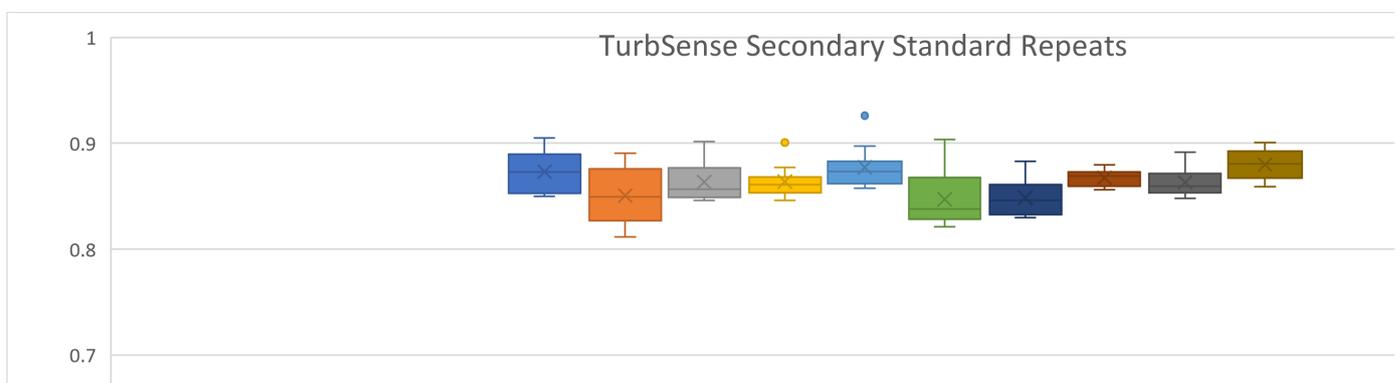


### Introduction

All turbidity measurements are made with reference to a primary standard which is a suspension of Formazin in water. As Formazin is hazardous and unstable over time it is accepted to use other NIST (or other) traceable standards such as Stabilised Formazin or a suspension of polymer beads that give the same results as Formazin. Such primary calibration solutions are expensive, potentially hazardous and notoriously difficult to make up in a lab from first principles. For that reason instrument suppliers often supply secondary standards. These are optically translucent solids that mimic the optical properties of a Formazin suspension. These secondary standards are robust, don't degrade over time, and provide an easy and reliable way to check the calibration of a turbidity meter. Secondary standards allow the customer to quickly and safely check the operation of their Turbidity Meter without the expense and difficulty of using a Primary Standard, and in some circumstances allows the user to re-calibrate their turbidity meter.

### TurbSense® Secondary Standards

TurbSense® Secondary Standards (SS) are manufactured to "approximate" turbidity values. These are the "Nominal" values of 0.9NTU and 18NTU. The actual values of turbidity of these SS will differ from the nominal values due to slight differences in materials and manufacturing. Each SS is measured for its turbidity response at the time of manufacture and these can vary by up to 10% from the nominal value and this "Measured" value is determined at the time of manufacturing and clearly marked on the base of the SS and inside the lid of the SS case. If the SS is used with any correctly calibrated TurbSense® the TurbSense® will read within 10% of the Measured value. It is also possible to calibrate an individual SS against an individual TurbSense® to provide even greater accuracy and repeatability. This value is determined by the customer and is the "Calibrated" value. If the same SS is to be used with multiple TurbSense® and a reproducibility of better than 10% is required then the SS can have multiple "Calibrated" values, one per TurbSense®.



The graph (box and whisker diagram) above shows the results of ten repeats of a single SS on ten TurbSense®. Each colour represents a single TurbSense®. For the SS used the "Nominal Value" was 0.9 NTU . The "Measured Value" was 0.863 NTU and each sensor gave a slightly different "Calibrated Value" from 0.846 NTU to 0.879 NTU. The coloured box represents the inter quartile range, the line represents the median value, the x represents the mean value and the vertical line represents the full range. (The two points where determined by the CISCO statistics engine to be outliers, probably caused by the sensor not being dried properly).

## How to use the Secondary Standards

The Secondary Standards (SS) can be used in three ways.

- A. **As a quick check that any TurbSense® is measuring correctly.** Compare the reading of the TurbSense® with the Secondary Standard in place, against the "Measured Value" from the base of the Secondary Standard. If the reading of the TurbSense® is outside +/- 10% of the "Measured Value" then re-calibrate the TurbSense®.
- B. **As a more accurate check where the Secondary Standard has been matched (calibrated) to an individual sensor.** In this case calibrate each TurbSense® of interest using a primary standard\*. Immediately after calibration place the TurbSense® into the SECONDARY STANDARD. Wait until the reading has stabilised and then record the "Calibrated Value" for the Secondary Standard for each TurbSense® that it will be used with. Use the Secondary Standard as in A above but compare with the "Calibrated Value" instead of the "Measured Value". This will give better results than the +/- 10% in A above as can be seen from the data presented in the box and whisker diagram.
- C. **As a method to calibrate a TurbSense®.** Calibrate the Secondary Standard to a TurbSense® as in B above. Following the initial calibration of the Secondary Standard it can then be used as if it were a Primary Standard. Please note that some regulatory bodies do not allow the use of Secondary Standard as a method of calibration when the results of the turbidity meter are to be submitted for regulatory purposes.



In all cases if the reading on the TurbSense® is outside the +/- 10% of the Measured or the Calibrated value then the TurbSense® will need to be re-calibrated either using a primary standard (by following the instructions in the manual), or by using a Secondary Standard that had previously been calibrated to that TurbSense®. If after recalibrating the TurbSense® the Secondary Standard is still outside the +/-10% then please contact Pi for assistance.

*\*If the TurbSense® is new from Pi it will already have been calibrated and won't need to be re-calibrated again before assigning a Calibrated value to the Secondary Standard.*



### Specification\*

<b>Nominal Value:</b>	0.9 NTU, or 18.0 NTU
<b>Measured Value Accuracy:</b>	+/- 10% of the Measured value
<b>Reproducibility:</b>	+/- 10% of the Measured value
<b>Response Times:</b>	Approximately 2 minutes (variable based on averaging)
<b>Repeatability:</b>	+/- 2% of the Calibrated value
<b>Cleaning:</b>	Using the microfibre cloth provided
<b>Diameter:</b>	21.15mm (0.833")
<b>Length:</b>	53.3mm (2.098")

*\*All subject to change without notice*