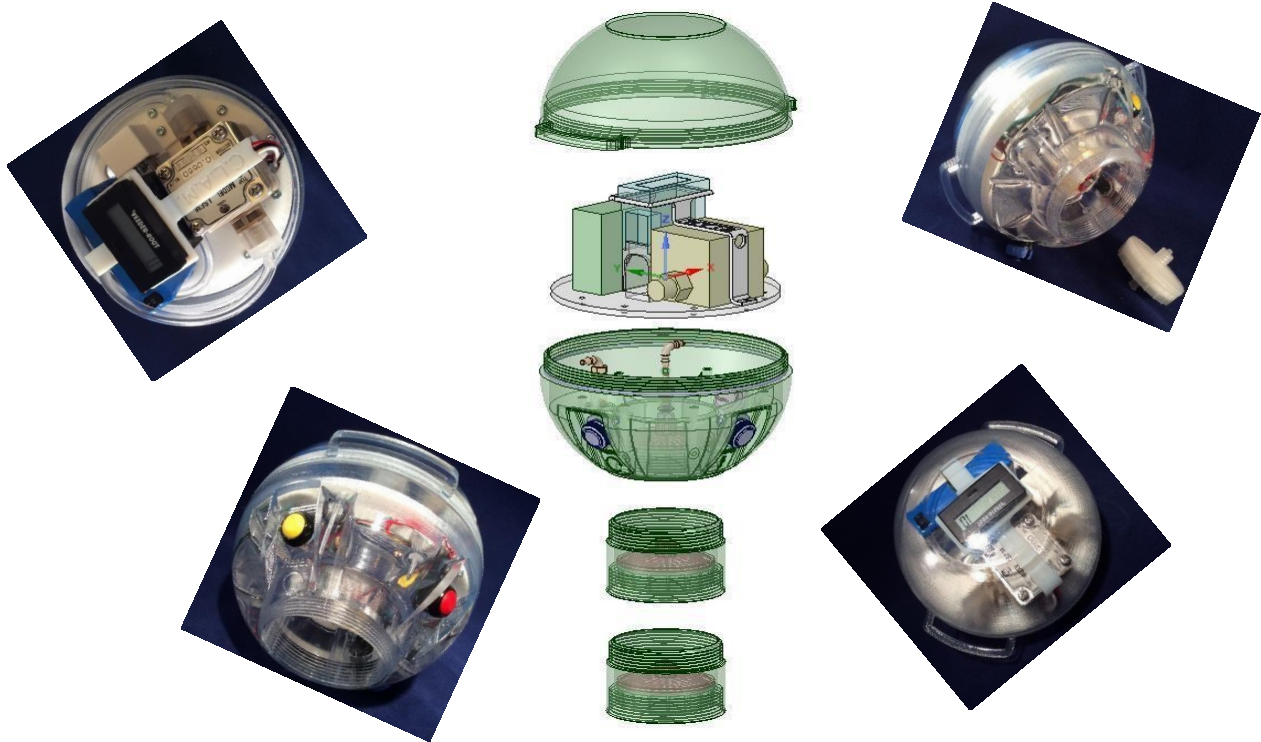


# The C.L.A.M.

## Redesigned with Onboard Volume Totalizing

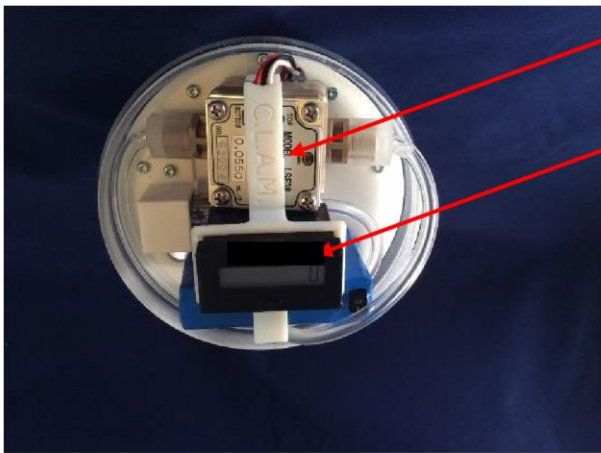
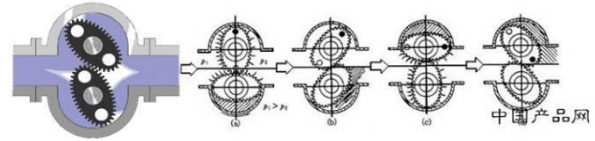


**The next generation C.L.A.M has been developed which provides;**

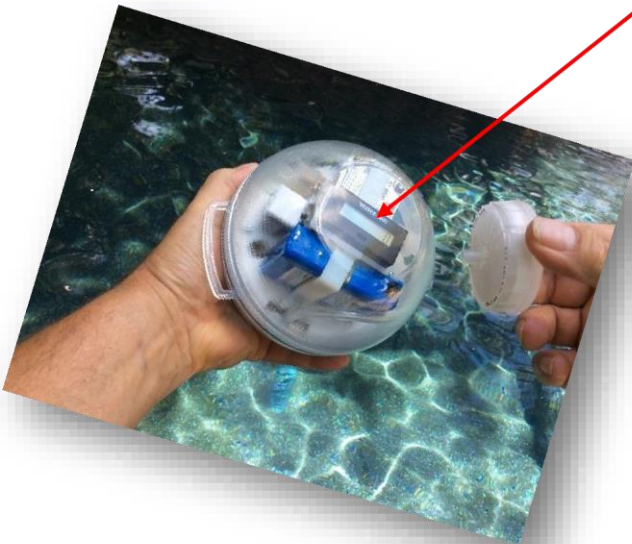
- The unit has onboard volume totalizing capability for compliance reporting.
- External start and stop control button.
- Eight digit volume display visible through the clear polycarbonate top.
- External digital display reset button.
- A rechargeable lithium ion battery system capable of providing 48 hours of continuous operation.
- External battery recharging port.
- The sphere designed clam is ballasted to float 2/3 submerged with the disks submerged, in this state subsurface samples can be taken, or be weight submerged to hundreds of feet.
- The redesigned spherical C.L.A.M. provides the same large volume time integrative SPE disk extractive event as the previous version, but with benefits of a total volume value of the time integrative extractive event.

## The Onboard Totalizer:

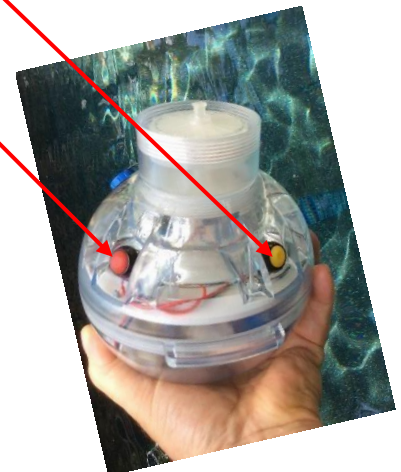
The new C.L.A.M. was redesigned to provide accurate total flow data, for high volume long term active extractive events. The C.L.A.M. now incorporates mechanical oval gear technology which is a unique positive displacement flow sensor. As the fluid being measured passes through the meter, it rotates 2 oval gears in a measuring cavity to displace a precise volume of fluid. A permanent magnet in the rotating gears signals the rotation count to a current transducer which records on the LCD counter display.



- The onboard totalizer has a small footprint and measures the effluent water after it has been extracted by the SPE Disk.
- Visual eight digit LCD counter display has its own external reset button.
- The totalizer system is housed within a thick high impact polycarbonate water tight submersible sphere.
- The Accuracy is +/- 1.0 % with a one count revolution displacement volume of 0.055 ml. A clear flat viewing port for the display is provided on the sphere.



- External display **reset** button and start/stop button for the **pump** are IP68 potted, and fully



submersible.

## Totalizer Calibration Verification:

- The onboard C.L.A.M. totalizer was validated in a field simulation using a floating C.L.A.M fitted with a conditioned C-18 disk.
- The C.L.A.M was placed in the water floating 2/3 submerged like a bobber for subsurface sampling.
- Effluent from the running C.L.A.M. passed through the onboard totalizer.
- The effluent from the totalizer was transferred by 1/8 tubing and collected in a large container sitting on a tared floor scales providing real time weight/volume values.
- The total display counts from the totalizer was recorded at four hour intervals along with the weight of extracted water. All the measurements were taken in real time without disturbing the flow and test in progress.



## Data Table for 32 hours volume comparison testing

Time	Collected Vol. in ml	Totalizer Counts	Calibration factor ml / counted Rev.	Totalizer calculated Vol. ml	Flow rate ml/min	Accuracy Calculated +/- %
4hr	15104	271212	0.0550*	14916	63	1.24
8hr	27310	489215	0.0550*	26907	57	1.48
12hr	39110	701650	0.0550*	38591	54	1.33
16hr	50125	893221	0.0550*	49127	51	1.99
20hr	57150	1065245	0.0550*	58588	48	1.04
24hr	65890	1201266	0.0550*	66070	46	0.27
28hr	72045	1302561	0.0550*	71640	43	0.56
32hr	78990	1440039	0.0550*	79202	41	0.03
<b>Totals</b>	<b>78.99 L</b>	14400399				<b>0.993 % ave.*</b>

\*Manufactures calibration factor for volume displacement is 0.550 ml per 1 gear revolution, or display count providing a +/- 1.0 % accuracy rating.

## Observations and Summary:

The results from the comparison test provide verification that the unit provides better than 1.0+/- % accuracy overall. These results were obtained using the manufactures 0.0550 displacement volume per 1rotational count. The calibration factor can be checked for accuracy by simply dividing the total counts read on the display divided by the effluent volume empirically measured. The C.L.A.M totalizing capacity was tested over many hours of continuous operation, in the floating state, flow rates could vary within the calibration range of 1-75 ml/min and the, calibration factor remained stable. Future testing will compare calibration and accuracy studies at greater depths, water will be collected in collapsed water bags to reflect the pumping rate and accuracy at that level, rather than pumping to the surface to collect an empirical sample.

The new spherical design offers ease of operation, continuous time integrative operation convenient volume determination all within a small rechargeable sphere that never needs to be open, and still **leaves the water behind!**

