight to the nose end of the VMP, or remove filaments from the brushes to reduce the drag.

The VMP-500LP is light enough to allow operations without heavy equipment such as a crane. Using a correctly sized block is recommended for guiding the tether cable during deployments. For the standard 0.27 inch diameter tether supplied by RSI, the minimum bending radius is 6 inches.

When deploying a tethered microstructure profiler, the tether is paid out more quickly than the instrument falls. This ensures that the instrument is decoupled from the ship and thus vibrations are minimized. Typically the tether is paid out such that there are two loops of cable at the surface approximately one to two meters in diameter.

10 PRE-DEPLOYMENT CHECK LIST

Employ the following checks before deployment

- ☐ Make sure all o-rings are not damaged; clean and lubricated.
- ☐ Make sure all sealing surfaces are clean and intact – no scratches or corrosion.
- ☐ Make sure all screws and bolts are tight.
- ☐ Make sure the instrument Pressure Case is fully sealed, i.e. no gaps at the Nose Cone and Bulkheads.
- ☐ Make sure that all components are secure, i.e. nothing is loose or rattling.
- ☐ Make sure cables are tied down.
- ☐ Make sure that the Probe Holders are tight to the Nose Cone.
- ☐ Make sure the probes are secured and fully seated in the Probe Holders.
- ☐ Make sure the Shear Probes are oriented as desired.
- ☐ Confirm all rubber underwater connectors have been greased before connecting.
- ☐ Confirm all metal (MHDG) underwater connectors have the O-ring installed in the male and female halves.
- ☐ Make sure all underwater cables have been properly connected and any trapped air released.
- ☐ Make sure the Nose Guard is installed so that the Pressure Port is visible.
- ☐ Make sure the Tether Cable has been properly clamped at the termination.
- ☐ Connect the SBE5 Pump (optional).
- ☐ Confirm the instrument is communicating with the computer through the Tether Cable and winch connections.
- ☐ Edit ODAS4-RT setup file to set the data file name. We recommend inserting the date as part of the name. This will help prevent the chance of overwriting files.

11 VMP-500LP OVERVIEW

The VMP-500LP is a free-falling 500 meter rated real-time microstructure instrument. It is connected to the shipboard data acquisition computer by a four conductor electro-mechanical tether. Two conductors supply 200VDC power and two conductors provide the serial communication link.

Up to six microstructure sensors can be installed. Typically the installed sensors are two shear probes and two FP07 fast response thermistors, with two spare sensor ports. A SBE-7 micro-conductivity sensor can be added to one of the spare ports. Note: When a sensor is not installed, a "Dummy" probe is installed in its sensor port. In addition, the T and C dummy probes have internal termination resistors so that the signals produced by these dummy probes are approximately at mid-scale of its sensor. The shear dummy probes are un-terminated and this simulates the signal from a shear probe when it is unperturbed by turbulence.

A Sea-Bird SBE-3 (Temperature) and SBE-4 (Conductivity) can be installed on the VMP-500LP as an option. The data from these sensors is logged along with the microstructure data.

On the rear bulkhead of the instrument are two underwater connectors:
Impulse MHDG-4 for the tether connection
Impulse MHDG-8 for the Sea-Bird SBE3/4 pair

A small tail is mounted aft of the rear bulkhead. The tail provides the instrument with the tether strain relief clamp and the mounting point for the drag brushes. The drag brushes control the descending speed of the VMP-500LP and increases the pitch stability of the instrument.

Power is supplied to the VMP-500LP by the 200VDC power supply on the Deck Cable. Inside the VMP-500LP a converter steps this voltage down to 12VDC for the Power Supply board.

The electrical system in the VMP-250 consists of the following items.

- A power supply board that has DC-to-DC converters to provide a +5VDC power rail to all analog components, a 3.3VDC rail for all digital components, and raw power equal to the supply voltage less 1V for optional equipment. A precision 2-axis inclinometer measures the pitch and roll of the instrument, and this too is available to the data acquisition system.
- An analog signal conditioning board that handles two shear probes, two thermistors, a pressure transducer and two piezo-accelerometers. It also, provides anti-aliasing filters on all channels, and has an ultra-linear, extremely low-noise 16-bit analog-to-digital converter.
- Tthe RSTRANS (Remote Serial TRANSceiver) that communicates in real-time with the deck unit, communicates with the other boards in the system and provides an input for signals from an optional Sea-Bird SBE3F thermometer and a SBE4C conductivity cell.
- An optional board for a µconductivity sensor.

11.1Power-Supply Board (P050)

A 0.25A fuse is mounted on the board at its power input. It is sufficient for handling the normal load of the instrument. If the user wishes to use the switched and raw output port of the board, then the fuse capacity has to be taken into account. Please, consult RSI for such applications.

DC-to-DC converters provide the power rails of +5V for all analog circuits and 3.3V for all digital circuits. These converters are turned on in sequence (3.3V, then 5V, and then raw output).

A 2-axis inclinometer is mounted on the power supply board. It has an accuracy of ±0.1º over the oceanic temperature range. One inclinometer is sensitive to tilting of the *y*-axis. The other unit is sensitive to tilting of the *z*-axis. On a vertically profiling instrument, such as the VMP-500LP this axis is vertical, nominally at 90º, and it is not very sensitive to tiling in the x-direction. This inclinometer is primarily intended for quasi-horizontal profilers, where the axis of the instrument is conventionally the *x*-axis, in which case it gives a very good measure of the pitch of such a profiler. The standard channels are 40-42 for the *x*- and the *y*-inclinometers and the inclinometer temperature, respectively.

The power supply board has 4 channels of analog input for optional signals. The input must be in the range of 0-to-5V. There are no anti-aliasing filters on these inputs other than a simple RC network with a cut-off of 40Hz. The input-to-output relation of these channels is

$$V_{in} = 2.560 + \frac{N}{12800} \tag{1}$$

where V_{in} is the input voltage and *N* is the signed 16-bit number produced by the analog-to-digital converter. The standard channel addresses are 33 through 36.
In addition to monitoring the input voltage from the battery, the power supply board also measures this voltage, and its input-to-output relation is

$$V_{Bat} = \frac{N}{1600} \tag{2}$$

where *N* is the signed 16-bit number produced by the analog-to-digital converter. The standard address is 32 for the battery measurement.

11.2 Back-up Battery in the VMP-500LP

A lithium CR123 battery is mounted on the power supply board. It maintains the logic function of the power supply board,. It has enough capacity to last about 6 months. When this battery is depleted, the VMP-500LP cannot be turned on. Therefore, the user should always insert a fresh new battery before every major deployment and certainly after the instrument has been in storage for more than a few months. When the instrument is turned on, no current is drawn from the CR123 battery.

11.3 Analog Signal conditioning board, µASTP-LP (P049)

The analog signal conditioning board supports 2 shear probes, 2 FP-07 thermistors, a pressure transducer and two 1-axis piezo-accelerometers. This board is the heart of the data acquisition system and it is extensively calibrated and tested for noise. Each instrument is supplied with a calibration certificate documenting the performance of this board. This report is also required to convert the data from certain channels into physical units. The piezo-accelerometers have no DC response and are treated like a shear probe channel. Their primary purpose is to sense the vibrations of the instrument in the *x*- and *y*-directions. The DC- and low-frequency response to tilting is measured by the inclinometers on the power supply board.
The µASTP-LP board also provides anti-aliasing filtering at 98Hz, using 8-pole Butterworth low-pass filters, for all microstructure signals, including the piezo-accelerometers and filtering at 5Hz for the pressure signal channels. The data are sampled at 512 per second for the “fast” micro-structure signals and at 64 per second for the other “slow” channels. This is user configurable in the setup file of the data acquisition software.
The coordinate system of the VMP-500LP is as follows:

x-axis: It is directed through the threaded hole for the pressure port. Nominally, horizontal on a vertical profiler.
y-axis: Orthogonal to the *x*-axis and nominally horizontal on a vertical profiler.
z-axis: Parallel with the axis of the instrument running from the front bulkhead to the rear bulkhead. Nominally vertical and directed upwards on a vertical profiler.

The numeric assignment of the signal channels follows standard values used by most RSI instruments and this is summarized in Table 1. Further details are in the ODAS-RT User Guide Oceanographic Data Acquisition System.

Ch #	Name	Signal
0	gnd	Analog ground.
1	Ax	*x*-axis piezo-accelerometer.
2	Ay	*y*-axis piezo-accelerometer.
4	T1	Thermistor 1.
5	T1_dT1	Thermistor 1 with pre-emphasis.
6	T2 or NA	Thermistor #2. Not used if a µ-conductivity sensor is installed.
7	T2_dT2, or C1_dC1	Thermistor 2 with pre-emphasis, or µ-conductivity sensor 1 with pre-emphasis.
8	Sh1	Shear probe 1.
9	Sh2	Shear probe 2.
10	P	Pressure.
11	P_dP	Pressure with pre-emphasis.
12	PV	Voltage on high-side of pressure transducer.
16	sbte	SBE3F, LS 16 bits, optional.
17	sbto	SBE3F, MS 16 bits, optional.
18	sbce	SBE4C, LS 16 bits, optional.
19	sbco	SBE4C, MS 16 bits, optional.
32	V_Bat	Battery voltage divided by 10.
33-36		Spare analog inputs
40	Incl_x	*x* –inclinometer.
41	Incl_y	*y* –inclinometer.
42	Incl_T	Inclinometer temperature
256	Sp_char	Special Character, 7FF0H

Table 1. Numeric assignment of signal channels in a VMP-250.

11.4RSTRANS (P004) Real-Time Communication Board

In a real-time transmitting instrument, all communication with the instrument is handled by the RSTRANS board. The RSTRANS board accepts addresses sent by the companion UTRANS via the instruments tether and transmits a data word, for every address received, back to the UTRANS. It is designed for long-line communication and uses RS485 drivers and Manchester II encoding. A 14-line Serial Instrument Bus is used to transfer address- and data-words internally between the RSTRANS and the µASTP-LP and power supply boards (see application note AN-011). The board also supports two frequency input channels that are used with the optional Sea-Bird SBE3F thermometer and SBE4C conductivity cell.

12 POST CRUISE DISASSEMBLY AND PREPARATION FOR SHIPMENT

Disassembly is generally a reverse of the assembly procedure. Upon disassembly ensure the following are completed:

a. Remove the Microstructure probes and clean with fresh water. Carefully package them into their sheaths. Install Dummy Probes in Probe Holders. The Dummy Probes are stamped:
    S1 – Shear 1
    S2 – Shear 2
    T1 – Temperature 1
    T2 – Temperature 2
    MC – Micro Conductivity
b. Rinse the instrument, fasteners, parts and all ancillary equipment thoroughly with fresh water. Ensure all salt water residue is removed, especially from all threads.
c. Flush the Pressure Port with Isopropyl Alcohol followed by fresh water to prevent biological growth. If bleach is available, flush with 50:1 water-to-bleach solution followed by fresh water.
d. Rinse, Clean and Store SBE4 per Sea-Bird Electronics Application Note No. 2D

e. Carefully return the VMP and ancillary equipment back in crates.

13 UPON RETURN TO LAB

Please see Rockland Scientific International, Maintenance Instructions: Vertical Microstructure Profiler, Revision 1 dated June 18, 2008. As a minimum wash all exposed parts in fresh water. Clean, inspect and lubricate all seals. Replace O-rings at least every two years.