QUICK-START GUIDE FOR AUTOMATIC 3-POINT CALIBRATION WITH SMART DIGITAL IOTRON™ & ZEUS™ pH SENSORS & INTELLIGENT 3TX-HiQ-pH DIGITAL TRANSMITTERS

If softwarelock (P01) is "On" then no changes can be made. Set P01 to "Off " to allow calibrations & configuration modifications. The P01 software lock will automatically reset back to "On" if no key is pressed for 60 seconds.

BEST PRACTICE pH SENSOR CALIBRATION GUIDE:

Some additional quick-start type thoughts about the best practice use of autocalibration mode of the intelligent 3TX-HiQ-pH transmitter with the IOTRON™ & ZEUS™ smart digital pH sensors. The 2-page standalone sheet included with these digital pH sensors details the available calibration options of potential interest:

http://www.astisensor.com/3TX-HiQ-pH_Smart_Digital_pH_Sensor_Calibration_Instructions.pdf

There is functionality that is not explicitly detailed in the document that impacts upon the workflow when using the autocalibration feature. Specifically it is possible to perform multiple slope autocalibrations without existing a single 'Slope' LED session. This is different than the 3TX-pH transmitters for use with analog pH sensors were you MUST exit the Slope LED mode to complete the slope calibration process. For the 3TX-pH for analog sensors style transmitter if you want to perform a three-point (dual slope) type calibration you must enter into the Slope LED mode on two separate occasions. One slope session will be for the acidic slope and another subsequent session will be for the alkaline slope. Using the autocal mode on the 3TX-HiQ-pH both the acidic & alkaline slope calibration can be done in succession without exiting the same slope session. Parameter P08 must be set "On" to enable the three-point calibration (dual slope) on the 3TX-pH or 3TX-HiQ-pH.

FALLACY OF THE 2-POINT pH BUFFER CALIBRATION AT pH4 & pH10

Many are under the erroneous belief that performing a two-point calibration at pH4 and pH10 means that they will have good results measuring anywhere across this range. This belief is altogether incorrect for a variety of reasons. The most salient fallacies and problematic aspects about this poor (but common) practice are:

* Slope derived from a two-point pH4 & pH10 calibration is actually incorrect through the entire range because it averages the acidic and alkaline slope to yield a slope that is in fact not accurate for the acidic measurement nor the alkaline measurements. In this way you get poor results anywhere in the measurement range.

* The lack of one of the buffers being either pH7 or pH6.86 means that there is no true asymmetric potential (A.P.) calibration. In short you will not really know what the pH sensor reads at pH7. Since for pH measurement the isopotential point is pH7 for the purposes of automatic temperature calibration you will induce errors in the temperature compensation by having an incorrect A.P. with the two-point pH4 & pH10 calibration approach essentially implicitly forcing the A.P. to be an erroneous value. The larger the deviation of the actual A.P. from this erroneous value the error introduced into the temperature compensation scheme.

* If only a two-point (single slope) style calibration is to be done then one of the buffers must be pH7 or pH6.86 to avoid this incorrect A.P. issue described above. This typically means essentially pH4 and pH7/pH6.86 for applications that are almost always acidic or pH7/pH6.86 and pH9.18/pH10 for applications that are almost always alkaline. For applications that cross the pH7 boundary commonly best practice is to enable the three-point calibration (dual slope feature) and perform the A.P./Offset calibration at pH7/pH6.86 followed by the acidic slope calibration with pH4 or pH1.86 and then alkaline slope calibration with pH9.18/pH10 or pH12.45.

* The alkaline pH buffers are much more temperature sensitive and generally unstable as compared to the neutral or acidic pH buffer. Very many factors are the cause of this but the result is the same. If you have only two pH buffers employed (two-point single slope calibration) and one of the two buffers used is likely to be inaccurate this makes for a very poor calibration. In increasing order of sensitivity to aging (decomposition), air (mainly intrusion of carbon dioxide), light, contamination and temperature induced changes are the pH9.18, pH10 and the pH 12.45 buffers. On a related note only the 3TX-HiQ-pH in the automatic calibration mode corrects for the temperature induced change to find the exact value of the pH buffers (see link below).

http://www.astisensor.com/Temperature_dependence_of_common_pH_buffers.pdf

The temperature dependence of the pH buffers can be accounted for in manual calibration mode by reading the value of the pH buffer at the current temperature as obtained from the connected pH sensor & adjusting to this exact value the convenience. This correction is performed automatically by the 3TX-HiQ-pH transmitter improving efficiency by saving time & reliability by ensuring an accurate pH buffer value at any temperature.

* If the procedure for the facility states that they must use pH4 buffer and pH10 buffer for their calibration then this can only be done in proper way by enabling the three-point calibration mode. Using the the intelligent digital 3TX-HiQ-pH transmitter this is quite easy to do with the automatic calibration mode. Find below the quick-start instructions on how to perform such a 3-point calibration all in one extended session:

- Set P01 lock to "Off" and then set P08 to "On"
- Clean the sensor and rinse with DI water and blot dry.
- Place in pH7 or pH6.86 buffer and allow the reading to stabilize. Set the P01 lock to "Off"
- Enter 'Offset' LED mode. Hold 'Up' & 'Down' keys simultaneously to begin an 'Offset' autocalibration session. After completion the A.P. (P16) will be properly calibrated.
- Rinse the sensor with DI water and blot dry. Place into pH4 buffer.
- Enter the 'Slope' LED mode. Hold 'Up' & 'Down' keys simultaneously to begin a 'Slope' autocalibration session. After completion the current working acidic slope (P17) will be properly calibrated.
- Rinse the sensor with DI water and blot dry. Place into pH10 or pH9.18 buffer.
- Hold 'Up' & 'Down' keys simultaneously to begin a second 'Slope' autocalibration session. After completion the current working alkaline slope (P18) will be properly calibrated.

The results of the calibrations performed can be viewed with the following display features:

- Set P01 lock to "On". This lock will reset back "On" after 60 seconds of inactivity to prevent accidental changes to the calibrations that were just performed. Toggle to the 'Offset' LED mode.
- Rinse the sensor with DI water and blot dry. Place into pH7 or pH6.86 buffer. The displayed reading should be reasonably close to the nominal pH buffer value. The current working A.P. (P16) can be viewed as a display feature by pressing the 'Down' button in the 'Offset' LED mode when P01 is "On".
- Rinse the sensor with DI water and blot dry. Place into a pH buffer that is below 7 such as pH4 of pH1.68. The display reading should be reasonably close to the nominal pH buffer value value. Toggle to 'Slope' LED mode. The current working acidic slope (P17) is viewed as a display feature by pressing the 'Down' button.
- Rinse the sensor with DI water and blot dry. Place into a pH buffer that is above 7 such as pH9.18, pH10 or pH12.45. The display reading should be reasonably close to the nominal pH buffer value value. The current working alkaline slope (P18) is viewed as a display feature by pressing the 'Down' button when P01 is "On".

The digital 3TX-HiQ-pH has all the same manual calibration capabilities as the analog 3TX-pH but only the 3TX-HiQ-pH has autocal capabilities as well as the ability to view & download the last five set of calibrations.