Frequently Asked Questions (FAQ) for 3TX pH, ORP, Ion Selective (ISE), Dissolved Oxygen (DO) & Conductivity Transmitters & Controllers with Application Notes

Question:
Can I share the 24VDC power supply used to energize other instrumentation or equipment at the same installation site to also energize the 3TX transmitters?

Answer:
Absolutely not. **It is altogether critical that the 24VDC power supply used to power the 3TX transmitters is COMPLETELY separate from all other equipment.** This also includes all other instrumentation as well other heavier equipment such as pumps, motors and so forth. This is because the 3TX measurement module series is a 3-wire transmitter. The 3-wire aspect can be explained as follows: the 4-20mA analog current loop output sent from terminal 7 returns back to terminal 8; the +24VDC is connected to terminal 6 while the ground DC common from the power supply is shared with the return of the 4-20mA scalable current loop output on terminal 8. In this way all of the ground terminal are shared between the current loop output and the DC common amongst all 3TX measurement modules energized from a single 24VDC power supply source. There exists a 3000V opto-coupler isolation between the inputs and outputs of the 3TX transmitter no matter the particular measurement module. The outputs are not, however, isolated from each other as the ground terminal is shared in the manner described above. Because of these reasons whatever 24VDC power supply is used to energize the 3TX transmitters should be altogether dedicated to only power these modules only. This dedicated 24VDC power supply can either be customer supplied or using the ASTI supplied 3TX-PS module.

The 35mm DIN-RAIL mountable 3TX-PS power supply offer a very simple and low-cost solution for the 3TX transmitters to have their own dedicated 24VDC power supply as required. It is also quite compact being only half the width of a standard 3TX module and 35mm DIN-RAIL mountable and so readily fitting into any of the enclosure options. When purchased as part of a complete DIN-RAIL mounted or enclosure assembled configuration, the 3TX-PS module will be pre-wired to all of the 3TX transmitter(s) supplied so that only the AC power input for the 3TX-PS need to be added to have the unit(s) up and working (plus connecting the analog and MODbus outputs as well as the sensors for input as usual). The 3TX-PS is a well-tested proven power supply solution at very many customer installation sites. The issue of having a dedicated 24VDC power supply for the 3TX modules is important for both passive input measurement module types such the 3TX-pH, 3TX-ISE (mate with pH/ORP/ISE sensors without preamplifiers) and 3TX-DO (mate with galvanic DO cells) as well as active input measurement module types such as the 3TX-pH-X, 3TX-ISE-X (mate with pH/ORP/ISE sensors with preamplifiers) and 3TX-CON (all contacting conductivity cells). The isolation on the AC/DC transformer of the 3TX-PS acts to isolate the 24VDC power from the rest of the electrical devices at the installation site ensuring that no such potential ground issues occur to the modules themselves nor any devices powered from the 3TX measurement modules such as preamplifiers and contacting conductivity cells. This isolation in the 3TX-PS also serves to ensure that no issues prevent themselves regarding ground on the analog 4-20mA current loop output or RS485 MODbus outputs eminating from the power supply side of the system. It is still possible to have ground loop and electrical isolation issues that eminate from the process side of the system, but this is a much more complex question and larger in scope than just the 3TX instrumentation.

The 3TX-PS power supply has a 500mA max rating at 24VDC (12 Watts) and easily handles up to 8 each 3TX modules with 60mA as the absolute max power consumption per 3TX module unit. The 3TX-PS is a universal 100 to 240 VAC 50/60 Hz power supply module. The agency approvals for the 3TX-PS module includes CE, CSA & UL for use in safe areas. If you plan to install the 3TX transmitters into a hazardous area please inquire to the ASTI factory for special accommodations necessary to support these application and installation types.

Question:
How do you wire up the analog output from the 3TX transmitter to a data acquisition or control system?

Answer:
Keep in mind that all 3TX transmitters are 3-wire devices (it is a part of their name). This means they have an ACTIVE 4-20mA analog current loop output, like a 4-wire type device. The data acquisition or control device to which this 3TX active 4-20mA output is connected should <u>passively</u> measure the current. Most PLC have a hardware or software toggle that allows you to select whether the 4-20mA received is from a 4-wire (or 3-wire) active type device or else if it is a 2-wire device which must be energized from the PLC power supply.

<u>NEVER</u> apply voltage across terminals 7 & 8 on any 3TX transmitter! This could happen if a 3-wire type 3TX transmitters is wired as though it were a 2-wire type devices. The result of such an improper wiring would destroy the output circuit with the damage not covered under warranty due to abuse/misuse.

The lead providing +24VDC power always goes to terminal 6 and the 4-20mA current loop output is always sent from terminal 7. The DC common (ground) is shared as terminal 8. The current loop output is sent from terminal 7 and return to terminal 8 (ground / DC common). The 3TX transmitters are always energized on terminal 6 with the DC ground of the 24VDC power supply (a.k.a. rail) always being the (shared) terminal 8.

Question:
Can I connect the output from 3TX transmitter to non-isolated 4-20mA analog inputs on my PLC?

Answer:
No. The output from the 3TX <u>MUST ALWAYS</u> be connected to isolated analog inputs. If your PLC does not have isolated analog inputs, then you must add an isolator for each current loop to be used. The ground cannot be shared on both the analog current output from the 3TX (which it is since it is a 3-wire device) and on the analog input on the PLC. The ground for each analog input on the PLC must then always be isolated.

Question:
If I purchased a 3TX-REL alarm/relay controller together with any of the measurement modules such as the 3TX-pH, 3TX-ISE, 3TX-DO or 3TX-CON can I modify the 4-20mA output scaling set at the ASTI factory?

Answer:
Yes. The output scaling for each module can be modified within the prescribed limits in the documentation. If you modify the output scaling from defaults for the 3TX-pH, 3TX-ISE, 3TX-DO or 3TX-CON modules you also need to modify the 4-20mA input scaling for the 3TX-REL and/or 3TX-TOT module accordingly. The 4-20mA output can be used both for connecting to the 3TX-REL and/or the 3TX-TOT pH compensation module as well as to other data acquisition or control devices using the bridge type wiring configuration (see link below):

http://www.astisensor.com/3TX-REL-Bridge-Wiring.pdf

If you ordered your system with both a measurement module and REL controller at the time of purchase from the ASTI factory, your system will be wired as shown on the above wiring schematic. To ensure optimal agreement between the measurement module (pH, ORP, ISE, Conductivity or Dissolved Oxygen) and the REL or TOT module to which the analog current loop output may be bridged, it may be necessary to refine the trim calibrations. In this case it is recommended to perform the 4-20mA trim calibrations on the measurement module first with calibrated multimeter (see 3TX transmitter documentation for the setup parameters to be adjusted). The 4-20mA trim calibration for the REL or TOT modules should be performed after the output trim calibrations have been refined on the measurement modules. When the trim calirbations are well paired, the reading should match closely. Scaling the outputs more narrowly can make matching the values easier.

Question:

What does the 4mA +/- X.XX% and 20mA +/- X.XX% label on the 3TX transmitter mean?

Answer:

Prior to dispatch each 3TX transmitter has the 4mA trim offset and 20mA trim gain calibrated for optimal analog precision. These values may change slightly over time or due to environmental conditions. In such cases the analog trim can be further adjusted by modifying the appropriate parameter on the transmitter for the analog output or analog input of interest (see the relevant instructions in the manual for that particular transmitter). If the 3TX transmitter is reset in the field, the analog 4mA trim offset and 20mA trim gain calibration values shown on this label will be restored from the factory calibration and any modifications to this calibration made after dispatch from the factory will be lost.

Question:

Why is there a serial number for each transmitter? I ordered a complete dual or triple transmitter or controller assembly. Shouldn't there be just one serial number?

Answer:

Well actually not for how the modular and highly configurable 3TX system works. Each measurement module (3TX-pH, 3TX-ISE, 3TX-DO & 3TX-CON) or complementary module (3TX-REL, 3TX-TOT & 3TX-DAT) will have its own serial number. The complete assembly will be fabricated, prewired and calibrated as your have requested at the ASTI factory but each individual component will have its own unique traceable serial number. Unlike many other electrochemical measurement and control systems, component can be changed out, repaired or upgraded module by module and so our scheme (must) separately tracks each transmitter module. **Accordingly, removing or modifying the 3TX serial number will void your warranty on that particular module/transmitter**. If no serial number exists on a unit or a label indicating "DEMO ONLY" exists on the transmitter then assistance will be provided on a best faith basis but no specific warranty will apply.

Question:

What is the sampling rate of each of the measurement modules? Is there any time averaging for the view measurement during calibration & measure modes? Can any of these settings be modified in the field?

Answer:

The sampling rate for all of the measurement module is 4 Hz (4 data samples processsed per second). There is time averaging (a.k.a. dampener) implemented as most appropriate for that measurement type for both the calibrate and measurment modes. The time averaging can be disabled at the ASTI factory for special order units when it is desirable to measure the raw 4 Hz measurement data sample rate. In most cases, a reasonable time averaging dampener yields the best results for calibration and control purposes. The time averaging settings (in terms of the number of seconds used) is set at the ASTI factory and cannot be modified in the field. Please inquire to the factory prior to purchase regarding any questions related to the dampener settings of your 3TX module since they can often be optimized for your use upon request at no additional charge but cannot be modified after dispatch to your location. For special applications, it is possible for ASTI to supply custom configuration of the 3TX transmitters without any dampener applied at all to see real time data at very high sampling frequency. This can be helpful for smaller pilot scale of benchtop use where these parameters can be change quite quickly as compared to larger production size systems.

Question:
Is there any good reason to modify the analog output scaling from the default values for the 3TX-pH, 3TX-ISE and 3TX-CON measurement transmitters?

Answer:
This will really depend upon your particular data acquisition and control setup. One thing to keep in mind is that the resolution of the 3TX analog output is fixed at 1000 steps completely independent of the scaling selected. This means that you have the same number of steps if you define your output to be the full range or a much more narrow portion of that range down to the minimum scaling allowed for that module. As a example if you have a 3TX-CON transmitter suitable for use with a 1.0/cm cell constant you maximum full scale range would be 0-50,000 microSiemens and the minimum scaling would be 0-5,000 microSiemens. Since the the output resolution is fixed independent of scaling, choosing the minimum range would give you ten times (10X) better relatively resolution in absolute microSiemens (5μS vs 50μS in this example). As another example the full range scaling for the 3TX-pH in the pH measurement mode is 0-14. If your application should truly only need to operate between the pH range of 4 to 11, then you relative output resolution would double by restricting it from the full range 0-14 to the more narrow 4-11 scaling since we have gone from a total of 14 pH units to only 7 pH units while the absolute output resolution is fixed. For most 3TX measurement module the scaling can be reduced down as low as 10% or 20% of the full range. Check the relevant 3TX transmitter specification sheet and manual to find the specific limits of your module (be sure to check revision number).

Depending upon your needs it may then be advantageous to restrict the output scaling to the typical minimum and maximum operational range for that measurement point to have the highest possible resolution on the analog output of the corrresponding 3TX module. As discussed in the previous Question & Answer above, if you change the output scaling (and thus the resolution) from the measurement transmitter you will also need to be sure to change the input scaling for any mating modules (such as the 3TX-REL or 3TX-TOT) that use the analog output from this measurement module. Most of the 3TX measurement modules with the MODbus output option will follow the analog 4-20mA scaling and the resolution is also fixed at 1000 steps by default. The MODbus protocol does allow for the possibility of much higher resolution output. One example is the 3TX-pHE module with 20,000 steps giving a resolution of 0.001 in pH mode and 0.1mV units in ORP mode. As another example, the 3TX-CON-E offers between 10,000 and 20,000 steps for the temperature compensated conductivity and 50,000 steps for the raw conductivity values giving the high possible resolution anywhere in the range for a given cell constant (see separate 3TX-CON-E cut sheet for details). Note that the temperature is always sent as 1,000 steps no matter the 3TX transmitter employed. Lastly, all of the measurement modules (3TX-pH, 3TX-ISE, 3TX-CON, 3TX-DO and 3TX-TOT) are compatible for use with the 3TX-DAT MODbus datalogger except for the special high resolution MODbus 3TX-pHE and 3TX-CON-E units, although these units ARE compatible with the free of charge Windows software and most any modern MODbus PLC system.

Question:
The 3TX-TOT wiring looks complicated. Will it be hard to use this total ISE measurement module?

Answer:
While the documentation on the 3TX-TOT module is exhaustive and thorough, this is primarily for the purpose to allow further customization by those that have very specific application needs. All of the wiring and configuration is performed at the ASTI factory when this module is fabricated as part of a complete total ISE measurement system. Bearing the ASTI factory preconfiguration in mind, there is typically very few parameters (if any) that need to be changed by the most users. Normally that needs to be done is to connect the sensor inputs as shown (all other module wiring will be completed prior to dispatch).

Question:
Can I add MODbus to the 3TX-pH, 3TX-ISE, 3TX-DO or 3TX-CON if purchased as analog output only units?

Answer:
No. The only option if you need MODbus output for module based as analog only units is to use a 3TX-TOT module which can convert the analog output to a MODbus output for selected configurations. The only other option is to purchase the identical measurement module(s) with the desired MODbus output and to change out the existing analog only units installed (be they in an enclosure assembly or on a DIN-RAIL). Since the 3TX-DAT datalogger only accepts MODbus input, if you believe that you may want to use this field datalogger it is recommended to purchase all of your measurement modules with the MODbus output in such cases.

Question:
Can the 3TX-pH and 3TX-ISE interface pH/ORP/ISE sensors with and without preamplifiers?

Answer:
Yes. Mor specifically the 3TX-pH can interface pH or ORP sensors ONLY WITHOUT PREAMPLIFIERS and the 3TX-ISE can interface ISE sensors ONLY WITHOUT PREAMPLIFIERS. Conversely, the 3TX-pH-X can interface pH and ORP sensors ONLY WITH PREAMPLIFIERS and the 3TX-ISE-X can interface ISE sensors ONLY WITH PREAMPLIFIERS. Note that by "ONLY WITH PREAMPLIFIERS"this can mean either that the sensor itself has an integral preamplifier or else that a sensor without an integral preamplifier is bridged across an external preamplifier (see separate documentation for mini external preamplifier option). Note that the two types of pH/ORP transmitters (3TX-pH & 3TX-pH-X) and ion selective transmitters (3TX-ISE & 3TX-ISE-X) are altogether different hardware versions and so are not interchangeable in the field. The decision regarding whether you plan to use a pH/ORP/ISE sensor with or without a premplifier will need to be known prior to purchasing any pH/ORP or ISE measurement system using 3TX transmitters so that the suitable type of pH/ORP/ISE transmitter can be selected. In particular be sure to know the precise cable lengths needed prior to any commissioning for new installation sites and to double-check the required cable lengths for any existing locations. In the case that you wish to have the flexibility to support long cable runs and/or to the benefit or noise rejection from the process equipment by using an integral or external preamplifier, you can always choose to purchase the preamplifier style (3TX-pH-X & 3TX-ISE-X). The pricing is identical for both hardware versions as all software and functionality is also perfectly identical. Lastly, note that only pH/ORP/ISE sensors with integral preamplifiers can be supplied with quick disconnect terminations (see separate write-up on this option if this feature is desired). Note that the quick disconnect option must be chosen at time of order.

Question:
Can I change the ion to be measured on the 3TX-ISE or 3TX-ISE-X ion selective transmitter?

Answer:
In the field the answer is no. At the ASTI factory we can modify the programming so that your 3TX-ISE or 3TX-ISE-X can measure any ion that you wish. This modification of the ion configuration, however, cannot be performed in the field. This restriction is well considered trade-off. While some potential inconvenience exists from needing to send the 3TX-ISE or 3TX-ISE-X transmitter back to the ASTI to be reconfigured for another ion selective measurement, this limitation is far outweighed by making it such that the transmitter cannot be accidentally misconfigured in the field. In addition, custom OEM configurations allow for user defined default values for all parameters so that the software reset can yield exactly the desired configuration in the field (minimum order quantities apply to be eligible for the free of charge Custom OEM configuration feature).

Question:
Can I change the contacing conductivity cell constant for which the 3TX-CON is to be used?

Answer:
In the field the answer is no. Careful attention should be paid to the expected minimum, typical and maximum conductivity values for the planned measurement type. The most optimal cell constant to be employed and associated supported ranges are then defined in conjunction with the ASTI factory on the basis of this information. A cell constant and range selection guide is avaialable upon request as a good initial guide. Prior to purchase and final specification of equipment, it is always best practice to contact the ASTI factory for an official recommendation. In many cases multiple transmitter configurations are available for the same cell constant or range and the best choice is often depend upon a variety of factors considered in totality.

Question:
How do you access the buttons & terminals when 3TX modules are installed in a 2M(W), 4M(W) or 6M(W) IP65 rated enclosures or else the 3MP, 3MF, 7MF & 9MF NEMA 4X rated enclosures?

Answer:
To access the three buttons for calibration and configuration of all 3TX transmitters with the 2M(W), 4M(W), 6M(W) enclosures only the clear window need be released (the top shell can stay in place). To access the terminals on the 2M(W), 4M(W) & 6M(W) type IP65 rated enclosures you must open the clear plastic window and also remove the four screws that hold the top shell of the enclosure assembly to the bottom shell. For the 3MP (NEMA 4X ½-DIN panel mount) and 3MF, 7MF & 9MF (NEMA 4X CSA/UL rated field mount style) enclosures only the latches need to be released to access all of the internal wiring as well as accessing the terminal buttons themselves. For all enclosure types the necessary cables should be securely installed through the cable gland sealing strain reliefs and secured tightly to prevent intrusion. Unused cable glands should have the factory supplied sealing caps secured to ensure weatherproof and waterproof operation. Enclosure ratings are only valid when the unit is completely closed and cables have been properly installed.

Question:
Can the 3TX systems be setup such that the top shell does not have to be removed when replacing sensors? Can sensors be changed out without having to pull the sensor cables into the enclosure each time?

Answer:
Yes. For the galvanic dissolved oxygen sensors that mate with the 3TX-DO and the contacting conductivity sensors that mate with the 3TX-CON the sensor terminations can be bridged across ordinary good-quality terminal strips provided that such bridging is done in a waterproof J-Box assembly. For the pH/ORP/ISE measurements the terminations can only be bridged when using the preamplifier style version of the pH & ISE transmitters (3TX-pH-X and 3TX-ISE-X) in combination with either an external preamplifier in a waterproof J-Box assembly (a.ka. Mini External Preamplifier) or else a pH/ORP/ISE sensor with an integral preamplifier (optionally available with quick disconnect terminations). The preamplified extension cable from the waterproof J-Box bridge in such a pH/ORP/ISE measurement installation scheme is then permanently connected to the 3TX-pH-X or 3TX-ISE-X transmitters inside their separate enclosure assembly. All common functionality such as calibration, configuration and simply viewing the process parameters is possible without removing the top-shell of the IP65 rated enclosures.

Question:
I am seeing a flashing "OFL" or "UFL" on my 3TX transmitter. What does this mean?

Answer:
The flashing "OFL" means that an overflow issue exists on the input while a flashing "UFL" means that an underflow issue exists on the input. When this error exists you will not be able to perform any programming or configuration of the transmitter until the issue is resolved. The "OFL" or "UFL" condition can be due to a variety of possible causes which are summarized below:

POTENTIAL TEMPERATURE INPUT RELATED PROBLEMS
- A temperature element is not properly connected to the transmitter input board. Most electrochemical transmitters require a valid temperature input in order to operate properly, and this general rule is also true for the 3TX transmitter.
    o Check that each of leads are firmly connected to the proper terminals per the wiring schematic
    o If no sensor is available or the sensor employed does not have a temperature compensation element, please use a 110 Ohm axial resistor to simulate a P100 TC input @ 25°C or a 1100 Ohm axial resistor to simulate a Pt1000TC input @ 25°C.
    o Even when using manual temperature compensation mode it is best practice to employ a simulation resistor on the 3TX transmitter. Such a simulation resistor can be supplied free of charge from the ASTI factory if requested prior to dispatch of the order.
- Check the transmitter setting for the Pt100/Pt1000 TC type matches the temperature element in sensor.

POTENTIAL SIGNAL INPUT RELATED PROBLEMS
- The input signal value obtained from the connected sensor exceeds the lower or upper boundary limits possible for the input circuit. There are a variety of potential causes itemized below:
    o Confirm the type of sensor is being connected matches the mating transmitter. There are a wide variety of 3TX transmitters that interface with broad range of sensor types. For example:
        ▪ The 3TX pH and ISE transmitters come in separate versions that are for use with sensors without integral preamplifiers (3TX-pH and 3TX-ISE) or else that will only work with pH and ISE sensors that have integral preamplifiers (3TX-pH-X and 3TX-ISE-X).
        ▪ The conductivity sensor employed must be connected to a 3TX-CON transmitter for use with that given cell constant. Confirm by checking labels on your conductivity sensor and the 3TX-CON conductivity transmitter to ensure that the cell constants match.
        ▪ The 3TX-DO transmitters can only be used with the standard thickness membrane sensors such as the AST-DO whereas the 3TX-DO-T transmitters can only be used with the thick style membrane sensor such as the AST-DO-T models.
    o Leads are not secure or the color coding is not correct. Please refer to the documentation supplied in hard copy with your shipment or the 3TX website for assistance with obtaining proper wiring schematic. If you are not unsure please contact the ASTI factory for assistance.
    o The connected sensor is either damaged or expired. Connect a different known working sensor on the same transmitter as a troubleshooting step to determine if the issue is with the input board in question or whether it is owing to the connected sensor.

If you have gone through all of the troubleshooting steps detailed above and are still receiving the "OFL" or "UFL" error then most likely your input board has stopped working properly. Contact the factory to obtain a valid RMA so that the transmitter in question can be returned for evaluation and warranty repaired/replaced as may be applicable. You will need the 11 digit serial number that can be found in the small label below the faceplate when making an RMA request.

Question:
How can I determine the documentation and software revision of the 3TX transmitter?

Answer:
The documentation revision of the transmitter can be found in small font at the end of the small label located above the faceplate. For example, this small label might show as "3TX-pH-A R9". This means that is a pH/ORP transmitter for use with sensors without integral preamplifier and the documentation revision R9 should be used. The most current documentation revision is posted on the 3TX website. Documentation for older versions and special software implementations are available upon request (and were supplied in hard copy with the original shipment). The software revision can be obtained as a display feature of the transmitter by pressing the "Up" & "Mode" keys simultaneously in the main 3TX measurement mode.

Special Note about Documentation & Software Revisions:
The documentation and software revision numbering is altogether decoupled although these two can be cross-referenced by contacting the ASTI factory. You may be asked to report the both the documentation and software revision of the transmitter as part of the technical support process.

Question:
How can I determine the production date and dispatch date of the 3TX transmitter?

Answer:
The production date formatted as (yy.m) is displayed by pressing the "Down" & "Mode" key simultaneously in main 3TX measurement mode. The month shows as 1..9 and A for October, B for November and C for December. For example October 2014 will display as "14.A". The dispatch date from the ASTI factory can be determined from the small label showing the 11 digit numeric serial number located below the faceplate. This serial number label should not be removed or adulterated in any way or else the warranty might be voided.

Special Note about Production & Dispatch Dates:
The production and dispatch dates are altogether decoupled. The two-year warranty period shall begin from the dispatch date and not the production date. You may be asked to report the both the production date and serial number of the transmitter as part of the technical support process.

Question:
I set the P01 software to 'Off' but I keep getting lock out of performing calibrations and changing values on the setup parameters. How long is the software lock 'Off' until it resets back to the default 'On' condition?

Answer:
The P01 software lock will revert to the default 'On' value after 60 seconds without any key being pressed. This software lock is reset back to the default 'On' condition to ensure that changes are not accidentally made to any calibration or setup parameters.

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