

# *Advanced Sensor Technologies, Inc.*

TEL: 714-978-2837 TOLL FREE: 1-888-WOW-ASTI (969-2784) FAX: 714-978-6339

## **IMPORTANT NOTES FOR CYANIDE ISE SYSTEM** **WITH 3TX-ISE & 3TX-TOT CYANIDE TRANSMITTERS**

### **Calibration, Installation, Cleaning & Use of Cyanide ISE Measurement Systems**

#### **For Applications Including:**

- **Industrial Cyanide Waste Treatment Systems**
- **Cyanide Leach Circuit (Final Stage Only)**
- **Environmental Monitoring of Discharge containing Cyanide**

Before proceeding further, it is recommended that a review of the following technical documents that describes the general provisions for online ion selective measurements:

[http://www.astisensor.com/GENERAL\\_GUIDE\\_TO\\_ONLINE\\_ISE\\_MEASUREMENTS.pdf](http://www.astisensor.com/GENERAL_GUIDE_TO_ONLINE_ISE_MEASUREMENTS.pdf)

All calibration solutions and process grab sample should be calibrated and tested at identical temperatures to the process temperature for optimal results. The actual temperature of the process solution (and thereby the calibrating solutions as well) is not as critical as the fact that they are calibrated at the same temperature to eliminate all potential sources of uncertainty. For greatest overall accuracy of the cyanide ( $\text{NH}_4^+$ ) measurement, however, all tests should be performed as close to 25 degrees Celsius (room temperature process solutions) as possible. The valid (permissible) temperature range for all cyanide ion selective sensors is five to fifty (5-50) degrees Celsius (41 to 122 degrees Fahrenheit).

Calibration Point 1 (always the lower concentration value) and Calibration Point 2 (always the higher concentration value) determines the response curve of any given cyanide Ion Selective Sensor (AB 6160, AB 6160A or AB 8160). The 3TX-ISE transmitter as supplied has already been preconfigured with the characteristic sensor slope for your application and range of interest. In the absence of suitable cyanide calibration standard solutions at the job site it is recommended to use the ASTI factory pre-programmed characteristic 2-point slope and to perform only a 1-point grab sample offset field calibration. The 1-point grab sample offset calibration provides concurrence with the process sample analysis and is the most important calibration to be performed in the field.

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Web Site: <http://www.astisensor.com> Technical Support: <http://www.astisensor.com/cgi-bin/ttx.cgi>

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The calibration value for point 1 is the low ppm solution and point 2 is high ppm solution. The one point offset calibration using a process grab sample is always performed by using the offset calibration option only. The calibration solutions should be kept clean and out of direct sunlight and/or other high-energy radiation sources to maximize accuracy of their ppm values. New sensors should be conditioned in cyanide standard solution for 3 - 5 minutes before beginning the calibration procedure as described in this guide. If necessary, special conditioning may be required for sensors in stock long periods of time and assistance with such needs can be obtained from the ASTI factory. All sensors should be rinsed with deionized (DI) water prior to conditioning in any standard solution.

The acceptable pH range for any of the cyanide ion selective installation is 11 to 13. In addition, if the 3TX-TOT pH compensation module is used pH values down to 8.5 can also be supported. Any calibration standards should be pH adjusted and stabilized to prevent errors in the 2-point slope calibration. There are currently no known commercially available cyanide calibration standards that can be used since none are known to meet these criteria. The last page of this ISE addendum contains the procedures for how to prepare suitable cyanide ISE standards in your laboratory. It is **NOT** recommend to use any calibration standard solution to perform the 1-point offset calibration. Note that adjusting the inline reading to agree with a grab sample determined value of the process sample should ALWAYS be the used as the 1-point calibration scheme.

At pH levels below 11.0, the cyanide sensor will not detect the total cyanide content, as some of the cyanide ion will be converted into the form of dissolved hydrogen cyanide gas (HCN) form. To convert the measured cyanide ion activity (free cyanide  $\text{CN}^-$ ) into “total” cyanide the free cyanide measurement must be compensated for pH by the TOT module. See the pH dependent extent of ionization curve for HCN dissolved gas and cyanide ions ( $\text{CN}^-$ ) for a graphical representation of this phenomenon. Compensation for the effect of pH on the extent of ionization for HCN may be required for pH values below 11 to provide the relevant complete total cyanide data. Please also note that these pH effects are a temperature dependent phenomenon. The provided extent of ionization curve is only completely valid for pure two component systems with deionized (DI) water. Real world water solutions of a much more complex makeup may vary somewhat from these idealized curves, although the deviation is not expected to be vast for most typical systems. The 3TX-TOT module is capable of performing such pH compensation to find the “Total Cyanide” as defined by the sum of the free ionized cyanide ion species ( $\text{CN}^-$ ) together with the dissolved gas HCN bound form. For further information please refer to the 3TX-TOT specification sheet and manual or contact ASTI directly. Note that all grab sample analysis will always return a value corresponding to the “total” cyanide species.

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## **FOLLOWING STEPS ARE REQUIRED FOR AN INSTALLATION OF A NEW CYANIDE SENSOR:**

- 1) Perform a two-point calibration to empirically determine slope. See the following procedure to ensure that a valid 2-point calibration is accomplished. In very many cases using the factory predefined slope is perfectly acceptable alternative to performing a 2-point slope calibration in the field.
- 2) Place sensor into process and allow it to find electrochemical and thermal equilibrium. The time required for this may vary depending upon the particular application.
- 3) To account for any differences between the ionic strength and interfering ions between calibration and measured solution, a grab sample should be taken and analyzed by a suitable analysis system, and the online cyanide ion selective measurement system adjusted to read the grab sample analyzed value. The sensor should be left continuously in service and this grab sample offset calibration performed as may be required, unless the sensor seems to be losing sensitivity, giving erratic readings or requires cleaning. The 1-point grab sample 1-point offset calibration is simply called "Offset" in the 3TX-ISE analyzer LED main menu.

**VERY IMPORTANT NOTE: The value obtained from any grab sample analysis for cyanide will always returned the "TOTAL CYANIDE" as will be displayed on the "Total ISE" LED on the TOT module. When performing this critical grab sample offset calibration, the "Offset" calibrate mode on the ISE module should be adjusted until the value shown on the "TOT" module in the "Total ISE" LED mode agrees with the grab sample analyzed value of the process solution.**

Please refer to the 3TX-ISE manual for instructions on how to perform both 1-point and 2-point calibrations using the three-button operation. Only issues specific to your given ion selective measurement are covered in this ISE addendum and all general use topics are discussed in the 3TX-ISE manual and specification sheet.

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## **Configuring 3TX-ISE Analyzers for Cyanide Measurements**

Your 3TX-ISE has been preconfigured at the ASTI factory for your ion selective measurement requested at your time of order. The ISE measurement type configured for the 3TX-ISE transmitter cannot be modified in the field. You can use the last parameter on the 3TX-ISE transmitter (P20) to reset the unit back to the factory-dispatched configuration (see 3TX-ISE specification sheet and manual for details about this). The only two variables that will change when you perform a calibration will be the slope parameter (P15) and the mV offset at the isopotential point (P14). Below are the nominal values for the parameter P14 and P15 for the cyanide ion selective measurement:

**Slope (Parameter P15 on 3TX-ISE):** **-59.2 mV per decade**

*The slope parameter will only be changed when a 2-point slope calibration is performed (see later in this addendum for details). Parameter P15 allows you to both view and manually modify the working slope. This slope may vary depending upon your application and range and has been preconfigured at the ASTI factory.*

**Offset (Parameter P14 on 3TX-ISE):** **-372 mV**

*The offset parameter will be changed both when a 2-point slope or 1-point offset calibration is performed (see later in this addendum for details). Parameter P14 allows you to both view and manually modify the offset.*

*This offset may vary depending upon your application and range as preconfigured at the ASTI factory.*

*Note that flashing digits when in the P14 display mode indicate negative mV values.*

**Formula Weight of Ion (Parameter P13 on 3TX-ISE):** **26.02 grams per mol (FIXED)**

*The value is a display only variable that clearly denotes the ISE measurement type. In this case the value for the formula weight of the ion measured is 26.02 grams per mole for cyanide.*

*To modify the slope (or any other parameter actually) the software lock (P01) must be disabled.*

You should check that your ASTI ISE sensor is properly wired according to the official ASTI hook-up schematic for ASTI sensors with and without preamplifiers to the 3TX analyzer (also provided later in this guide for convenience). All common wiring configurations are found in this ISE addendum for your convenience or installation and commissioning.

The 3TX-ISE transmitter supports ISE sensors without preamplifiers and the 3TX-ISE-X transmitter supports ISE sensor with preamplifiers. The use of preamplifiers is not generally not required for cable lengths of less than 20 feet (6 meters). Consult the ASTI factory for further assistance with best configuration for your use.

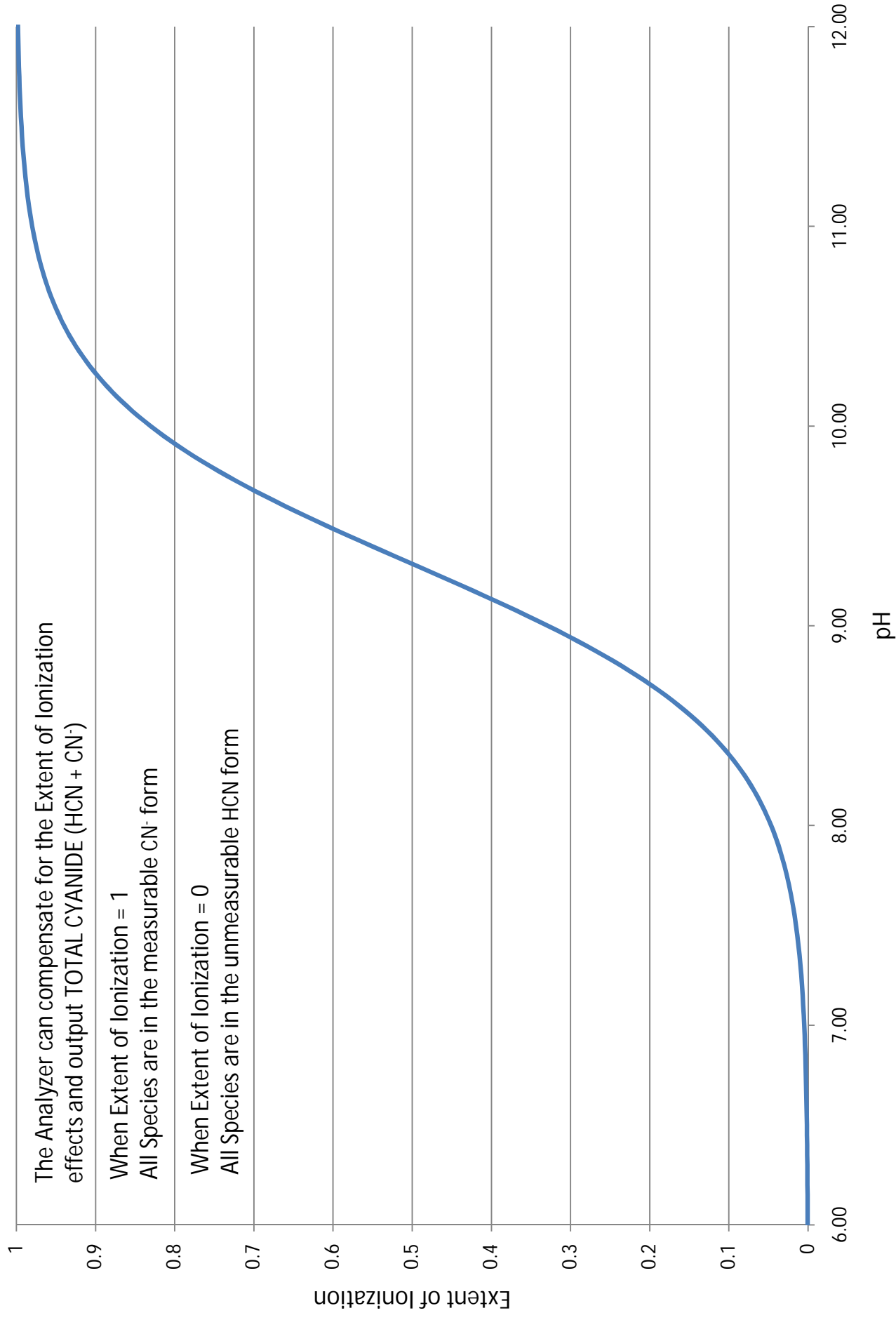
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Please note that if you perform a reset to factory defaults (P20), you will need to repeat your 2-point calibration using calibration solutions that are one decade (10X) apart in value. In addition, you will need to once again place the ISE sensor back into service and allow it to equilibrate. You will then also need to repeat your 1-point grab sample offset calibration. This means taking a sample from the process and determining the ISE concentration (in ppm) for the grab sample and then using the 1-point offset calibration feature of the 3TX-ISE analyzer to bring the online reading in accordance with the laboratory grab sample determination.

Please also note that the activity coefficient for the free cyanide ions in solutions is pH and temperature dependent within the measurable range of pH and temperatures for your system. In addition, the extent of ionization that converts the (unmeasurable) dissolved ammonia gas into the measurable cyanide ion form is also a pH and temperature dependent process. The following page describes such dependence. If you have purchased the 3TX-TOT module, you will be able to compensate for the pH induced effects on the extent of ionization but NOT for any changes to the free ion activity as a function of pH and temperature (these are physically chemistry issues that cannot so easily be de-convoluted as can the extent of ionization). Depending upon your exact pH and temperature conditions, you may or may not need to have this 3TX-TOT module. Contact the factory for additional assistance with this technical issue. Note that the 3TX-TOT can be added after the initial time of commissioning although it is generally recommended for this module to be supplied complete as part of the initial package used for installation since ASTI can then prewire, preconfigure and test the 3TX-TOT as part of the supplied package (without any additional cost).

# Extent of Ionization of HCN to $\text{CN}^-$ at 25 C





Connection Diagram of Iotron™ pH, ORP and Ion Selective (ISE) Sensors without Preamplifiers  
(Tinned Leads Only) to 3TX-pH pH/ORP Transmitters and 3TX-ISE Ion Selective Transmitters

ASTI Cable Color Coding	Instrument Terminal Value	3TX-pH/ISE Terminal Number
Red	pH/ISE Sensor (-) <i>a.k.a Reference</i>	1
Clear	pH/ISE Sensor (+) <i>a.k.a mV Signal</i>	2
Black	Pt100 or Pt1000	4
Black	Pt100 or Pt1000	5

**Note 1:** The 3TX-pH transmitter can be used for either pH or ORP measurement and wiring connections are the same for both pH and ORP sensors (only the Parameter No. 03 needs to be changed/toggled to select between the two input types). For ORP sensors select mV as the input type in P03.

**Note 2:** For 3TX-ISE the ion measurement type (ammonium, fluoride, nitrate, calcium..etc) must be defined at time of purchase and cannot be changed after receipt of transmitter (see label on 3TX-ISE for which ion measurement type is supported for that given unit).

**Note 3:** Depending upon the TC ordered it may be necessary to change the parameter 04 from PT1000 (default) to PT100 (selectable).



**Connection Diagram of Iotron™ pH, ORP and Ion Selective (ISE) Sensors WITH Preamplifiers  
to 3TX-pH-X pH/ORP Transmitters and 3TX-ISE-X Ion Selective Transmitters**

ASTI Cable Color Coding	Instrument Terminal Value	3TX-pH/ISE Terminal Number
Green	+5V Power (Green)	1
White	pH/ISE Sensor <i>mV Signal</i>	2
Black	-5V Power (Black)	3
Yellow	TC (Yellow)	4
Blue & Red	TC (Blue) & Common–Ground–Reference (Red)	5

**Note 1:** The 3TX-pH transmitter can be used for either pH or ORP measurement and wiring connections are the same for both pH and ORP sensors (only the Parameter No. 03 needs to be changed/toggled to select between the two input types). For ORP sensors select mV as the input type in P03.

**Note 2:** For 3TX-ISE the ion measurement type (ammonium, fluoride, nitrate, calcium..etc) must be defined at time of purchase and cannot be changed after receipt of transmitter (see label on 3TX-ISE for which ion measurement type is supported for that given unit).

**Note 3:** Depending upon the TC ordered it may be necessary to change the parameter 04 from Pt1000 (default) to Pt100 (selectable). The wiring is identical whether Pt100/Pt1000 are used.

**Note 4:** Mating pH/ORP/ISE sensor must have the appropriate type of preamplifier integrated inside the sensor or using an external preamplifier in a waterproof J-Box to interface with the 3TX-pH-X or 3TX-ISE-X transmitter. These 3TX-pH-X & 3TX-ISE-X are different hardware from the 3TX-pH and 3TX-ISE transmitter that can directly interface pH/ORP/ISE sensors WITHOUT preamplifiers. The software and functionality is identical for both types of 3TX transmitter; the only difference is whether the sensor to interface must or must not have a preamplifier. The maximum recommended cable length for sensors with preamplifiers is 300 feet (in conduit).





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**Connection Diagram of Iotron™ pH, ORP and Ion Selective (ISE) Sensors WITH Preamplifiers AND Quick Disconnect Q5M Termination on Sensor mated with Q5F Quick Disconnect Extension Cable Wired to 3TX-pH-X pH/ORP Transmitters and 3TX-ISE-X Ion Selective Transmitters**

<u>ASTI Cable Color Coding</u>	<u>Instrument Terminal Value</u>	<u>3TX-pH/ISE Terminal Number</u>
Green	+5V Power	1
White	pH/ORP/ISE Sensor mV Signal	2
Black	-5V Power	3
Yellow	TC	4
Red	TC * & Common–Ground–Reference	5

\* The second side of TC is tied together with the common/reference signal inside the sensor when the Q5M & Q5F connector are used and so only the red wire need to wired to terminal 5.

Note 1: The 3TX-pH-X transmitter can be used for pH or ORP (simply toggle P03 between pH & mV modes). The wiring connections are exactly the same for both pH and ORP sensors.

Note 2: For 3TX-ISE-X the ion measurement type (ammonium, fluoride, nitrate, calcium..etc) must be defined at time of purchase an cannot be changed after receipt of transmitter (see label on 3TX-ISE-X for which ion measurement type is supported for that given unit).

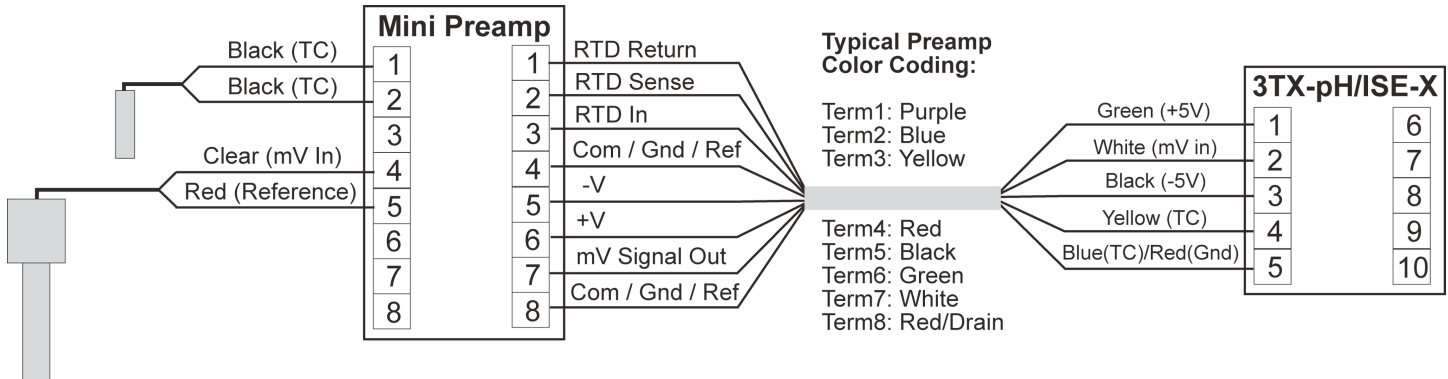
Note 3: Depending upon the TC ordered it may be necessary to change the parameter 04 from Pt1000 (default) to Pt100 (selectable). The wiring is identical whether Pt100/Pt1000 are used.

Note 4: Mating pH/ORP/ISE sensor must have the appropriate type of preamplifier integrated inside sensor and Q5M/Q5F quick disconnect terminations to interface with the 3TX-pH-X or 3TX-ISE-X transmitter with the wiring prescibed above. The preamplifier compatible 3TX-pH-X & 3TX-ISE-X type transmitters are different hardware from the 3TX-pH and 3TX-ISE transmitter that can rather only interface pH/ORP/ISE sensors WITHOUT preamplifiers. The software and functionality is identical for both types of 3TX transmitters with the only difference being whether the sensor to interface must or must not have an integral preamplifier. The maximum recommended cable length for sensors with preamplifiers is 300 feet (in conduit).

## Connection Diagram of ASTI Sensors WITHOUT PREAMPLIFIERS (Input) to External “Mini” Conventional Preamp (Output) to ASTI 3TX-pH-X and 3TX-ISE-X Preamp Style Transmitters

**Input from ASTI pH / ORP / ISE Sensors  
Without Preamp  
(Inside J-Box Connections)**

**Output from ASTI “Mini”  
Conventional External Preamp  
(Inside Transmitter Assembly Connections)**



**Connection from ASTI “Mini” External Conventional Preamp Output (Schematic on Left)  
to Input Terminal Block on ASTI 3TX Transmitter (Schematic on Right)**

**Note 1:**

The temperature compensation element input shown on the far left as the input side to the “Mini” external preamp terminal 1 & 2 can be 100 or 1000 Ohm Platinum (selectable in 3TX-pH-X or 3TX-ISE-X transmitter).

**Note 2:**

When using the “Mini” external conventional preamplifier with the 3TX-pH-X and 3TX-ISE-X it is not necessary to interface with the output side terminal 1 (RTD Return). This is not required because the 3TX transmitters do not support 3-wire TC inputs. As such the blue terminal 2 and yellow terminal 3 output connections provide the 2-wire Pt100 or Pt1000 TC inputs.

**Note 3:**

When using the “Mini” external conventional preamplifier with the 3TX-pH-X and 3TX-ISE-X it is not necessary to interface with the output side terminal 8 (duplicate common/ground/reference). This is because the 3TX transmitters do not require two common input leads (as some transmitter do) but rather just a single common/ground/reference connection from terminal 4 (red color coded lead).

**Note 4:**

This “Mini” external conventional preamplifier can interface quite a number of additional transmitters besides the 3TX-pH-X and 3TX-ISE-X units. Please inquire to ASTI factory for wiring schematics to other transmitter types.

**Note 5:**

It is possible to power this “Mini” external preamplifier from a two-sided battery pack power source if it is to be mated with a pH/ORP transmitter that does not support preamplifiers. Inquire to ASTI factory this type of alternate wiring schematic.

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## **Cyanide (CN<sup>-</sup>) Probe Two Point Calibration**

This calibration method should not need to be performed frequently. **All new cyanide ion selective sensors can generally simply use the factory defined 2-point slope calibration.** This two-point calibration determines the sensitivity or slope of each sensor, which is then stored in the analyzer. Subsequent 1-point offset calibrations can be made using only the offset option. An offset calibration must be performed after every 2-point calibration (without exception). Details for the 1-point calibration are given in the proceeding page.

**THE “HOLD” FEATURE IS AUTOMATICALLY ACTIVATED EACH TIME THAT ANY 2-POINT OR 1-POINT CALIBRATION IS PERFORMED. THIS MEANS THAT THE LAST PROCESS VALUE WILL CONTINUE TO BE SENT VIA THE ANALOG 4-20 mA AND MODBUS DIGITAL OUTPUT BEFORE ENTERING THE CALIBRATION MODE. THIS IS THE DEFAULT BEHAVIOR AND CAN ONLY BE MODIFIED AT THE ASTI FACTORY IF THIS IS NOT DESIRED.**

### **Set-up requirements:**

Two 250 mL GLASS OR PLASTIC BEAKERS

*(Preferably heavy enough so that the ISE sensor does not tip over the beaker!)*

Low Cyanide Standard Solution (low ppm)

High Cyanide Standard Solution (high ppm)

**Parameter No. 01 is a “lock” which must be set to ‘Off’ to change ANY parameter, including the temperature, offset and slope calibrations.**

Calibration of the ion selective sensor is done with Up/Down keys. To perform a 2-point slope calibration using the ‘Mode’ key select ‘Offset’ and adjust the reading the Up/Down keys until the display shows the correct value for the first Low ISE standard. Next use the ‘Mode’ key to select ‘Slope’ and use the Up/Down keys until the display reads the second desired value for the second High ISE standard. After this 2-point slope calibration is performed it is always necessary to perform a production ‘Offset’ calibration to ensure agreement with grab sample analysis (described on the following pages).

The exact values for these low and high cyanide standard solutions will depend upon your particular needs. The last page of this addendum details a typical cyanide calibration standard formulation. Alternative customized recommendations may be made by the ASTI factory should your application require it.

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## **Important Notes about Calibration:**

- Fill a 250 mL GLASS beaker with enough standardization solution such that the entire tip of the Cyanide sensor will be submersed
- Please read sheet on the cleaning procedure for this ion selective sensor. The cleaning procedure should usually be performed when transferring a sensor in or out of solution. Sensors can also be cleaned before being placed into different concentration standardization solutions and/or grab sample solutions. Cleaning is only required if fouling appears on the ISE membrane or on the reference junction. If no contamination is apparent, then the simple rinsing procedure can be used (see following sections for details).
- Thoroughly rinse the sensors with DI water and gently blot dry with a clean paper towel. Be careful not to scratch or damage the sensitive cyanide ion selective membrane
- Allow a minimum of 3 – 5 minutes for the sensor to stabilize once it has been removed from the process and placed into the low standard solution (low ppm).
- Allow a minimum of 3 – 5 minutes for the sensor to stabilize between the low and high Calibration Solutions (low ppm to high ppm).

**YOU CAN VIEW THE SENSOR SLOPE AND OFFSET RESULTING FROM A 2-POINT CALIBRATION WITH PARAMETER P15 (SLOPE) AND PARAMETER P14 (OFFSET).**

**IF YOU PERFORM 1-POINT GRAB SAMPLE OFFSET ONLY PARAMETER P14 WILL CHANGE WHEREAS THE SENSOR SLOPE (P15) WILL REMAIN FROM YOUR PREVIOUS 2-POINT SLOPE CALIBRATION.**

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## **Single Point (1-Point) Offset Calibration – Grab Sample**

*This is the correct method to Adjust for Sensor Drift!!*

### **Cyanide Sensor One Point Calibration (“Production Offset”)**

Only use “Offset” function in Calibrate Menu.

Can be performed as frequently as may be required.

When the cyanide sensor has been calibrated by the 2-point method previously described only a “single point” grab sample offset calibration should be required thereafter.

**THE “HOLD” FEATURE IS AUTOMATICALLY ACTIVATED EACH TIME THAT ANY 2-POINT OR 1-POINT CALIBRATION IS PERFORMED. THIS MEANS THAT THE LAST PROCESS VALUE WILL CONTINUE TO BE SENT VIA THE ANALOG 4-20 mA AND MODBUS DIGITAL OUTPUT BEFORE ENTERING THE CALIBRATION MODE. THIS IS THE DEFAULT BEHAVIOR AND CAN ONLY BE MODIFIED AT THE ASTI FACTORY IF THIS IS NOT DESIRED.**

### **Set-up requirements:**

Two 250 mL GLASS OR PLASTIC BEAKERS

Process Grab Sample Solution

***Parameter No. 01 is a “lock” which must be set to ‘Off’ to change ANY parameter, including the temperature, offset and slope calibrations.***

A grab sample should be taken from the process and analyzed by an alternate method for cyanide ion concentration. There are a variety of ways to perform the grab sample analysis including the commonly employed portable photometers. In some cases where there is significant turbidity in the sample, a dilution scheme may be advisable for best results. This grab sample determined concentration of the process sample (by whatever method employed) will then be entered into the standardize menu as further described below. Using this recommended procedure, the online cyanide sensor can be standardized and be in agreement with the grab sampling method chosen without ever having to remove the sensor from process service.

### **Important Notes about 1-point “Standardize” Calibration:**

The sensor should be left in service and obtain a stable reading with the process solution. It is not necessary in any way to remove the sensor from service to perform a 1-point grab sample offset “Standardize” calibration.

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Calibration of the ion selective sensor is done with Up/Down keys. To perform a 1-point slope calibration using the 'Mode' key select 'Offset' and adjust the reading the Up/Down keys until the display shows the correct value in accordance with the concentration determined by analysis of the grab sample. The ISE sensor should be left in service for the production 1-point 'Offset' calibration. All settings are stored in EEPROM so unit can be powered down without loss of configuration or calibration.

**VERY IMPORTANT NOTE: The value obtained from any grab sample analysis for cyanide will always returned the "TOTAL CYANIDE" as will be displayed on the "Total ISE" LED on the TOT module. When performing this critical grab sample offset calibration, the "Offset" calibrate mode on the ISE module should be adjusted until the value shown on the "TOT" module in the "Total ISE" LED mode agrees with the grab sample analyzed value of the process solution.**

**THERE IS A TIME AVERAGING (DAMPEN) FUNCTION THAT IS SET IN THE 3TX-ISE AT THE ASTI FACTORY. THIS VALUE IS CONFIGURABLE FOR BOTH THE EXTENT OF TIME AVERAGING FOR THE MEASURE AND CALIBRATE MODES SEPARATELY. IF YOU FIND THAT YOU WISH TO HAVE MORE OR LESS TIME AVERAGING THAN WHAT IS PROVIDED ON YOUR UNIT AT PRESENT, CONTACT THE FACTORY FOR ASSISTANCE WITH THIS. THESE VALUES CANNOT BE MODIFIED IN THE FIELD BUT RATHER NEED TO BE CHANGED AT THE ASTI FACTORY. THE PRESET VALUES ARE FINE FOR THE VAST MAJORITY OF USERS AND APPLICATIONS ALTHOUGH THEY CAN BE MODIFIED UPON REQUEST WITHOUT INCURRING ANY COST.**

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## Cleaning and Maintenance of ASTI Cyanide (NH<sub>4</sub><sup>+</sup>) Probe

**Before a major 2-point calibration is performed the sensor may need to be cleaned each time. The frequency of cleaning will depend on the process water and build up of process reagents on the probe tip.**

### Note:

Any noticeable deposits on the tip of the sensor will result in a less accurate calibration and measurement.

### CLEANING:

1. Thoroughly rinse the sensor tip with DI water. Gently blot the sensor tip dry.
2. The cyanide sensor tip can be cleaned with isopropyl alcohol to remove any oily or waxy build-up. No other solvents or reagents should be used without contacting ASTI to ensure that it is suitable.
3. Scrape the entire reference area clean with a sharp blade or Stanley knife. This reference is solid-state and cannot be damaged with ordinary cleaning techniques. **Do not scratch the membrane.**
4. Once the reference junction has been cleaned the entire sensor tip can be soaked in either the low or high standardization solution. After allowing sufficient time for conditioning before proceed to perform a 2-point calibration.
5. Any compatible solution can serve as conditioning media for extended storage. It is NOT necessary to store the sensor in a media containing cyanide for proper storage. Do not allow sensor to be exposed to air for prolonged periods of time as this will cause the reference junction to become dehydrated (meaning that a reconditioning period will be required to restore it to normal operation). Always store the sensor in a suitable media when not in use. At time of dispatch, the cap was filled with suitable conditioning solution sealed onto sensor tip with TEFLON tape.

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## **Miscellaneous**

The decimal place on the 3TX-ISE and 3TX-TOT display will automatically move as appropriate based upon the ppm value of the sensor reading. Note that the displays will always auto-range from 0.00 to 9.99, 00.0 to 99.9 and 000 to 999 ppm. Your analog and digital MODbus output will, however, be defined as selected in parameters governing this aspect of operation. This means that your output may be maxed out and not reflect the exact process reading if you selected too low a range for your output scaling. In addition, it should be noted that the output and display are altogether decoupled meaning that any limit imposed by the output scaling will not limit the value shown on the local LED display.

Do not to allow air bubbles to get trapped near the cyanide ion selective membrane. This is will cause erroneous readings and drift. In some cases air bubbles may become entrapped within the ISE sensor itself. A firm shake down of the sensor should alleviate any internal air bubbles and proper installation of the sensor (including having the line be completely full and degassed) will ensure that there are no air bubbles on the measuring tip. Contact ASTI factory for details regarding optimal process installation approaches.

The cyanide sensor is comprised of a high-impedance ion selective membrane system. Care should be taken not to move or touch the cable once a value is being stabilized (even if an integral preamplifier is employed). Touching the sensor cable can cause a noisy signal that may result in erroneous values and calibrations. For best results the sensor cable should be run in conduit. For noisy environments and/or longer cable runs a preamplifier should be employed either integral to the sensor or else an external preamplifier in a waterproof J-Box assembly. In some cases, it may be desirable to both use a preamplifier and to run the cable in conduit (for rather noisy environment or else in combination with longer cable runs, or both).

Please see the specification and hook-up schematics found in the AB 6160, AB 6160A or AB 8160 cyanide sensor shipping box. This data is included in this ISE addendum for convenience as well in case the hard copy was lost or misplaced.





**CLEANING AND POLISHING OF SOLID-STATE IOTRON™  
& IOTRODE™ ION SELECTIVE ELECTRODE SENSING TIPS**

INSPECTION AND CLEANING

Perform the following inspection and polishing procedure when a solid-state ion selective sensor becomes unresponsive, sluggish or performing a calibration becomes difficult. The sensor may be contaminated or attacked by some of the components in the sample.

- Remove the sensor from the equipment and visually inspect it. If the sensor's ion selective sensing membrane (the center piece at the front of the sensor) is dull in part or in whole, is recessed into the black body, it may need repolishing.
- If only a deposit of organic nature and is soluble in isopropyl alcohol try to remove by rubbing with a tissue soaked in the alcohol first. If the sensor's sensing membrane regains its shiny state reinsert sensor and recalibrate the equipment per the appropriate ion selective sensor addendum instructions posted at [www.astisensor.com/indexrefreshprodoc\\_isemanuals.htm](http://www.astisensor.com/indexrefreshprodoc_isemanuals.htm).
- If sensor has been contaminated and contamination cannot be removed with isopropyl alcohol as described, or the sensing membrane has become dull or recessed into the body, the sensor then needs regrinding and polishing. The sensing membrane is only about 0.100 to 0.150 inches thick, so minimizing the grind thickness allows for a longer service lifetime.

POLISHING

- Use the any "wet or dry 600 grit silicon carbide" polishing paper or cloth for grinding. Place the polishing paper on a smooth surface, and make sure the surface is free from particulates. Wet the polishing surface with high purity deionized water and hold the sensor perpendicular to the surface of the polishing paper to the middle of the wetted surface.
- Rotate the sensor counterclockwise (clockwise if left handed) while pressing firmly against the surface on an increasing circle to about a 1" to 2" diameter. This motion will partially rough-up the surface of the polishing paper and will rough grind the sensor. Repeat the rotation in reverse by reducing the circle.
- After this procedure the sensor surface should be uniformly dull, showing small scratches. If this does not describe the sensor surface, repeat procedure and rotate sensor 180 degrees in your hand. Wash hands and equipment and rinse sensor in deionized water.
- Obtain a smooth polishing cloth. Adhere it to a smooth particulate free surface which can be used as a polishing block. Wet the surface of the cloth with deionized water.
- Add about 0.1 gram of 1.0 micron aluminum oxide polishing powder (a fine white powder). Use the same technique and motions for polishing as described in the grinding section, starting in the middle of the aluminum oxide pool.
- Check the surface after about six to ten circles, if not shiny and scratch free to the naked eye, repeat the procedure. Rotate the sensor 180 degrees in your hand after each checking as this will provide more uniform surface.
- Wash hands and equipment, rinse sensor in deionized water. Condition the sensor for about 30 minutes in the calibration solution of the lower concentration and recalibrate the equipment as described in the ion selective addendum.
- If the polishing cloth is cleaned and stored clean it can be repeatedly used, if broken down, replace with new one.



## Procedures for Preparation of Cyanide Standard Solutions

### Materials

Sodium Cyanide (Analytical/Reagent Grade or better)  
Sodium Hydroxide (Commercial Grade OK)  
1 Liter Volumetric Flask (one each)  
5 Liter Volumetric Flask (one each)  
1 liter plastic bottles (five each)  
DI Water (15 MegaOhms or higher resistivity grade)

ENSURE THAT ALL GLASSWARE IS CLEAN AND DRY BEFORE PROCEEDING. THOROUGHLY CLEAN EACH VOLUMETRIC FLASKS AFTER PREPARING ANY SOLUTION WITH DI WATER.

### Stock Solution Preparation Procedures:

#### *Preparation of 1 Molar Sodium Hydroxide stock solution (DO THIS FIRST!):*

1. Measure out 200 grams of sodium hydroxide.
2. Place this sodium hydroxide into a 5 liter volumetric flask.
3. Dilute with DI water to 5 liter mark. Mix solution well until all sodium hydroxide is dissolved.
4. Seal 5 liter volumetric flask with glass stopper.

#### *Preparation of 100 ppm Cyanide stock solution:*

1. Measure out 0.1884 grams of sodium cyanide salt.
2. Place this sodium cyanide into 1 liter volumetric flask.
3. Dilute with 1 Molar sodium hydroxide stock solution to the 1 liter mark. Mix solution well until it is completely homogeneous.
4. Transfer this 100 ppm cyanide stock solution to a 1 liter plastic bottle and label appropriately.

### Cyanide Calibration Solution Preparation Procedures:

#### *Preparation of 0.2 ppm Sodium Cyanide Standard Ion Solution*

1. Draw 2.0 mL of 100 ppm cyanide stock solution and transfer to a 1 liter volumetric flask.
2. Dilute with 1 Molar sodium hydroxide stock solution to the 1 liter mark. Mix solution well until it is completely homogeneous.
3. Transfer this 0.2 ppm cyanide calibration solution to a 1 liter plastic bottle and label appropriately.

#### *Preparation of 0.5 ppm Sodium Cyanide Standard Ion Solution*

4. Draw 5.0 mL of 100 ppm cyanide stock solution and transfer to a 1 liter volumetric flask.
5. Dilute with 1 Molar sodium hydroxide stock solution to the 1 liter mark. Mix solution well until it is completely homogeneous.
6. Transfer this 0.5 ppm cyanide calibration solution to a 1 liter plastic bottle and label appropriately.

#### *Preparation of 2.0 ppm Sodium Cyanide Standard Ion Solution*

7. Draw 20.0 mL of 100 ppm cyanide stock solution and transfer to a 1 liter volumetric flask.
8. Dilute with 1 Molar sodium hydroxide stock solution to the 1 liter mark. Mix solution well until it is completely homogeneous.
9. Transfer this 2.0 ppm cyanide calibration solution to a 1 liter plastic bottle and label appropriately.

#### *Preparation of 5.0 ppm Sodium Cyanide Standard Ion Solution*

10. Draw 50 mL of 100 ppm cyanide stock solution and transfer to a 1 liter volumetric flask.
11. Dilute with 1 Molar sodium hydroxide stock solution to the 1 liter mark. Mix solution well until it is completely homogeneous.
12. Transfer this 5.0 ppm cyanide calibration solution to a 1 liter plastic bottle and label appropriately.