



Fighting Fouling

EXTENDING SONDE DEPLOYMENT TIMES WITH EXO'S WIPED (C/T) SENSOR

YSI.com/WipedCT

Case Study
NB18



a xylem brand

EXO Wiped Conductivity & Temperature Smart Sensor



a xylem brand

YSI Environmental Monitoring Systems
Case Study NB18

Wiped (C/T) testing and article written by
Mike Lizotte, YSI Senior Applications Specialist

BACKGROUND

Since the beginning of YSI's entry into the multiparameter sonde market in 1994, we have focused on delivering high quality data at the lowest possible cost. Over the years many product enhancements and improvements were made to get us closer to this goal. The one sensor that has eluded most anti-fouling efforts has been the conductivity sensor. While the standard YSI dual cell conductivity sensor is a very accurate and linear device, its design makes it difficult to prevent the accumulation of fouling. Fouling in a conductivity cell leads to an artificial decrease in the conductivity and salinity readings which forces researchers to shorten deployed times to maintain the quality of their data.

In 2005 we designed our first Wiped (C/T) Sensor for the **6600EDS** sonde, this sensor (pictured top-right) was huge success in respect to its cleaning capabilities, however it had one major drawback - extensive hardware changes were required to upgrade the sensor. This translated to an expensive upgrade and weeks of downtime for the sonde to be sent back to the factory. These challenges were too big of a hurdle to overcome, so the development project was shelved.

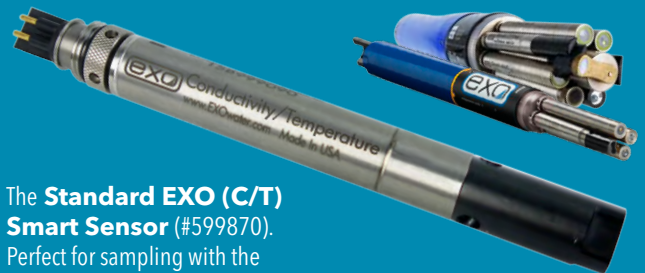
In 2009 YSI began working on our next generation sonde called **EXO** and the Wiped (C/T) Sensor project was put back on the sensor development plan. With microprocessors in the sensors and more sophisticated electronics, we could finally tackle the conductivity sensor fouling issue. In 2012, EXO sondes were released to the market, and the sonde launched with our standard (C/T) sensor design to give us time to thoroughly test the Wiped (C/T) concept with rigorous lab & field studies. The **EXO2** version of the Wiped (C/T) Sensor changed dramatically from its 2005 predecessor. The exposed temperature sensor was removed and relocated into the sensor body, prolong brush life, eliminate a potential water entry point, and avoid damage from rough handling during a cleaning process. We also chose to partner with our sister company in Germany (WTW) who have been building sensors with epoxy infused carbon electrodes for years. Their proprietary sensor and electrode potting technology helped produce a very accurate, robust and durable (C/T) cell design that could be integrated into an EXO smart sensor.



Bulkhead of the 6600EDS sonde, and the unreleased Legacy 6-Series Wiped Conductivity & Temperature sensor.

Sampling & Profiling

EXO1 & EXO2



The **Standard EXO (C/T) Smart Sensor** (#599870).
Perfect for sampling with the
EXO1 & EXO2 Sondes.

Long-Term Monitoring

EXO2 Only



The **EXO Wiped (C/T) Smart Sensor** (#599827).
Perfect for long-term monitoring
with the **EXO2** Sonde.



YSI.com/WipedCT



PUTTING WIPED (C/T) TO THE TEST

In June of 2014 our lab testing was completed and field testing began at our Ohio and Florida test sites. The Ohio site documented fresh water and high turbidity event fouling while the Florida site tested the probes in a severe marine fouling, environment in Tampa Bay. The plots (below and on the next page) show one of these deployments. This deployment was 47 days long (June 4th to July 21st), and the sonde was in shallow water and unprotected from sunlight. The maximum water depth over the sensors was less than 1.5 meters at high water, and the sonde was equipped with two Wiped (C/T) Sensors and one Standard (C/T) Sensor.

HERE IS WHAT THE DEPLOYMENT DOCUMENTED:

- The Standard (C/T) Sensor, protected only with copper tape, started showing fouling drift within a few days after deployment in this highly productive environment.
- The temperature sensors on the three probes tracked perfectly with one another.
- The two Wiped (C/T) Sensors tracked each other perfectly, demonstrating no fouling drift!
- Both Wiped (C/T) Sensors post calibrated within their stated accuracy specification without cleaning. The Standard (C/T) Sensor post calibrated accurately only **after** the fouling was removed.
- **Figure 1** shows one of the Wiped (C/T) Sensors, as cleaned by the central wiper
- **Figure 2** shows the Standard (C/T) Sensor as recovered, note the the fouling within the two cells, causing drift in the data collected.

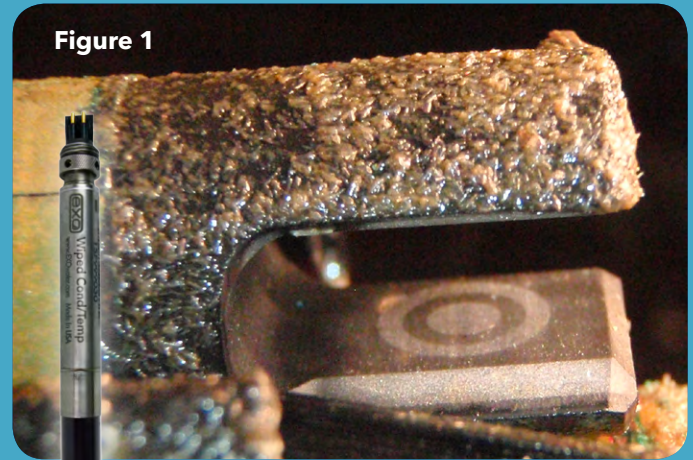


Figure 1

EXO Wiped (C/T) Smart Sensor head after 47 day deployment in the Gulf of Mexico. (Green data in the plots.)

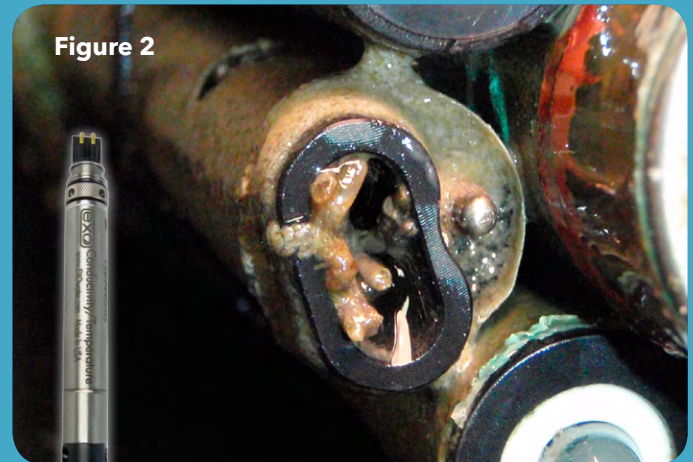
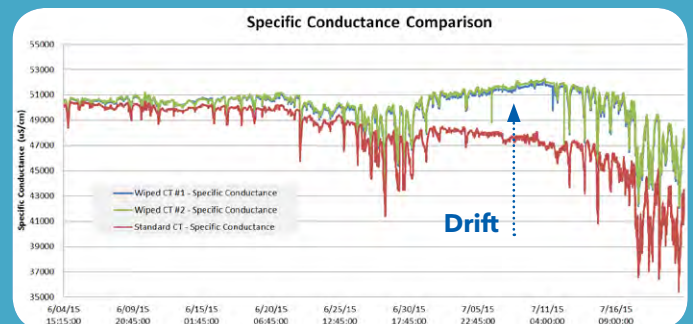
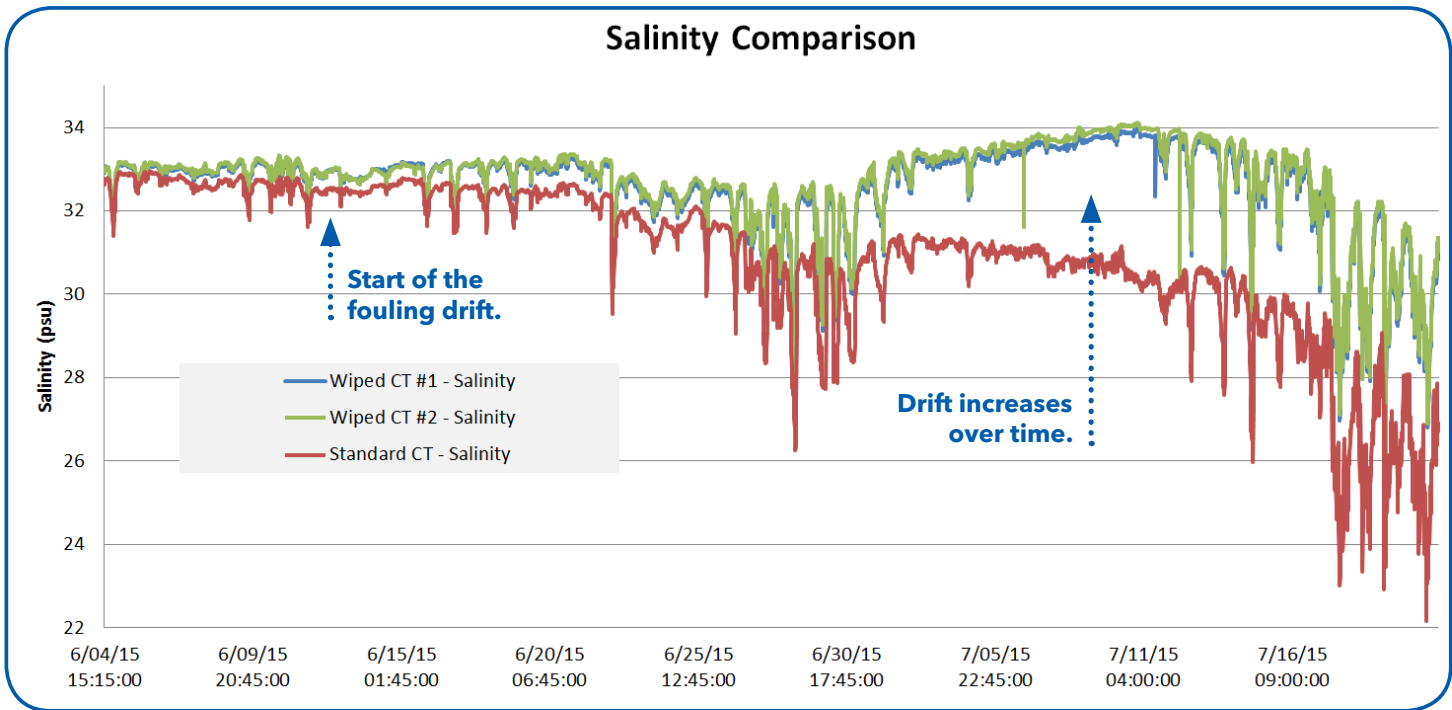


Figure 2

Standard (C/T) Sensor impacted by the accumulation of biofouling. (Red data in the plots.)



Specific Conductance plot showing fouling drift in the **Standard (C/T) Sensor** in productive waters.



WHAT DO THE DATA SHOW?

Diving into the conductivity and salinity plots, within a week after the deployment the Standard (C/T) Sensor started to experience some fouling drift. While initially the effects are minimal, the problem gradually increases to a point where the DO mg/L and depth calculations would be affected. After 2 weeks, the Standard (C/T) salinity was reading was -1.92 PSU's lower than the clean Wiped (C/T) Sensor, and at the end of the 47 day study the sensor fouling had reduced the reading even further, with the Standard (C/T) now - 4.63 PSU's lower than the wiped probes.



Combat particulates, algae, barnacles, and other types of fouling in long-term monitoring with EXO's Wiped (C/T) Smart Sensor.

WHAT DOES THIS MEAN TO YOU?

The data presented here displays the value of the new sensor clearly. At a site where we normally could get only two weeks of quality conductivity and salinity data, before maintenance was required, we now get **six plus weeks easily** (and probably more)! The ability to increase data quality and lower the cost associated with servicing field sites is significant. Many long term monitoring organizations deploy their sondes for short, two week periods, and over the course of the monitoring season this translates to approximately 26 trips made to the site. With the Wiped (C/T) Sensor and a **conservative** four week (monthly) servicing, we now only have to make half the trips. This saves calibration standards, labor hours, travel costs and frees up staff time to do other productive work.

To see a live data feed of the Wiped (C/T) Sensor in action you can go to the [University of South FL's "Clam Bayou" COMPS \(Coastal Ocean Monitoring and Prediction System\) site](#) which is run and maintained by Dr. Mark Luther and Mr. Jeff Scudder at USF, St. Petersburg campus. This site has been using the Wiped (C/T) Sensor since August 2014 with great success. In addition, we also have support and technical assistance from Dr. Ryan Moyer at FWC (Florida Fish and Wildlife Conservation Commission) and his staff. On the cover is a picture of the FWC staff at the COMPS site collecting water samples for FDOM post processing. A special thanks to all those who have played a role in testing our new sensor.



Pictured on cover:

Kneeling, **Dr. Ryan Moyer**
 Standing, **Amanda Chappell & Christina Powell**
 Seated, **Dr. Kara Radabaugh**



Leverage the flexible, plug-and-play sensor architecture of an existing EXO2 Sonde.

- User upgradeable solution
- Same sonde platform, new sensor
- No downtime, no service costs to transition



EXO Wiped (C/T) Sensor Specifications		YSI.com/WipedCT
Conductivity	Range	0 to 100 mS/cm
	Accuracy	±1% of the reading or 0.002 mS/cm, whichever is greater
	Resolution	0.0001 to 0.01 mS/cm (range dependent)
Specific Conductance	Range	0 to 100 mS/cm
	Accuracy	±1% of the reading or 0.002 mS/cm, whichever is greater
	Resolution	0.0001 to 0.01 mS/cm (range dependent)
Salinity	Range	0 to 70 ppt
	Accuracy	±2% of the reading or 0.2 ppt, whichever is greater
	Resolution	0.01 ppt
Temperature	Range	-5 to 50°C
	Accuracy	±0.2°C
	Resolution	0.001°C
	Response Time	T95<30 seconds
Additional Specifications		
Operating Temperature	-5 to 50°C	
Storage Temperature	-20 to 80°C	
Depth Rating	250 meters	
Warranty	2 years	
Compatible With	EXO2 Sonde and Central Wiper	
Ordering Information (order items separately)		
599827	EXO Wiped Conductivity & Temperature Sensor	
599831	EXO Wiped (C/T) Sensor, Spacing Kit (Note: one spacing kit is included with initial sensor purchase, but is considered a consumable part.)	

Discover the benefits of Wiped (C/T):



Save money by reducing the number of site visits each year. Pays for itself in under a year depending on application.



Improve the representativeness of your conductivity data by avoiding stagnant readings and reducing the impact of micro-environments.



Lower the cleaning & maintenance requirements for conductivity sensors, and spend less time with anti-fouling screens and removing the build-up of hard growth.



Reduce the need for post-processing data and spend less time manually adjusting for fouling-related sensor drift.



Improve the reliability of your conductivity sensor, now with non-metallic electrodes.



Prevent common types of fouling from impacting your valuable data, including; particulates, algae, barnacles, and trapped gasses.



Most conductivity cells cannot be fully cleaned by mechanical anti-fouling wipers, but the **EXO Wiped (C/T) Smart Sensor** was purpose-built to protect your conductivity data.



For further information, please contact:

Website: YSI.com

Email: info@ysi.com

Phone: 800-897-4151
or (+1) 937-767-7241



YSI, a Xylem brand manufactures environmental monitoring instruments and systems. Formerly known as YSI, the group is a market leader with a reputation for high levels of accuracy and reliability. The company's water quality measuring instruments are designed for both laboratory and field use. In addition to bench top and hand-held instruments, Xylem Analytics also builds monitoring systems and wireless networks that are able to operate in remote locations and challenging environments. The company's water quality monitoring sondes can be fitted with a wide variety of sensors including dissolved oxygen, PH, temperature, turbidity, conductivity, salinity, ORP, chlorophyll, open-channel flow, vented level, ammonia, chloride, rhodamine, depth photo synthetically active radiation.