

ST-500 Probe Troubleshooting Guide

Symptoms and Likely Causes

Obtain several readings using the ST500 probe and compare the results with a calibrated handheld fluorometer measuring fluids with known concentrations of PTSA.

| Symptoms: | Likely causes: (See numbered list below) |
|---|--|
| Probe reading is varying but very low. Handheld reading normal. | 1,2,3,4,5,6 |
| Probe reading is varying but higher than handheld. | 1,2,3,4 |
| Probe reading is varying but lower than handheld. | 1,2,3 |
| Probe reading is constant high value. Handheld reading normal. | 2,3,4,6 |
| Probe reading is negative or zero. Handheld reading is normal. | 2,3,4,5,6 |

Likely Causes:

1. The probe light path has been fouled.
2. An incorrect calibration was performed on the probe electronics
3. The setup on the controller/display unit is in incorrect
4. The cooling tower water contains very high level of contaminants that affects the PTSA fluorescence measurement
5. Probe electronics not connected properly
6. Probe electronics have failed



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Fouled Probe Causes and Corrective Actions

The ST-500 probe is designed to provide reliable and continuous PTSA readings even when installed in moderately contaminated industrial cooling water. Any equipment in contact with industrial cooling systems is subject to many potential foulants and contaminants. Although the optics and algorithms can compensate for the effects of moderate fouling, heavy fouling will prevent the light from reaching the sensor, resulting in incorrect readings and the potential for product overfeed if the ST-500 is used as part of an automated feed control system. When used to control product dosing, it is suggested that the automation system be configured to provide backup control settings to limit potential product overfeeds, for example by limiting pump size or feed duration, or by alarming if the pumping rate exceeds a desired maximum feed time limit.

The ST-500 probe should be cleaned as per your application. Every application will have different needs. You can establish your cleaning frequency based off using our uPyxis phone application. For cooling tower water that has very high turbidity, suspended solids, corrosion products, oily contamination, or the level of scaling forming inorganics that is beyond the treatment capability, more frequent cleaning is recommended. The amount of scale on the probe body is a good indication on how often the probe needs to be cleaned. The most common scale that affects the probe measurement is iron oxide. Calcium carbonate and calcium phosphate deposits are also very common. Oily organic deposit or biofilm has also been found on many probes returned to Pyxis for evaluation. Silica deposits have also been identified on the quartz glass in a few cases.

NOTE: If the probe is fouled by silica, the quartz glass is not able to be cleaned without damaging the optical light path severely and the probe must be discarded.

The need to clean the ST-500 probe can also be determined by the probe response to calibration standards. The uPyxis phone or desktop application can assist in determining the amount of fouling on the probe and the need to be cleaned. The probe measures the optical density of the excitation light and an axillary light to determine how much light is being blocked by the deposit or absorbed by the presence of the sample color. During calibration in DI or 100 ppb PTSA standard, the diagnosis software can identify if the probe is fouled and needs to be cleaned.

An advertisement for Pyxis products. The background is a blue gradient with a wavy, water-like texture. On the left, the Pyxis logo is displayed in white. In the center, there are several bottles of cleaning solutions and reagents in various colors (red, yellow, blue, green). To the right, there are several small, dark brown bottles of calibration standards. Below the products, the text "Cleaning + Calibrations = Accuracy & Repeatability!" is written in a large, white, sans-serif font. At the bottom, the text "Find all your Standards, Reagents, & Cleaning Solutions at www.pyxis-lab.com/shop" is written in a smaller, white, sans-serif font.

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Probe Cleaning and Maintenance

The ST-500 probe is designed to provide reliable and continuous PTSA readings even when installed in moderately contaminated industrial cooling waters. Although the optics are compensated for the effects of moderate fouling, heavy fouling will prevent the light from reaching the sensor, resulting in low readings and the potential for product overfeed if the ST-500 is used as part of an automated control system. When used to control product dosing, it is suggested that the automation system be configured to provide backup to limit potential product overfeeds, for example by limiting pump size or duration, or by alarming if the pumping rate exceeds a desired maximum limit.

The ST-500 probe is designed to be easily removed, inspected, and cleaned if required. It is suggested that the ST-500 probe be checked for fouling and cleaning needs on a routine basis. Heavily contaminated waters may require more frequent cleanings. Cleaner water sources with less contamination may not require cleaning for several months.

Methods to Cleaning ST-500 probe

Any equipment in contact with industrial cooling systems is subject to many potential foulants and contaminants. Our inline probe cleaning solutions below has been shown to remove most common foulants and contaminants. A small soft bristle brush, Q-Tips cotton swab, or soft cloth may be used to safely clean the probe housing and the quartz optical sensor channel. Pyxis Lab Inline Probe Cleaning Solution Kit can be purchased at our online Estore/Catalog <https://pyxis-lab.com/product-category/accessories/page/2/>

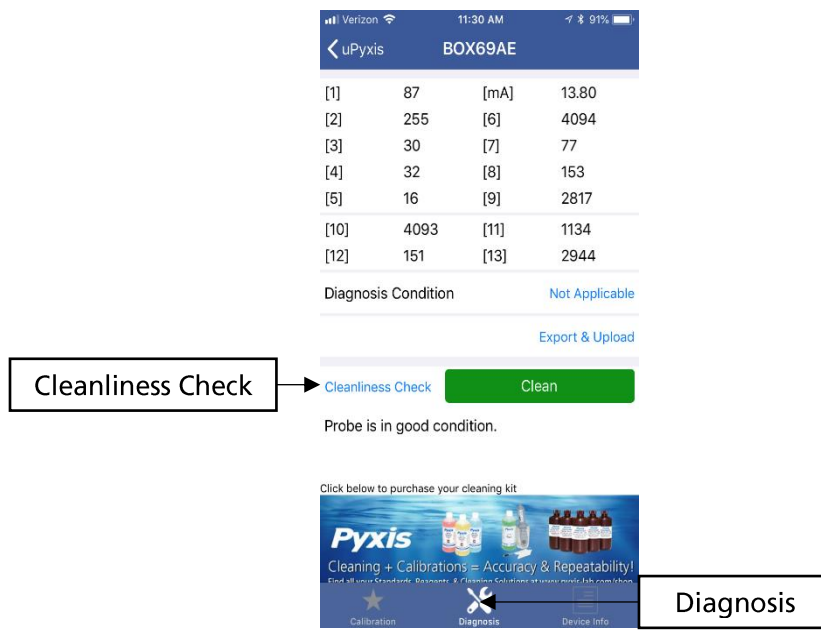
Visual Inspection Method: Remove the ST-500 from its custom mounting tee. When the ST-500 probe is powered, a flashing blue light should be visible inside the ST-500 probe's quartz measuring tube. If a flashing blue light is not visible, the ST-500 problem may be the results of other causes (see Causes 5 or 6).

Calibration Standard Method: Obtain a calibration standard with a concentration in the operating range of the system to be measured.

PTSA Calibration Standards are available on our Pyxis-Lab online Estore/Catalog at: <https://pyxis-lab.com/product-category/calibration-standards-reagents/>

After performing the cleanliness check via our uPyxis application, a visual inspection, & removing any visible deposits with a soft cloth then place the ST-500 probe in a small beaker containing a calibration solution. The probe readout device should indicate the calibration solution concentration, or the product concentration equivalent to that PTSA concentration. If the readout is not within 10% of the expected value, the ST-500 probe problem may be the results of other causes (see Causes 2,3,4,5 or 6).

Diagnostics Method: The diagnosis information can be obtained by connecting the ST-500 probe to uPyxis Mobile application or uPyxis Desktop application installed. Connect to the ST-500 probe, then click the **Diagnosis tab**. When in diagnosis screen click the **Cleanliness Check** and the application will let you know if the probe is fouled or in good condition.



The screenshot shows the uPyxis mobile application interface. At the top, it displays the status bar with Verizon, 11:30 AM, and 91% battery. Below the status bar, the app title 'uPyxis' and device ID 'BOX69AE' are shown. A table contains 13 data points:

| | | | |
|------|------|------|-------|
| [1] | 87 | [mA] | 13.80 |
| [2] | 255 | [6] | 4094 |
| [3] | 30 | [7] | 77 |
| [4] | 32 | [8] | 153 |
| [5] | 16 | [9] | 2817 |
| [10] | 4093 | [11] | 1134 |
| [12] | 151 | [13] | 2944 |

Below the table, the 'Diagnosis Condition' is listed as 'Not Applicable'. There is an 'Export & Upload' button. A 'Cleanliness Check' button is highlighted with a red box and an arrow pointing to it. Below this button, the text 'Probe is in good condition.' is displayed. At the bottom, there is a section titled 'Click below to purchase your cleaning kit' with a 'Pyxis' logo and a list of products. A 'Diagnosis' tab is highlighted with a red box.



ST-500 Inline Probe Cleaning Solution

Soak the lower half of the ST-500 probe in 100 ml inline probe cleaning solution for 30 minutes. Rinse the ST-500 probe with distilled water and then check for the flashing blue light inside the ST-500 probe quartz tube. If the surface is not entirely clean, continue to soak the ST-500 probe for an additional 30 minutes. Pyxis Lab Inline Probe Cleaning Solution can be purchased at our online Estore/Catalog <https://pyxis-lab.com/product-category/accessories/page/2/>.

A promotional banner for Pyxis products. The background is a blue gradient with a wavy, water-like texture. On the left, the Pyxis logo is displayed in white. In the center, there are three small bottles of Pyxis reagents (red, yellow, and blue) and a Pyxis ST-500 probe. On the right, there are five small bottles of Pyxis standards (brown). Below the products, the text "Cleaning + Calibrations = Accuracy & Repeatability!" is written in white. At the bottom, it says "Find all your Standards, Reagents, & Cleaning Solutions at www.pyxis-lab.com/shop".

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Incorrect Calibration of ST-500

Constant 4 mA Output

The ability for the probe to output a current of 4 mA or greater to the controller/display indicates that the main functions are working properly. If the tower water does contain PTSA, a constant 4 mA output may be caused by the following failures:

1. The probe is severely fouled. The cleanliness of the probe can be determined with using the latest Probe Configurator for PC and uPyxis App for phones. Refer to the cleaning procedure in section 1.
2. The tower water is turbid and contains < 30 ppb PTSA, the zero and slope calibrations need to be performed.
3. If the above two failures are ruled out, the probe may be damaged due to other causes (see Causes 3,4,5 or 6).

Constant 20 mA Output

A constant 20 mA output may be caused by the following failures:

1. The PTSA concentration in the tower water is higher than the probe full scale output setting. The default current output for PTSA > 200 ppb is 20 mA. Use a handheld fluorometer to check the PTSA concentration.
2. A slope calibration should be always carried out after a zero calibration. A zero calibration performed without a slope calibration could severely distort the calibration coefficients saved in the probe and lead to a constant 20 mA output even with the actual PTSA concentration below 200 ppb.
3. The default setting is 20 mA = 200 ppb. This value can be only changed using the Nebula Probe Configurator software. If you suspect that this setting was changed, please use the Probe Configurator to check/reset to the default value or desired value.

Noisy Current Output

When a noisy PTSA concentration reading is encountered, please first observe if the current (4-20 mA) reading in the controller is noisy as well. If the current reading is stable while the ppb PTSA reading is noisy, the 4-20 mA conversion setting in the controller may not be correct. Please reset to 4 mA = 0 ppb and 20 mA = 200 ppb.

The noisy current output is largely caused by an improper solution ground connection. For the best performance, the probe solution wire (clear coated wire) needs to be electrically connected to the sample water. The stainless steel pin at the top of the probe is internally connected to the solution ground wire. In most application, the stainless steel pin provides an effective solution ground connection path.

1. Clean the stainless steel pin and remove any scale on the surface. Use a sand paper to sand the surface if it is covered by tenacious substance.
2. If the noisy current output persists after the above two steps, the probe is failed due to other causes and needs to be returned to Pyxis for evaluation and repair.

Discrepancy between the Probe and Pyxis Handheld Fluorometers

For most applications, less than 10% difference between the ST-500 and handheld fluorometers are expected. All Pyxis inline and handheld fluorometers measure extra optical properties of the water to compensate interference caused by sample color and turbidity. For this reason, please always compare the ST-500 reading with a Pyxis handheld fluorometer. Please calibrate the handheld fluorometer before troubleshooting the online-offline discrepancy.

1. If the sample water turbidity is greater than 40 NTU, please filter the sample water for SP-900/910 measurement.
2. If the sample water turbidity is greater than 100 NTU, please filter the sample water for SP-350/400/380/700 measurement.
3. If the discrepancy is greater than 10% and less than 30%, calibrate the probe using one of the following three methods.
4. If the discrepancy is greater than 30% and sample water turbidity greater than 100 NTU, measure the filtered the sample with a Pyxis fluorometer and calibrate the probe to the value measured using one of three above methods.
 - 4a. Connect the Pyxis fluorometer to the probe via the Bluetooth/WiFi adaptor. Calibrate the probe from the fluorometer.
 - 4b. Calibrate the probe using uPyxis Mobile App or uPyxis Desktop.
 - 4c. Conduct the one-point calibration by rescaling current-to-ppb relationship according to the controller calibration procedure.
5. If the discrepancy is greater than 30% and sample water turbidity less 100 NTU, clean the probe according the clearing procedure in the manual. If the discrepancy is persisting, please contact Pyxis at service@pyxis-lab.com

Note: Reference ST-500 Fluorometer Probe Instruction Manual Section 5 & 6 for Probe Calibration.

