

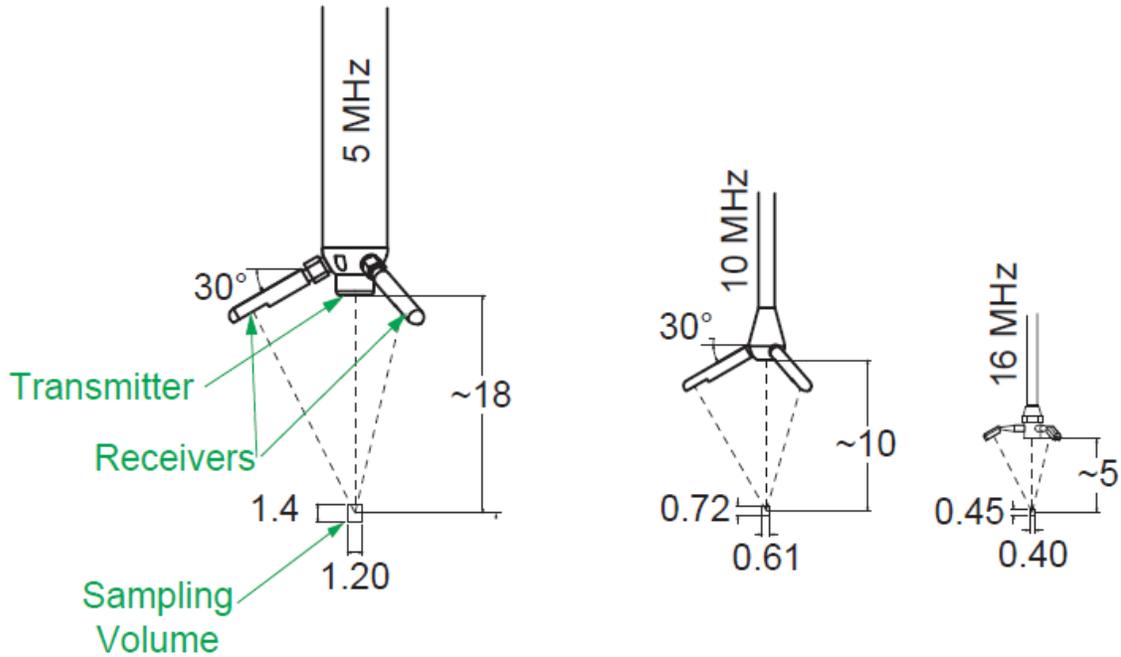


## A Primer on SonTek ADV systems

### ADV Field Systems

There are three frequencies/systems offered; 5 MHz ADVOcean, 10 MHz ADV, and 16 MHz MicroADV. The system consists of three primary components: probe, probe cable, and processing electronics, and depending on the configuration the processing electronics are located in a splash proof enclosure or underwater housing. For operation, the user pre-selects an appropriate velocity that will cover the highest expected velocities during the measurement period.

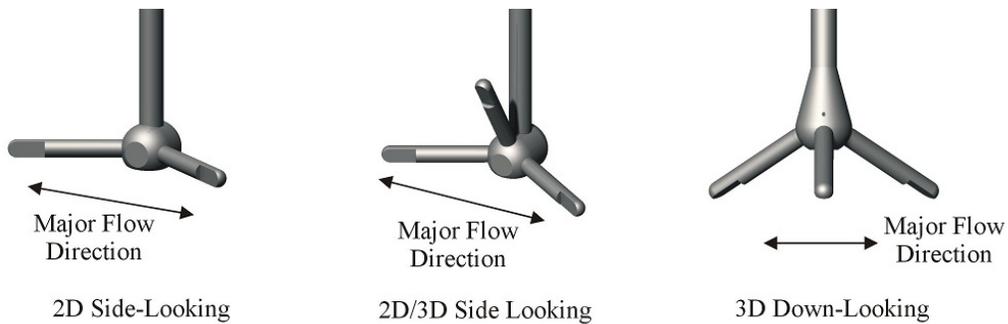
	5 MHz ADVOcean	10 MHz ADV	16 MHz MicroADV
Max. sample rate	25 Hz	25 Hz	50 Hz
Sample volume distance	18 cm	10 cm	5 cm
Sample volume size	2.0 cc	0.25cc	0.09cc
Maximum Velocities			
Horizontal	500 cm/sec	360 cm/sec	360 cm/sec
Vertical	120 cm/sec	90 cm/sec	90 cm/sec
Maximum depth (probe limit)	400m	60m	60m
Available sensor geometries	3D down	3D down 2D/3D side 2D side	3D down 2D side



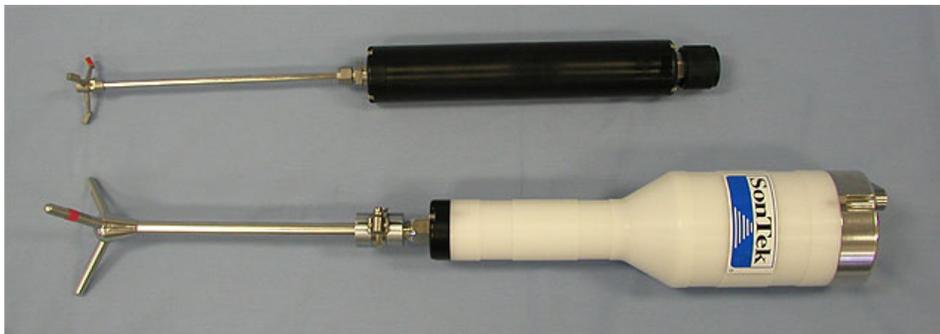
all dimensions in cm

Probe geometries

- The 10 MHz ADV is available in 3D down looking, 2D side looking and 2D/3D side looking geometries, mounted on the standard 25cm stem or optional 100cm flexible cable.



- The 16 MHz MicroADV is available in 3D down looking and 2D side-looking sensor on the standard 25cm stem or optional 40cm stem or 100cm flexible cable.
- The 5 MHz ADVOcean is only available with the 3D down looking sensor configuration, and the sensor arms are attached directly to the probe body. It is the most robust ADV probe and is an excellent solution for use in harsh, energetic environments.
- A nice feature of these ADVs is that multiple probes of the same frequency can be used with the same processing electronics (although not at the same time). If a system will be used for a range of applications that could benefit from different sensor geometries, it can be ordered with additional probes with the appropriate sensor configurations. The user then simply selects and connects the appropriate probe to use for each application.
- The probes can be equipped with a compass/tilt sensor and/or pressure sensor using the white expanded Delrin probe housing. Below is a photo showing the standard 16 MHz MicroADV probe, and a 10 MHz ADV probe equipped with the expanded Delrin housing:



#### Temperature sensors

Temperature sensors are included with all 10 MHz and 5 MHz systems, and on MicroADV systems equipped with the expanded Delrin probe housing.

#### Boundary Measurement

At the beginning of each measurement the ADV system will send out pings to determine the distance to the boundary and adjust the lag timing between the two acoustic pulses as necessary in order to avoid interference. For an autonomous deployment, the system will measure and also record the boundary distance (if within detection range) at the beginning of each measurement period. Thus, the



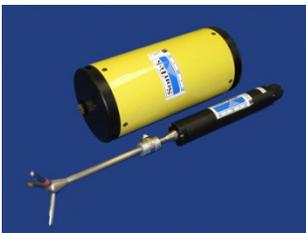
boundary distance information can be used to monitor changes in bedform topography that result from sediment transport, sand migration, etc. The nominal maximum boundary detection limits for each frequency are:

- 16 MHz MicroADV: 25cm
- 10 MHz ADV: 45cm
- 5 MHz ADVOcean: 100 cm

### ADV Field Configurations/Systems



Splash Proof – This configuration is for real-time output only using the HorizonADV software, where the computer running the software is the data logger. No external sensors are available with the Splash Proof configuration. There is an “Auxiliary” signal connector located on the electronics housing that includes analog outputs in addition to “Synch In” and “Synch Out” signal lines. The Synch In signal allows for synchronous sampling with multiple ADV systems via an external clock signal provided to all systems, which can be provided by something like a simple function generator. The analog outputs include Vx, Vy, Vz, and Mean Amplitude. The standard probe can be upgraded to include a compass/tilt sensor and pressure sensor. There is an option available for a built-in rechargeable battery, where the splash proof housing would be longer in order to accommodate the battery. The battery has enough capacity for around 6-10 hours of operation depending on system configuration and velocity range setting.



Underwater – The base configuration is essentially the same as a Splash Proof system, but with the processing electronics located in an underwater housing. Therefore, the base configuration is real-time output only using HorizonADV, but the system can be upgraded to add an internal recorder. External sensors (OBS, Sea-Bird MicroCat) and analog velocity output capability are optionally available. The Underwater system might typically be used for a real time application that requires a greater distance between the computer and probe location than could be accommodated by the length limitations for the probe cable, or where the processing electronics might be exposed to the elements and so the splash proof housing would not be appropriate.

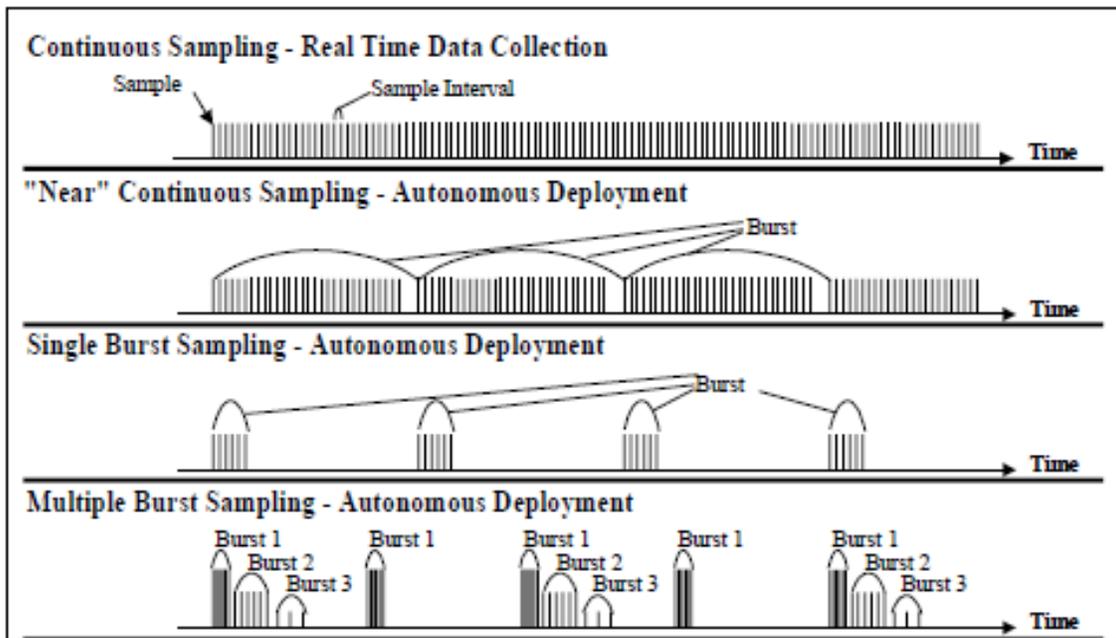


Autonomous (Hydra) – The Hydra configuration comes standard with the probe in the expanded Delrin housing and includes a pressure sensor and compass/tilt sensor, and the processing electronics come standard with a recorder. The underwater housing is longer to accommodate either one or two alkaline battery packs (two is the standard configuration). Data is post-processed using the ViewHydra software,

and the Hydra can also be used for real-time output using the HorizonADV software. External sensor integration (OBS, Sea-Bird MicroCat) is optionally available. In addition, Hydras can be configured for synchronous operation, where one system is the “Master” and provides the clock signal used to control the sample timing to other “Slave” systems.

The standard pressure sensor is a piezo-resistive strain gauge sensor with an accuracy specification of 0.1%. There is optionally available the frequency-based RPT pressure sensor, which has an absolute maximum depth limit of 20m, an accuracy of 0.01%, much higher resolution, and much better long-term stability.

A powerful feature of the Hydra is that it can be configured for multiple-burst sampling, for up to three different sampling strategies. For example, one burst might be configured for measuring mean currents using a low sample rate (0.2 Hz), another might be used for measuring turbulence using a high sample rate (25 Hz), and the third might be configured for measuring waves (2Hz). The main criteria for multiple-burst sampling is that the burst intervals for the 2<sup>nd</sup> and 3<sup>rd</sup> types must be integer multiples of the burst interval for the first type.





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## Argonaut-ADV

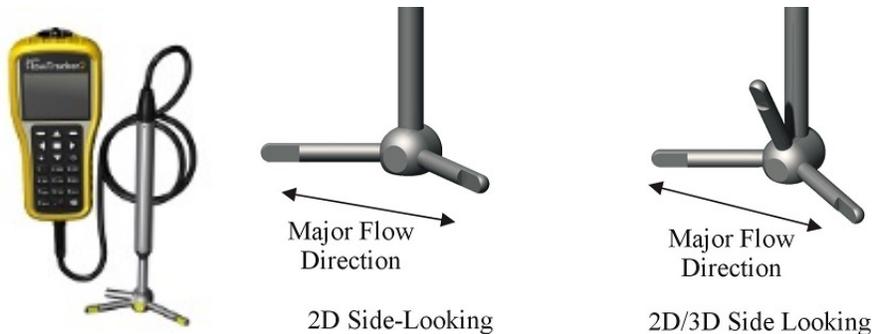


The Argonaut-ADV is a ‘one-piece’ system consisting of a 10 MHz ADV sensor on a 15cm stem, connected to a 10cm diameter Delrin housing. As it is a 10 MHz ADV, it has a 10cm distance to the sample volume. A powerful feature of the Argonaut-ADV is its Auto-Velocity range capability, in which the system will send out pings at the beginning of reach measurement period to measure the ambient velocity conditions and determine the appropriate velocity range setting to use, optimizing the velocity resolution. The system comes standard with a 4MB recorder, compass/tilt sensor, temperature sensor and alkaline battery pack. It can be used for real-time output or autonomous operation, and includes SDI-12 output capability for connecting to data

loggers, etc. A pressure sensor is available as an option. The maximum velocity limit is 4.5m/s, and the maximum installation depth limit is 60m.

As with the other ADV systems, it will measure and record the distance to the boundary at the beginning of each measurement period. The standard sensor geometry is 3D down looking, with 2D side and 2D/3D side-looking sensor geometries optionally available. The standard 15cm stem can also be optionally replaced with a 100cm flexible cable.

## FlowTracker2 Handheld ADV system



The FlowTracker2 system consists of a handheld unit and a 10 MHz ADV probe assembly with a 1.5m length cable. The probe assembly can be detached from the handheld unit, and any handheld unit can be used with any probe assembly. The probe assembly is available in 2D side-looking and 2D/3D side-looking geometries, where the ‘standard’ configuration that would typically be used for discharge measurement is the 2D side-looking configuration. There are probe extension cables available in 1.5m, 3.5m and 8.5m lengths, to support a total cable length up to 10m.



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## SonTek Technical Notes

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The FlowTracker2 handheld unit includes a large color LCD display and also has a GPS sensor for geo-referencing, with automatic or manual fixes. The handheld unit also utilizes an easily removed battery cartridge that holds 8 AA batteries, and a spare cartridge is included with the system.

The maximum velocity limit is 4.0 m/s, and the system has auto-velocity range selection. The system has both Discharge and General Measurement modes, and for the Discharge mode the system supports the Mid-Section, Mean-Section and Japanese methods. The FlowTracker2 also supports under-ice measurements.

SonTek optionally offers a wading rod kit that includes a 2-piece breakdown rod with a bubble level and the two mounting brackets for attaching the Handheld unit and the ADV sensor assembly, along with a nice hard plastic shipping case that also has room for the FlowTracker2 as well as a tagline and other miscellaneous items.