

DiP-FAST-M: Passive eDNA sampler, 5-60 m Water Depth

Document Version: 1.0

Updated: 9/12/25

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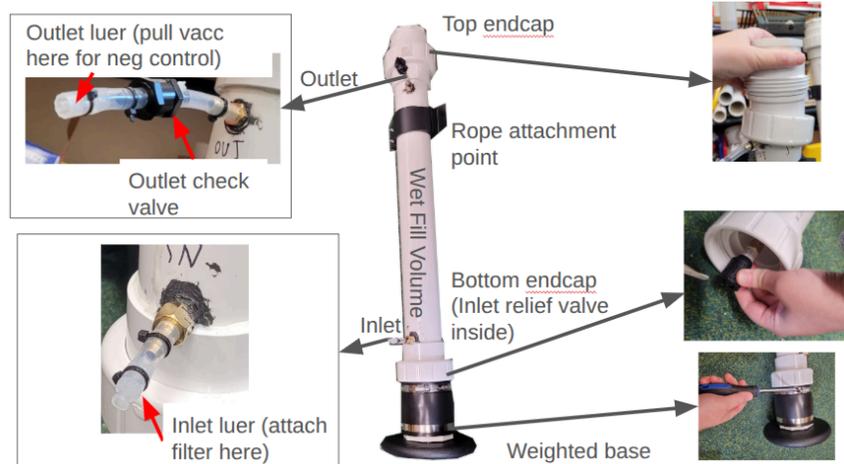
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System Description

The DiP-FAST (Differential Pressure Filtered Accumulating Sample Tube) was developed for the rapid filtering of subsurface water in situ, with the objective of operating similarly to a Nisken bottle. Operating on the principle of differential pressure creating a relative vacuum, it uses check valves and/or pressure relief valves to allow water in and compressed air out at specified differential pressures. The resulting system is low-cost and easily manufactured, with reliable performance without pumps or complex electronics. The parts of the DiP-FAST:

1. Wet fill volume: the tube water flows into
2. Inlet relief valve: pressure relief or check valve that controls water flowing into the tube. For the DiP-FAST-M, this valve is adjustable to set the minimum pressure at which water will begin to flow.
3. Inlet luer attachment: where water flows into DiP-FAST
4. Outlet with pressure relief valve: Pressure relief valve to release air during system recovery to prevent dangerous pressurization

Additional DiP-FAST options include weighted base and logger. The weighted base screws onto the bottom of the unit, the logger screws onto the top of the unit and records external pressure/temperature, wet fill volume pressure, GPS, or other sensors.



Key Terms:

Soak time: Time required with system at desired depth to achieve desired fill volume

Wet Fill Volume: The internal volume of the DiP-FAST that can get wet, i.e. fill with water.

Standard Use

The DiP-FAST-M is used to collect filtered samples along with the water that passes through the filter at depths of 5 m - 60 m. Standard operations include taking a negative control, setting the valve pressure, attaching a filter, deploying, and recovering the system. Systems with electronics packages can also record external pressure/temperature, wet volume pressure, and GPS.

Selecting a Pressure Setting

		Valve Setting (PSI)									
		5	10	15	20	30	40	50	60	70	80
Depth (m)	5	384	0	0	0	0	0	0	0	0	0
	10	1131	676	0	0	0	0	0	0	0	0
	15	1531	1278	907	308	0	0	0	0	0	0
	20	1780	1620	1403	1094	0	0	0	0	0	0
	30	2075	1993	1893	1766	1377	555	0	0	0	0
	40	2242	2193	2136	2067	1882	1582	1015	0	0	0
	50	2351	2318	2281	2238	2129	1975	1737	1322	420	0
	60	2427	2403	2377	2348	2277	2183	2052	1858	1541	930

Use the table above to choose your desired pressure setting based on the target depth and minimum volume you wish to filter. It is recommended to set the actuation pressure to at least 15 PSI LOWER than the pressure at your desired depth. Note that the system has significant hysteresis with the filter attached: if you set the pressure to e.g. 10 PSI (7 m) and lower the system to a desired depth of e.g. 30 m quickly, the amount of water filtered between 7 m when the valve opens and the eventual depth of 30 m will be minimal.

Filter Compatibility

The DiP-FAST should work with most filters typically used for eDNA sampling though soak time for maximum fill will vary depending on the exact filter media and holder. Instructions below are for using a Cobetter filter holder with 47 mm disk filter, but the system has been trialed with other filters and filter housings, including Sterivex 0.22 um and Smith-Root non-self-preserving filters. Our general recommendation is an MCE hydrophilic filter appropriately selected for your application. Note the following warnings:

Warning: Filters that include desiccant CANNOT be used with the DiP-FAST, as they are not designed for in situ sampling/submersion.

Warning: Check manufacturer maximum pressure for the filter housing in use and select your maximum depth accordingly. E.g. the Cobetter filter holders have a maximum pressure of 87 PSI so should not be used with the DiP-FAST-M at depths > 60 m; the Sterivex filters have a maximum pressure rating of 45 PSI so should not be used with the the DiP-FAST-M at depths > 30 m. For deeper applications, the DiP-FAST-D includes a pressure regular to prevent filter damage.

Negative Control Protocol 1: Vacuum Pump

 <p>Fully open inlet valve screw so that it is at minimum pressure</p>	 <p>Seal DiP-FAST on both ends by screwing on endcap</p>	 <p>Attach vacuum pump to outlet check valve</p>	 <p>Attach filter assembly to inlet luer lock</p>
 <p>Attach negative control tube to filter inlet luer on one end and into distilled water on the other</p>	 <p>Pull vacuum using hand pump until water begins flowing</p>	<p>Maintain vacuum until desired volume has been filtered. NOTE: once the filter gets wet, water flow must be maintained. If you stop and try to start again, the filter may entirely prevent air from being cleared, resulting in no flow.</p>	<p>Preserve filter as desired; open and empty DiP-FAST. NOTE: on the fully open setting of the inlet pressure relief valve, water will begin spilling out of the DiP-FAST via the inlet as soon as you release vacuum/open the tube.</p>

Negative Control Protocol 2: Syringe

A syringe is sometimes easier if you only have a hand vacuum pump available or you are having issues with the filter clogging.

Fully open inlet valve screw so that it is at minimum pressure	Seal DiP-FAST on both ends	Fill large syringe with DI water	Attach filter assembly to inlet luer lock
Attach syringe luer lock to inlet of filter assembly	Depress syringe until all water flows through filter.	Refill syringe and repeat until desired volume goes through filter.	Preserve filter as desired; open and empty DiP-FAST.

Sterilization

Theoretically the filter is on the inlet and should not touch the water inside the DiP-FAST; however, the follow steps are recommended if sterilization is desired:

Cleaning the inlet tube and inlet pressure relief valve: Follow negative control protocol to suck 10% bleach solution through the inlet, followed by DI water.

Cleaning the outlet tube: Turn unit upside down and place in bucket so that the outlet tube is on the bottom and inside the bucket. Pour 10% bleach solution in, it should flow out the outlet into the bucket. Rinse with DI water the same way.

Cleaning the inside of the DiP-FAST: Fill with 10% bleach solution and shake; rinse with DI water. Both endcaps come off for more thorough cleaning; let us know if you come up with something that works better!