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MicroRider-1000
Modular, Self-contained Turbulence Profiler

Description

The MicroRider is a small instrument package for turbulence measurements, designed to integrate with a variety of instrument carriers, such as AUV, ROV, CTD rosettes, ocean gliders, and profiling floats. The MicroRider carries the following sensors

- Velocity shear probes (SPM-38-1),
- Fast response thermistors (FP07-38-1),
- Micro conductivity probe (SBE7-38-1)[1]
- High-resolution pressure sensor;
- High-resolution acceleration sensors;
- Tilt sensor.

microRider-1000

The instrument is powered by 9 – 18 VDC and data are recorded internally on a memory card. The MicroRider will start recording as soon as power is applied, or upon receiving a digital trigger signal. As an option, one external signal input or output (analog signal or frequency) is available, so that data records from the MicroRider can be correlated with other instruments' records. Sampling frequencies for individual channels can be set by software between 8 Hz and 4096 Hz, where 512 Hz is the recommended frequency for turbulence signals.

All signal channels are supported by proprietary low-noise signal conditioning circuits, which are carefully calibrated for frequency dependent gain to ensure maximum fidelity of the measured temperature variance and shear spectra. The data recording system consists of high-Q anti-aliasing filters (see our application note AN010 at www.rocklandscientific.com for details), a low-distortion analog-to-digital converter, and a computer running our Linux data acquisition system ODAS5-IR.
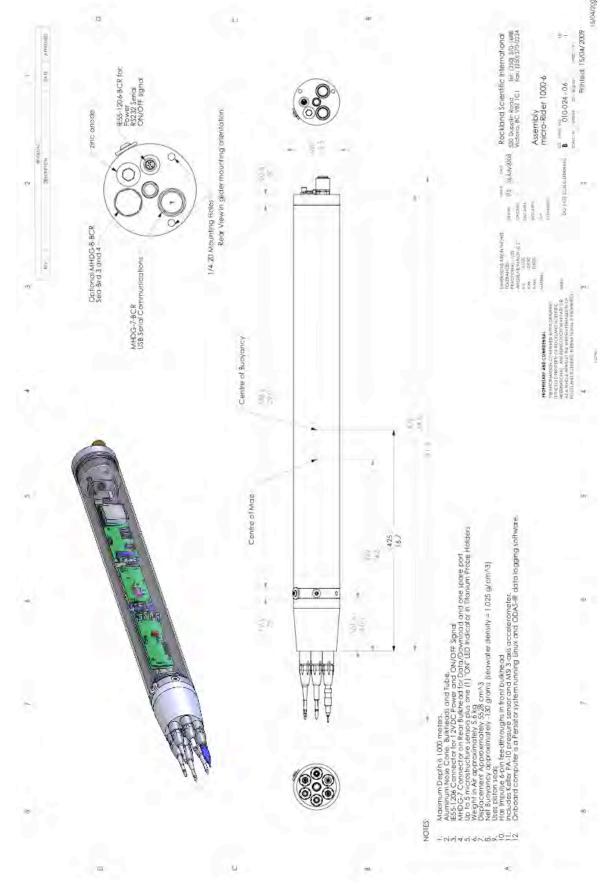
To improve the signal-to-noise ratio at high frequencies, the thermistor and pressure signals are provided both as a direct measurement (i.e., T and P) and as pre-whitened signals (i.e., T+dT/dt and P+33dP/dt). The pre-whitening procedure is akin to the Dolby® Stereo noise reduction system.

The internal accelerometers provide vibration information. Since the MicroRider is designed to ride on a wide range of instrumentation platforms, the vibration data are of vital importance to the measurement. Platform vibrations that enter the signal frequency band can be effectively reduced using coherent signal processing techniques.

Data are recorded internally on a Compact Flash memory card. The data acquisition is handled by a small computer system (CF2 Persistor) that is integrated inside the pressure case. The data are downloaded through a serial connection, through a bulkhead connector at the rear end cap. The data rate from the turbulence sensors is approximately 40 MB per hour (~ 1 GB per day). This assumes that the acquisition system is running all the time. The data acquisition can be turned on/off when needed via the two control lines on the end cap.

Power (9 - 18 VDC) is supplied by the supporting vehicle (AUV, ROV, glider, etc.) through one of the underwater connectors on the rear bulkhead. This connector has four pins: 2 for the power, the other two for supplying a "trigger signal" that triggers the data acquisition on or off. This is useful for putting the microRider "to sleep" to conserve power.
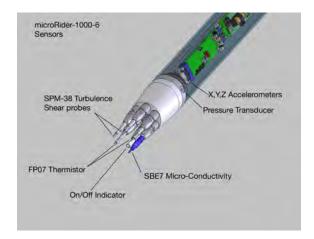
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[1] Selecting this option reduces the number of possible FP07-38 probes from two to one.

IE55-1206-BCR for:
Power
RS232 Serial
ON/Off signal

Zinc anode

Optional MHDG-8 BCR
Sea Bird 3 and 4

MHDG-7-BCR
USB Serial Communications

1/4 20 Mounting Holes

Rear View in glider mounting orientation.

Centre of Buoyancy

Centre of Mass

425
16.7

NOTES:

1. Maximum Depth is 1000 meters.
2. Aluminum Nose Cone, Bulkheads and Tube.
3. IE55-1206 Connector for 12VDC Power and ON/OFF Signal.
4. MHDG-7 Connector on Rear Bulkhead for Data/Download and one spare port.
5. Up to 5 microstructure sensors plus one (1) "ON" LED Indicator in Titanium Probe Holders.
6. Weight in Air approximately 5.6 kg.
7. Displacement Approximately 5528 cm^3.
8. Net Buoyancy approximately -130 grams (seawater density = 1.025 g/cm^3).
9. Uses piston seals.
10. Has impulse 6-pin feedthroughs in front bulkhead.
11. Includes Keller PA-10 pressure sensor and MSI 3-axis accelerometer.
12. Onboard computer is a Persistor system running Linux and ODAS-IR data logging software.

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Assembly
micro-Rider 1000-6

B   010-024-06

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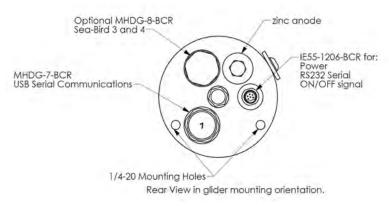PROPRIETARY AND CONFIDENTIAL

DIMENSIONS ARE IN INCHES
TOLERANCES:

Features summary

- SPM-38-1 microstructure turbulence shear probes;
- FP07-38-1 microstructure fast thermistors;
- High resolution pressure sensor;
- Two-axis, high-accuracy accelerometers for measurement instrument vibration;
- Tilt sensor
- SBE7-38 microstructure conductivity sensor;
- Support for Seabird SBE-3F / SBE-4C WOCE accuracy temperature and conductivity sensor;
- Anodized aluminum pressure case rated to 1000 m depth;

- Tapered nose cone to reduce flow deformation from pressure tube;
- On/Off indicator mounted on nose cone;
- On-board data acquisition with 4 GB memory (up to 16 GB available);
- High-fidelity signal conditioning using *signal + derivate* technique;
- ODAS5-IR real-time data acquisition software with up to 1024 Hz sampling rate;
- PLOT_ODAS library for MATLAB for data processing and display of turbulence spectra.

MicroRider on Slocum Glider

MicroRider on CTD rosette

Specifications

Pressure Rating	1000 dbar (up to 6,000 dbar available)
Analog input (optional)	-2.5V ... +2.5V or 0 ... + 5VDC
Frequency input (optional)	for SBE3/SBE4 sensors
Power	9 – 18 VDC supply. Consumption: ~ 1W operating, 10^{-5}W sleep.
Signals provided (depends on configuration)	Turbulence Shear (2x), T (2x), T+dT/dt (2x), C (2x), C+dC/dt (2x), P, P+dP/dt, Acceleration (2x), Tilt (2x)
Sampling Rate	Nominal 512 Hz for turbulence sensors, 64 Hz for slow-response sensors User configurable via setup file.
Weight	~5.5 kg in air ~ 0 kg in water
Length	0.85 m (pressure case) 1.02 m (with probes)

Velocity shear

Range	$3 \times 10^{-10} - 10^{-4}$ W kg^{-1}
Accuracy	5%
Resolution	2.5×10^{-3} s^{-1}

Water temperature (SBE 3F)*

Range	-5 – 35 ℃
Accuracy	1×10^{-3} ℃ (NIST traceable)
Resolution	1×10^{-4} ℃
Time Response	0.070 s ± 0.010

Micro Temperature (FP07)

Range	5 – 35 ℃
Accuracy	N/A
Resolution	1×10^{-5} ℃ (using signal + derivative technique)
Time Response	0.007 s ± 0.003

Conductivity (SBE 4C)*

Range	0 – 7 S/m
Accuracy	0.0003 S/m
Resolution	0.00004 S/m at 24 Hz
Time response	0.060 seconds (pumped)

* optional input

Pressure (Keller)

Range	0 – 1000 dbar
Accuracy	0.1 %
Resolution	0.0005 dbar (using signal + derivative technique)

Analog/Digital Converter

Number of channels	15 + 1 (ground)
Resolution	16 bits (true)
Linearity	15 ppm

Accelerometers (Piezo-ceramic)

Range	±2 g
Accuracy	0.5%
Resolution	3×10^{-5} g (1 – 20 Hz)
Stability/Linearity	±0.5%, ±0.01g
Frequency response	0 – 300 Hz

Micro Conductivity (SBE7)†

Range	0 – 7 S/m
Accuracy	N/A
Resolution (spatial)	~ 5 mm
Time response	infinite

Tilt Sensor

Range	Dual axis ± 90°
Accuracy	0.1°
Resolution	0.025°