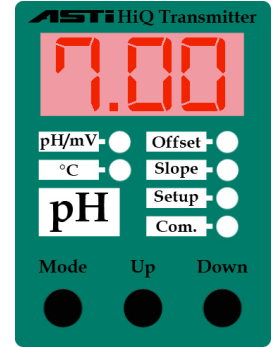




## 3TX-HiQ Digital Measurement System

Superior & Cost-Effective Monitoring,  
Control & Datalogging in Process

pH, ORP & Temperature Parameters



- *Simplify commissioning & maintenance with smart digital plug & play sensors & intelligent transmitters*
- *Available for both continuous measurements & portable intermittent use*
- *Lowest startup and ongoing cost of ownership of any digital measurement platform*
- *Proprietary solid-state reference system for long-life & low-maintenance*
- *Suitable for abrasive slurries, solvents and high pressures & temperatures*
- *Sensors are built-to-order allowing for extensive customization*
- *Robust industrial construction handles the most difficult severe service measurements*
- *Inline, immersion, submersible, sanitary & HOT-TAP valve retractable style process installations supported*



3TX-4MW-3EA-HiQ-pH-PS Triple Channel Intelligent Transmitter Assembly with snap panel connectors & Smart Digital ZEUS™ pH Sensor

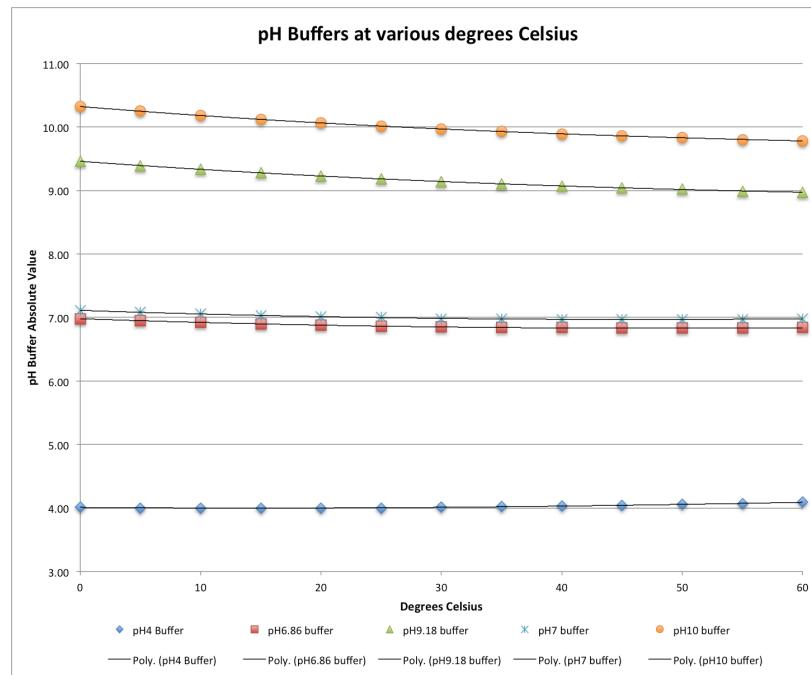
## HiQ Smart Digital pH & ORP Measurement System Feature Summary:

- Smart Digital IOTRON™ pH Sensors & ORP Sensors for Intelligent 3TX-HiQ-pH pH & ORP Transmitters are **the most cost-effective & rugged industrial smart digital pH & ORP measurement system available.**
- Intelligent management of calibrations with **true plug and play digital sensors.** Calibrate anywhere and hot-swap interchange the sensor in and out of field service with rugged industrial NEMA 6P snap connector.
- **Calibration values are automatically loaded** when Smart Digital IOTRON™ pH Sensors & ORP Sensors are connected to Intelligent 3TX-HiQ-pH Transmitter. No user action of any kind nor any contact with the transmitter is required for exchange of a sensor. In this way sensors can be removed and installed between different transmitters at will as may be desired.
- Intelligent installation management:
  - Create and upload complete transmitter configuration to smart digital sensor or download complete transmitter configuration from smart digital sensor to transmitter. Shadow copy allows for easy reverting to previous configuration.
- Optimized commissioning & maintenance:
  - Track smart digital sensor initial installation & last used in field dates plus total service time usage. Tracking of this information over the course of time allows for an optimization of stocking levels to further reduce the cost of ownership.
- All aspects of installation are completely portable from the shop to the field.
- 3TX-HiQ intelligent transmitters for smart digital sensors are identical form factor to the 3TX transmitters for analog sensors for seamless integration of both digital & analog sensors & transmitters.
- For measurement with analog Conductivity, Ion Selective (ISE) or Dissolved Oxygen (DO) sensors and shared 3TX module documentation visit the [3TX webpage](#)
- Review the [3TX FAQ](#) before commissioning any system to ensure proper installation.

Complete digital HiQ measurement system installation guide with hook-up schematics can be found at the end of this printer friendly PDF document.

## SENSOR CALIBRATION FEATURES & INSTALLATION MANAGEMENT

- Calibration data is stored on smart digital sensor. Calibrate in the lab or instrument shop & snap pre-calibrated sensor into process use. Plug & play sensors can be swapped in and out at will.
- No contact with transmitter of any kind is required for an operator to change out a sensor.
  - Calibration values automatically loaded from digital sensor to 3TX-HiQ-pH transmitter. Install & swap out for cleaning, re-calibration or replacement is quick, easy & simple.
- Smart digital sensors come standard with 6 meters (20 feet) cable with rugged NEMA 6P & IP67 rated quick disconnect waterproof & corrosion-resistant snap connector. No screwdrivers are ever needed.
- Total cable length up to 610 meters (2,000 feet) using extension cables with mating rugged NEMA 6P & IP67 quick disconnect waterproof & corrosion-resistant snap connector terminations.
- Automatic pH calibration recognizes 4.00, 6.86, 7.00, 9.18 & 10.00 pH buffers for 1-point, 2-point and 3-point calibrations with built-in correction for temperature induced changes to pH buffers (see below):

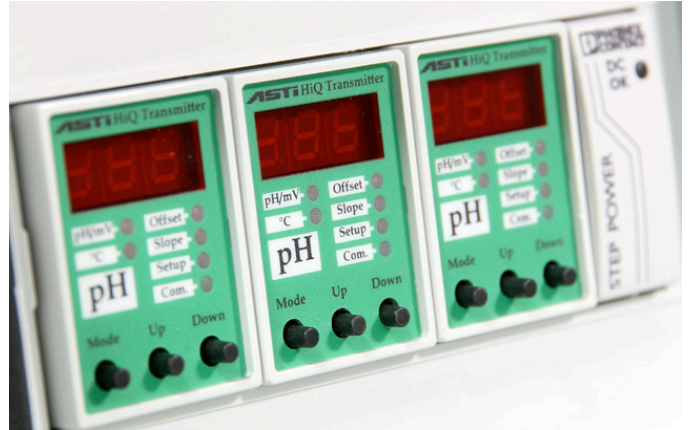


- Manual pH calibration allows offset & slope adjustment to any pH buffer or grab sample reference value
- Display previous five calibration sets on transmitter & the date that correspond to each one. Historical & current calibrations can be viewed and saved to track calibrations through sensor lifecycle.
- Total time in field service use is logged on sensor for systematic tracking of complete sensor life cycle to allow for best practice installation, maintenance and inventory/stocking management
- Min and max temperatures in use digitally stamped on sensor for process condition tracking
- Calibrate the smart digital sensor on Windows software as well as on 3TX-HiQ-pH transmitter
- Calibration values can be hard reset back to the ASTI factory defaults (configuration unchanged)

## TRANSMITTER CONFIGURATION MANAGEMENT FEATURES



*3TX-4MW-3EA-HiQ-pH-PS Triple Channel Intelligent Transmitter Assembly with 4 each HiQ4F female snap panel connectors for quick disconnect smart digital HiQ4M snap connector sensor inputs*



*Detail of 3TX-HiQ-pH Intelligent Digital pH/ORP transmitters. All functionality accomplished by the 'Mode', 'Up' or 'Down' buttons.*

- The HiQ configuration system features are available by pairing the smart digital HiQ sensor with the intelligent 3TX-HiQ transmitter, selecting the desired parameter settings and saving this configuration to a Windows file or else invoking a shadow copy on the 3TX-HiQ transmitter.
- The HiQ configuration system provides systematic & advanced management of the your field installations without the high cost and complexity of the HART®, Profibus or FOUNDATION™ fieldbus digital protocols.
  - The HiQ configuration system allows for very detailed tracking of both the current and previous complete transmitter configuration for each installation point in a simple and low-cost manner.
- Transmitter configuration on 3TX-HiQ can be downloaded to the smart digital sensor as a backup or else to be uploaded directly onto other 3TX-HiQ transmitters to clone configurations
- Configuration on the smart digital sensor can be saved as a file when used with the supplied Windows software for backup, archiving or tracking the configurations at each installation site
- Configurations saved to file can be directly loaded to smart digital sensor. Configurations loaded to sensor can in turn be loaded onto any 3TX-HiQ transmitter to which it is connected.
- The 3TX-HiQ transmitter can create a restore point backup of the exact current working configuration. The 3TX-HiQ can be reverted back to this restore point configuration at any time.
- The 3TX-HiQ transmitter configuration can be hard reset back to the ASTI factory defaults

**Complete digital 3TX-HiQ intelligent transmitter manual & user guide can be found in a subsequent portion of this printer friendly PDF document.**

## OVERALL 3TX-HiQ-pH MEASUREMENT SYSTEM FUNCTIONALITY

- One pH/ORP transmitter for all your needs: -2 to +16 pH range services all possible pH installs. The -1,000 to +1,000 mV ORP range services nearly all possible practical field ORP applications.
- Analog 0-20mA or 4-20mA output can be scaled to 1pH to get an effective output resolution of 0.001pH units or else down to 100mV to get a net output resolution of 0.1mV for any part of the ORP range.
- The RS-485 MODbus RTU output mode can be set to achieve a 0.001pH or 0.1mV resolution for best precision or set to a lower 0.01pH and 1mV resolution mode to achieve compatibility with the 3TX-DAT MODbus field datalogger or else if the higher resolution mode is simply not desired
- 3TX-HiQ-pH transmitter comes standard with both scalable analog 0-20mA or 4-20mA to support legacy control systems & RS-485 MODBUS for use with more modern digital control systems.
- Commissioning new field installations using RS-485 MODBUS RTU digital output is as simple as daisy-chain wiring together all installed 3TX-HiQ transmitters and assigning the node address for each module.
  - The MODBUS protocol allows for the flexibility to add or remove nodes at will and avoid any potential ground loops issues.
- Analog output is galvanically isolated from the sensor input, scalable linear and fully reversible.
- User adjustable temperature compensation coefficient for special sensors & critical applications.
- Automatic temperature compensation (ATC) from -40 to +210°C ensures accurate pH readings.
- **Analog and digital outputs are placed on hold automatically when in calibration mode.** When calibration mode is entered, the last value from measurement mode will be held for both the 4-20mA analog output as well as the MODbus output.
- Active 4-20mA can support remote external displays to allow for viewing measured values in control panels, secondary field locations, or instrumentation shops.
  - It is possible to connect a single 4-20mA output to multiple devices since it is a powered active current loop output. The details are provided as detailed in [this drawing](#)
- Although all of the 3TX transmitters are 3-wire devices they can also be powered with installations that are designed for 2-wire loop-powered devices. An example of this wiring approach can be found by using the following [2-wire to 3-wire installation scheme](#). Please review the [3TX FAQ](#) for the typical 3-wire power and output installation scheme for the 3TX modules.

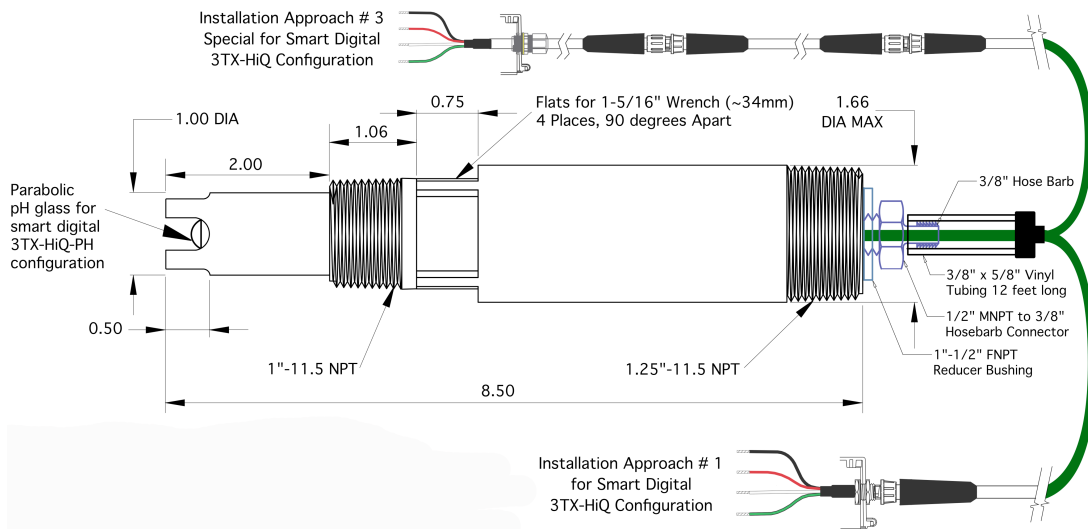
## SMART DIGITAL SENSORS FOR 3TX-HiQ-pH INTELLIGENT TRANSMITTER



*Selected smart digital pH sensors with low-profile break-resistant parabolic pH glass elements for use in slurry & abrasive process solutions*

- Entire line of proven built-to-order customizable application specific Iotron™ inline, immersion, submersible, twist lock, sanitary, HOT-TAP retractable pH & ORP sensors can be viewed from the [pH Sensors & ORP sensors overview webpage](#). ALL of these sensors are available for use with 3TX-HiQ-pH transmitter.
- Ultra-Rugged Industrial Grade Construction **ZEUST™ SMART DIGITAL pH SENSORS** are ideal choice for Tough Process Inline, Immersion or Submersible installations. Suitable for measurements with high temperatures & high pressures, dissolved ammonia, chlorine, sulfides & solvents and many other aggressive conditions such as abrasive slurries and high flow velocity.

### Dimensional Drawing for ZEUST™ Smart Digital pH Sensors for Inline, Immersion & Submersion Industrial Process Installations for use with 3TX-HiQ-pH Intelligent Digital Transmitter



- The **ZEUST™ SMART DIGITAL pH SENSORS** are typically in stock or available on a short lead time to solve your most difficult and severe service pH measurement application promptly. The complete specification sheet and installation guide can be downloaded here >> [Item # 1205 ZEUST™ SMART DIGITAL pH SENSOR](#).
- The unique rugged **low-profile impact & break resistant parabolic pH glass** element optimized for use in slurries & high viscosity applications (X3XX series) is available as a smart digital sensor
- The novel **extreme dehydration resistant style reference technology** that allows for prolonged exposure to dry conditions and intermittent wet & dry use also available as smart digital sensor

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## WHAT ARE THE BENEFITS OF USING IOTRON™ SMART DIGITAL SENSORS?

- 100% pure digital communications means reliable operation even in noisy process environments.
- No degradation in signal even with very long cable runs up to max of 610 meters (2,000 feet)
- Bridging connections & modifying installations is easy and done without loss of signal quality with NEMA 6P & IP67 quick disconnect waterproof and corrosion-resistant snap connectors.
- Low-cost snap digital extension cables facilitate consolidation of transmitters into a single panel enclosure where very many remote field installations can all be conveniently all viewed at once.
- Smart 3TX-HiQ software identifies the type of sensor connected to confirm it is compatible for the mating transmitter. There exists no possibility of ever interfacing the wrong sensor type.
- 3TX-HiQ-pH smart configuration feature automatically recognizes & differentiates between pH & ORP sensors. The relevant settings are automatically adjusted if existing setup is incompatible.
- Input terminal wiring identical for all smart digital 3TX-HiQ measurement modules. Smart sensors have exactly the same color coding & wiring to input terminals on 3TX-HiQ transmitters.
- All Extension cables for HiQ sensors are intercompatible. Uniform extension cables minimize stocking. Field installation guide details options to commission & exchange sensors in the field.

## SENSOR & INSTALLATION TRACKING FEATURES

- Digital date stamping of dispatch from factory, initial field installation & final field service use
- Digital stamping of serial number & item number for each smart digital HiQ style sensor

## TURN-KEY PLUG & PLAY SMART DIGITAL pH DATALOGGING SYSTEM



*IOTRON™ Smart Digital pH Sensor & 3TX-HiQ-pH Intelligent Digital pH Transmitter with MODBUS 3TX-DAT Field Datalogger with quick disconnect snap RS-232 to USB download cable in 3MF NEMA 4X Rated Enclosure with 2 each HiQ4FP panel snap connectors for HiQ4M inputs 3TX-3MF-2H-HiQ-pH-DAT-PS assembly as shown above ready for wall/plate installation or 2" NPT pipe mounting with optional kit (not shown)*

## TURN-KEY PLUG & PLAY SMART DIGITAL pH DATALOGGING SYSTEM CONT'D



*PNXGR 8052-HiQ IOTRON™ Smart Digital Twist Lock Quick Disconnect Bayonet Style Inline pH Sensor with HiQ4M snap connector  
3TX-2M-1H-HiQ-pH-PS Intelligent Digital Transmitter with HiQ4FP panel mount connectors for HiQ4M snap input  
Datalogging on Windows PC using RS-485 to USB converter from MODBUS RTU from 3TX-HiQ-pH (100 feet twisted-pair cable shown)  
IP65 Rated Enclosure complete with universal 100-240 VAC line powered operation ready for immediate commissioning  
3TX-2M-1H-HiQ-pH-PS ready for wall/plate installation or 2" NPT pipe mounting with optional kit*



*Plug & Play Submersible pH & ORP Measurement System for Intermittent Battery-Powered Operation at Remote Installs is **Case Study # 22**  
PNXGRE 5631/5331-HiQ-12m-WPB/20 IOTRON™ Smart Digital Submersible pH Sensor for Intermittent Wet & Dry Use & Hot-Swap Exchange  
3TX-7MF-3H-2EA-HiQ-pH-DAT-Q2FP-UPT Intelligent Digital pH & ORP Measurement & Datalogging System for Smart Digital pH/ORP Sensors  
**Ultralow-Power-Timer (UPT) switch** uses just 0.4mA @ 24VDC to allow for very long intermittent operation from Sealed Lead Acid (SLA) Batteries  
Logged pH, ORP & temperature data downloaded & visualized on Windows PC via RS-232 to USB snap plug & play cable to 3TX-DAT Datalogger  
NEMA 4X Rated Field Enclosure System with all NEMA 6P rated snap connections is ready for immediate commissioning  
7MF-24VDC-2EA-12AH-SLA-Q2FP Hot-Swappable 24VDC battery power supply with Q2M-Xm-Q2M snap disconnect power cable &  
3TX-7MF-3H-2EA-HiQ-pH-DAT-Q2FP-UPT Measurement & Datalogging System Ready for wall/plate install or 2" NPT pipe mount with kit*



**SELECTED PHOTOS OF IOTRON™ SMART DIGITAL SENSORS**



*5X31 Sanitary Series smart digital pH sensor with WPIT sealing option*



*6X31 series submersible pH sensor with WPH sealing option*



*PNXGR 8052-HiQ Twist Lock smart digital pH sensor with 4 ea tines*



*PNGRO 6011-HiQ 3/4"-3/4" Inline/Immersion smart digital pH sensor with "GRO" 2 each protective tines*



*Standard grommet seal provided for all sensors if no waterproofing option is invoked. For outdoor use or indoor use with wet environments (washdowns) or fully submersible installs see the [waterproofing options](#)*



*PNTJ 6831/6631-HiQ Sulfide Resistant Smart Digital ORP Sensor*



*HiQ4F female snap & HiQ4M male snap connector for digital sensors*



*Snap to Snap extension cable for smart digital HiQ sensors*



*PN 6053-HiQ General Purpose Smart Digital pH Sensor*

## WINDOWS SOFTWARE FOR CALIBRATION & CONFIGURATION OF SMART DIGITAL pH & ORP SENSORS FOR 3TX-HiQ-pH TRANSMITTERS



*Portability HiQ to Windows Bridge Box Assembly (Item # 14099) with Smart Digital ZEUS™ pH sensor (Item # 1205) & USB Male "A" to Q6M cable. Ready for use as a field calibrator of smart digital sensors with Windows PC or tablet.*

*Portable HiQ to Windows Bridge Box with industrial RS-485 to USB converter. Top angle view showing rugged carrying handle & rubber feet. Sealing caps ensure NEMA4X rating when sensor input and USB output ports are not in use.*

- HiQ Windows software is provided with a free of charge perpetual software zero cost license. Only a suitable RS-485 to USB converter assembly is required to use the Windows software. ASTI offers a field ready NEMA4X **Windows Interface Bridge Box for Smart Digital HiQ Sensors** to enable turn-key out of the box use of this HiQ Windows software.
- HiQ Windows software provides convenient testing and calibration of plug and play smart digital sensor and creating complete 3TX-HiQ transmitter configuration which can be saved to file as well as to additional HiQ smart digital sensors. This can be done at field installation points throughout the plant from anywhere that a laptop, desktop or tablet with a USB connection is available.
- Windows software is not required for any feature of the 3TX-HiQ intelligent transmitter and smart digital sensor measurement platform but rather available for those that prefer to calibrate the sensor and configure the transmitter with this option.
- Calibrate the smart digital sensors:
  - All sensors can be offset calibrated for temperature.
  - The HiQ smart digital pH sensors can accept 1-point (offset), 2-point (slope) as well as a 3-point calibration that results in a dual slope scheme whereby you can a separate operating slope for acidic and alkaline measurement ranges.
    - The autoread mode ensures a systematic result no matter which operator does the pH calibration for the sensor.
  - ORP sensor can be offset for the mV value to create a calibrated relative mV (RmV) for use as a process control setpoint.
- The complete sensor status can be viewed. The stats window allows for following information:
  - Permanent values such as the sensor item number, invoice number & dispatch date from ASTI factory, sensor serial number, sensor type, sensor board software revision and first installation date in field (activation).
  - Dynamic information gives "snapshot" of the current sensor status such as last five calibration values for temperature, offset and slope(s) as well as the last date used, the total time in field service and the highest and lowest temperature.
- HiQ Windows software acts as a pH & ORP measurement device without 3TX-HiQ-pH transmitter functioning equivalent to a laboratory pH or ORP meter displaying calibrated pH, relative mV (ORP) and temperature from the connected digital HiQ sensor.
  - To record the values obtained from your measurements use the MODBUS output from 3TX-HiQ-pH with the free of charge ASTI Windows datalogging and graphing software for 3TX transmitters with MODBUS output.

## TYPICAL FIELD COMMISSIONING SCHEME FOR 3TX-HiQ DIGITAL SYSTEMS



*"LUNCHBOX" portable assembly with 6700mAH rated LiPo battery with Smart Digital ZEUST™ pH sensor interfaced via HiQ4FP female panel connector to mate with HiQ4M male sensor snap connector. Ready to use as a field calibrator of smart digital pH/ORP sensors for 3TX-HiQ digital transmitters or intermittent spot grab sample measurements in process in configuration shown above. Install protective caps when port is not in use to ensure NEMA 4X rating of assembly.*

*Side angle view showing rugged carrying handle & rubber feet installed for ease of portability. Measuring 3TX module installed can be swapped as desired from 35mm DIN-RAIL hardware. Protective caps are supplied to seal all ports not actively in use to maintain NEMA 4X rating. 3350mAH @ 5VDC rated lithium polymer (LiPo) battery shown installed for ~4.5 hours runtime. Optional larger 6700mAH @ 5VDC LiPo battery pack (shown to left) will allow ~9 hours runtime.*

- Calibrate smart digital HiQ sensor with Windows software or spare 3TX-HiQ transmitter. Use of HiQ Windows setup & calibration software requires optional ASTI supplied HiQ to Windows bridge box assembly (see previous page for details).
  - The values from the calibrations performed with the Windows software will not be written to the calibration history for a brand new out of box HiQ digital sensor but can be viewed in the calibrate Window.
    - Calibration values will only be written to the history after the sensor is field activated (see below).
    - If you wish to simply test the functionality of your new-in-box smart digital 3TX-HiQ sensor without setting the initial field installation date only the Windows software can allow you accomplish this goal.
  - Initial calibration and transmitter configuration can be performed between 3TX-HiQ transmitter and HiQ sensor instead of Windows software. When 3TX-HiQ transmitters are used for first calibration & configuration setup the initial field installation (activation) date will be stamped. If first calibration & configuration is done with Windows software the initial installation date is not stamped. First calibration with Windows software is not added to calibration history.
- Setup the 3TX-HiQ transmitter configuration as is desired for the planned installation point with the Windows software or spare 3TX-HiQ transmitter. Using the Windows software to create the configuration allows for it to be saved on the PC with a logical filename should it need to be loaded onto a new sensor in the future or else to keep track of changes to the transmitter configuration over time for the given installation point. If multiple installations will use exactly the same transmitter configuration this same file can be loaded onto multiple sensors. This task of loading the same configuration onto multiple smart digital sensors can also be accomplished via the 3TX-HiQ Intelligent transmitter using the appropriate parameter call.
- Connect the HiQ smart digital sensor that was previously calibrated with the Windows software to the 3TX-HiQ transmitter. The calibration values will be automatically loaded and the values displayed in the measurement mode will reflect the process parameter and temperature including this previous calibration done with the Windows software. At this moment the initial installation field is stamped onto the sensor as the activation date. After this moment, the last date in field service will also be stamped whenever this sensor is connected to any intelligent HiQ digital transmitter.
- Load the configuration saved onto the smart digital HiQ sensor onto the 3TX-HiQ transmitter (see transmitter manual for details).
- Calibrations performed with 3TX-HiQ-pH transmitter or HiQ Windows software are recorded to calibration history after sensor activation. It is not relevant whether subsequent calibrations are performed with the 3TX-HiQ-pH transmitter in field installation or a separate 3TX-HiQ-pH transmitter in the shop or using a portable battery-powered LUNCHBOX or CARRY-ON assembly.

## **TYPICAL OPTIMIZED ONGOING MAINTENANCE SCHEME & WORKFLOW FOR HiQ SMART DIGITAL MEASUREMENT SYSTEMS**

- One of the core advantages of the smart digital HiQ platform is the availability to calibrate in one location and to install the sensor into another location. The calibration values saved on the sensor are automatically loaded to the 3TX-HiQ intelligent transmitter after the sensor is interfaced with the NEMA 6P rated field snap connector without any user action of any kind meaning for a true plug and play hot-swap ability between any sensor and transmitter.
  - The choice of where to perform the calibration is a matter of what is best for your particular facility and operational setup. In order to avoid downtime while the calibrations are performed, at least one spare HiQ digital sensor is required. If a spare HiQ sensor was not purchased as a part of the initial commissioning it is recommended to purchase one for ongoing maintenance best practice.
- There are three convenient options to perform the calibration of the HiQ digital sensor and modify the transmitter configuration after the initial field commissioning aside from using the field installed 3TX-HiQ transmitter to which the HiQ sensor is installed for continuous inline service. All are functionally equivalent and the choice of which approach is employed need only be selected based upon what best suits your needs. The three possibilities are:
  - Use a spare 3TX-HiQ transmitter assembly. The unit employed can be identical to the field commissioned package so that this spare 3TX-HiQ transmitter assembly can serve both for purposes of calibration as well as a backup in case the field unit(s) are damaged due to some unforeseen incident.
  - Use a portable LUNCHBOX or CARRYON assembly with a 3TX-HiQ transmitter installed. The primary advantage here is that such a portable unit is battery powered (either from a 9V or a 5V USB rechargeable cell) and so the calibration can be done in any location whether line power is available or not. This portable assembly can also serve to spot check process measurement values as well as performing recalibration for the field installed sensors.
  - Use the HiQ Windows software. This can be done in the lab with a desktop PC and also in the field if the HiQ to Windows bridge box is purchased with the portability package and a laptop computer is employed.
    - Note that when calibrating a sensor new out of box only the Windows software will not stamp the sensor with the initial installation field activation date nor the last date in service.
    - If you simply wish to spot-check any sensor in stock then the Windows approach is the best choice as it will not stamp/update either the field activation (first date in use) nor the last date field in field service dates.
- While calibration values from any of the three choices detailed above will automatically be loaded onto the field installed inline 3TX-HiQ transmitter in contrast any change in the transmitter configuration requires an affirmative user action (see 3TX-HiQ or HiQ Windows manual for more details about this aspect). This requirement for an affirmative user action to make any change to the transmitter configuration is done to prevent accidental crossing of transmitter configuration for different installation points.
  - Since transmitter configurations are NOT automatically loaded from the HiQ sensors (but rather only the calibration are automatically loaded) this design scheme allows for the HiQ sensors to be seamlessly hot-swapped between installations that may have different transmitter configuration but use the same type of smart digital sensor model.
- It is best practice to save any modifications to the transmitter configuration for a given installation point as a new filename from the HiQ Windows software for archival tracking of transmitter configurations as well as to allowing to revert to a previous setup if desired.

## All modules in the 3TX series share these features and options:

- **Easy-to-read displays:** Bright three-digit LED displays are visible even in bright sunlight and do not suffer from the common problems associated with LCD displays, such as environmental fatigue and wear.
- **Easy to use:** Simple & intuitive three-button operation. No complex codes to memorize for day-to-day tasks.
- **Easy installation:** Enclosures are customized for your modules and arrive ready for field mounting on any wall with no additional specialized hardware required. Modules are also available individually in a small, 35mm DIN-rail mountable form factor for direct integration into OEM equipment.
- **Galvanic isolation** between all inputs, power & analog output (3000V rating)
- **Weatherproof:** NEMA 4X CSA/UL rated & IP65 enclosures include high quality sealing cable glands (a.k.a. strain relief) that are ideal for weatherproof sealing on sensor, power, and output cables. Waterproof caps are also provided at no additional cost for all cable glands to seal and weatherproof any channels that will not be used.
- **Certifications:** CE marked for use in safe, non-hazardous areas.
- **Security:** Optional lock available for enclosure assembly to restrict access to selected keyholders.
- **Power supply options:** Choose our CSA/UL/CE approved universal 100 to 240 VAC 50/60 Hz power supply module for line powered operation, or you may use any module with a 3-wire 24VDC powered operation if you already have a dedicated 24VDC power supply (i.e. not shared with other equipment) available onsite.
- **Battery powered options:** **Portable 3TX Transmitter Assemblies** are field ready for Temporary Installations, Troubleshooting and Grab Sample Analysis of pH, OPP, Ion Selective (ISE), Conductivity & Dissolved Oxygen (DO) parameters of process samples using industrial analog and digital sensors. The 3TX portable assemblies employ the **3TX-PS/BAT module** that provides dual isolated and regulated 24VDC power to energize the 3TX transmitters from 5V, 6V or 9V rechargeable or non-rechargeable batteries. Portable assemblies can be converted to permanent continuous inline measurement systems for going from proof of feasibility to closed-loop control.
  - The 3TX portable assemblies are ideal for applications where power is either unstable/unreliable or else when no AC or DC power source is available at all. All portable 3TX assemblies can be converted for use as permanent installations since the enclosure and all employed fittings are NEMA4X rated.
- **Option to customize default values for 3TX transmitters for use with analog sensors:** Each module can be preset with your own preferred defaults for all user parameters at no additional cost (minimum order quantities may apply). This allows for your own customized transmitter configuration to be restored in the field using the reset all parameters function that is implemented on all 3TX modules.
- **1/2-DIN Panel & Pipe mounting option:** A universal two-inch (2") NPT pipe mounting kit is available for all 3TX enclosure options. The 3MP enclosure can be installed into any standard 1/2-DIN panel cutout. All enclosures are ready for wall mounting standard without any additional special hardware.

Download the **common mechanical, electrical and dimensional details for all 3TX transmitter supplied in the base 35mm DIN-RAIL configuration**

Download the **dimensional drawings for the weatherproof 2M, 4M & 6M IP65 enclosures and pipe mounting kit**

Download the **dimensional drawings for the NEMA 4X CSA/UL listed 3MP 1/2-DIN panel mounting enclosure assembly**

Download the **dimensional drawings for the NEMA 4X CSA/UL listed 3MF field wall & pipe mounting enclosure assembly**

Download the **dimensional drawings for the NEMA 4X CSA/UL listed 7MF field wall & pipe mounting enclosure assembly**

## The modular components of the 3TX series provide the flexibility to meet your application needs in a cost-effective way:

- **Custom configurations** offer the freedom to only pay for the specific modules you need
- **Select any combination of measurements** that you need: pH, ORP, dissolved oxygen (DO), conductivity, ion selective (ISE) and temperature. The pH and ORP measurement can be accomplished either via digital or analog sensors. The ion selective (ISE), dissolved oxygen (DO) and conductivity measurements must be accomplished by means of an analog sensor.
- **Select the number of measurement channels** in the field assembly, from a single up to nine (9) channels
- Enjoy the flexibility to **add measurement and/or complementary modules after commissioning** using the original analyzer assembly (assuming sufficient room exists for the expansion in the selected enclosure).
  - Measurement modules can be added for inline measurement of the pH/ORP parameters using the 3TX-pH for analog sensors and the 3TX-HiQ-pH for digital sensors
  - Measurement modules can be added for inline measurement of ion selective (3TX-ISE), dissolved oxygen (3TX-DO) and conductivity (3TX-CON) parameters for use with analog sensors.
  - In addition the 3TX-HiQ intelligent digital transmitters can be interfaced with complementary modules such as programmable alarm/relay controllers (3TX-REL), MODBUS dataloggers (3TX-DAT) and pH compensation for ISE modules including MODbus converter for all inputs (3TX-TOT).

### Control Module (3TX-REL)

- Each 3TX-REL module has 2 each independent Single-Pole Single-Throw (SPST) 5 Amp contact relays.
- Each relay is fully configurable by the user as to control mode and variables for each control algorithm.
- Tight integration between 3TX alarm & relay controller and 3TX measurement modules software makes configuration and scaling simple & easy for any local control requirements of the pH, ORP, ion selective (ISE), dissolved oxygen (DO) or conductivity parameters. Find below a very useful configuration guide for setup of the REL module with any of the 3TX measurement modules:
  - Download the **[3TX-REL analog input configuration guide \(R10 or later software versions\)](#)**
- The 3TX-REL alarm and relay controller module includes both basic and more sophisticated controlling options, including all of the following modes:
  - 1) A simple supervision option for alarm functionality only;
  - 2) An On/Off control with a user-configurable deadband (a.k.a. hysteresis);
  - 3) Time proportional control (TPC); and,
  - 4) Proportional frequency control (PFC, a.k.a. variable pulse controller).

Download **[alternate wiring schematic for 3TX-REL module](#)** when analog output from 3TX-HiQ-pH, 3TX-pH, 3TX-ISE, 3TX-DO or 3TX-CON measurement transmitter is to be connected to other data acquisition or control device prior to connection with 3TX-REL alarm/relay module. Standard wiring for when the analog output from measurement transmitter is connected directly to the 3TX-REL is contained in the respective measurement module specification sheet.

## Datalogging Options for MODbus output from 3TX-HiQ Digital Transmitters

1) You may use a **free of charge optional Windows PC software interface kit to the MODbus digital output**. This allows for real time display of all values for all transmitters that are wired to that MODbus line. In addition, the software kit allows for datalogging for all transmitters connected on the line, including both the scaled output value and temperature for each measurement module. Up to 247 devices can be supported on a single MODbus digital line (2-wire cable), and long cable length can be supported for field installations up to 6500 feet (1.23 miles or 1.98 kilometers) to make viewing in the instrument shop practical and easy.

Find below a link to the installation and user manual for the **free of charge Windows PC datalogging and graphing software** described above for use with 3TX transmitters with the optional MODbus RS-485 digital output (Revision 2.4.2):

- [\*\*Manual for ASTI Windows Datalogging and Graphing Software for 3TX Transmitters with MODbus\*\*](#)

2) Alternatively, you may **add a 3TX-DAT field datalogging module**. The 3TX-DAT module allows for datalogging of up to 63 each MODbus digital inputs from any mix of digital 3TX-HiQ and analog 3TX-pH, 3TX-ISE, 3TX-CON, 3TX-DO and 3TX-TOT modules as input nodes. The sampling rate is fully configurable from once per second to once per hour, although all nodes must have the same sampling rate. With 8MB onboard flash memory standard there is a quite extensive datalogging capacity. Configuration of the 3TX-DAT is accomplished via the free of charge Windows datalogging and graphing software for 3TX transmitters with MODbus and uploaded & downloaded using the separate Windows software for 3TX-DAT. The 3TX-DAT unit can be supplied pre-configured from the ASTI factory upon request without additional charge. The logged data is downloaded to a PC or tablet for further workup, with graphing and analysis also via the Windows software. The 3TX-DAT can be added at any time after commissioning if datalogging should become a requirement provided that the mating measurement module(s) have the MODbus output option and sufficient room has been left in the ASTI supplied or customer provided enclosure assembly.

Find below a link to the installation and user manual for the **free of charge Windows PC DAT Configuration & Download software** described above for use with 3TX transmitters with the optional MODbus RS-485 digital output together with the DAT logging module (Revision 1.5):

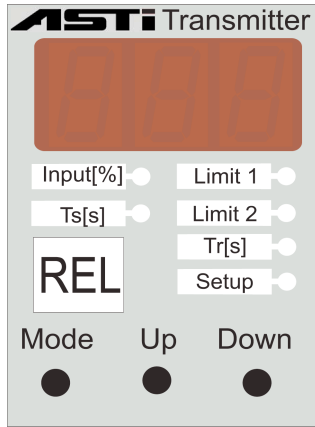
- [\*\*Manual for Windows Software to Configuration & Download logged data from 3TX-DAT Module\*\*](#)

## 3TX-TOT pH Compensation Module to Compute Total ISE

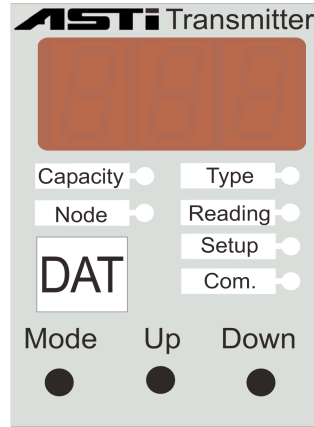
- 3TX-TOT module computes the total ISE. For example, this module can compute total ammonia, total fluoride and total cyanide.
- The module computes the total ISE using three inputs: 1) the free ion activity; 2) the pH; and, 3) the temperature. These three input parameters are provided by the analog output from the respective measurement modules.
- A scalable 4-20mA analog signal is available to output the computed total ISE to PLC or other data acquisition equipment.
- MODbus output is standard: All input and output data can be sent via RS-485 MODbus RTU from the 3TX-TOT module.
- Links below provide examples for visualization of weak base and weak acid species where the total ISE can be determined:
  - [\*\*Total Ammonia\*\*](#) (NH<sub>3</sub>-N, or total ammonia as nitrogen)
  - [\*\*Total Fluoride\*\*](#) (Total HF, or unreacted fluoride) or [\*\*Total Cyanide\*\*](#) (Total HCN, or unreacted cyanide)
- Find below a link to the technical document that summarizes the capabilities of the 3TX-TOT module and addresses the questions of what exactly pH compensation means for ISE measurements and when it is required (recommended):
  - [\*\*Total ISE 3TX-TOT Module Summary\*\*](#)
- Find below a link for the 3TX-TOT wiring supplement for the Approach 1 Spliced Pt100/Pt1000 TC input scheme when using pH & ISE sensors with integral preamplifiers:
  - [\*\*3TX-TOT wiring supplement when using pH & ISE sensors with integral preamplifiers\*\*](#)
- Download [\*\*MODbus output supplement for 3TX-TOT\*\*](#) to configure your MODbus data acquisition, SCADA or control system.

## Selected Complementary Mating Modules for Control & Datalogging of pH & ORP Measurement with 3TX-HiQ-pH Digital Transmitters

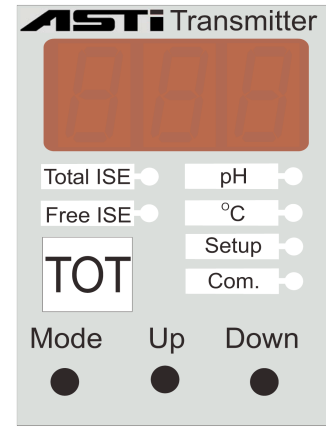
### 3TX-REL Alarm & Relay Controller



### 3TX-DAT MODbus Datalogger



### 3TX-TOT Total ISE pH Compensation Module



## Key Features of 3TX-HiQ pH & ORP Measurement Module

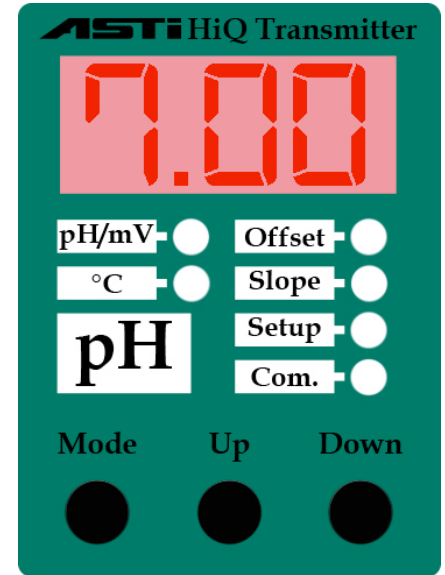
Measurement	Input	Measurement Range	Outputs	Calibration Capabilities	Special HiQ Smart Digital Sensor Features	Special 3TX-HiQ Transmitter Features
pH or ORP <b>3TX-HiQ-pH</b>	- Any Iotron™ Type Series Smart Digital pH Sensor or ORP Sensor	-2 to +16 for pH Mode  -1000 to +1000 mV for ORP Mode	- Fully Isolated, Scalable & Reversible Analog 0-20 mA or 4-20 mA output for pH or ORP process value  - Minimum 1 pH unit or 100mV for ORP mode between 0/4mA and 20mA output setpoints  - RS-485 MODbus RTU digital output comes standard; Selectable High Resolution mode or 3TX-DAT compatible mode	- Two (2) or three (3) point calibration for determination of separate acidic and alkaline slopes  - 1 point user defined pH standardize calibration to correct for offset (drift)  - Offset calibration for temperature value	- Date stamping for initial installation (field activation), last date in field service and total time in use allows for detailed life-cycle management for optimal inventory.  - Date stamping for dispatch from factory, factory invoice number as well as sensor item number & serial number for detailed procurement tracking.  - Entire 3TX-HiQ-pH intelligent transmitter configuration can be saved on the smart digital pH sensor or ORP sensor for cloning of setup or else as a backup to enable reverting capability.	- Calibration values from connected HiQ-pH or HiQ-ORP sensor automatically loaded without any user action. Last 5 calibrations stored on sensor can be viewed.  - Shadow copy of allows for on-the-fly saving of current configuration with ability to later revert back if desired.  - Entire transmitter configuration can be loaded to connected smart digital HiQ smart digital pH or ORP sensor for cloning to other transmitter(s) or else for saving to file with Windows software for archival purposes.

*Last Revised November 2, 2016*



## *3TX-HiQ-pH Transmitter for Smart Digital pH & ORP Sensors*

- Calibrate smart plug & play pH & ORP sensors in lab/shop & install in the field.
- Smart digital Iotron™ plug & play sensors automatically load calibration values. No interaction with transmitter needed if sensor is calibrated before field install.
- The live working calibrations and last five sets of historical calibrations stored on sensor can be displayed & downloaded to file including date associated for each
- Cable lengths up to 610 meters (2,000 feet) using rugged NEMA 6P & IP67 rated quick disconnect waterproof & corrosion-resistant snap connector terminations.
- Iotron™ pH & ORP smart digital sensors stores all calibration data, dispatch date, installation date, time used in the field, last used date & the complete transmitter configuration in onboard non-volatile EEPROM memory for installation portability
- Download transmitter configuration to sensor or upload from sensor to transmitter
- Data Ranges for Input: -2 to +16 for pH, ±1000mV for ORP, -40 to +210 °C
- Fully Scalable Analog 0-20 mA or 4-20 mA current loop output for pH or ORP
- Digital output via RS-485 MODbus RTU in standard or high resolution mode
- Smart software checks for correct sensor type to prevent accidental connection of incompatible sensor. Sensor item#, serial# & invoice# are all stored on sensor.
- Galvanic isolation between sensor input, power & analog output (3000V rating)
- Adjustable time zone on real time clock (RTC) used for stamping calibration & installation dates. RTC battery backup ensures date integrity during loss of power.
- Perform 1-point, 2-point or 3-point pH calibrations. The 3-Point mode (dual slope) uses a separate slope used for acidic (-2 to +7) & alkaline (7 to 16) pH ranges.
- Offset calibration available for pH & ORP measurements and temperature.
- Automatic pH calibration mode recognizes 4.00, 6.86, 7.00, 9.18 & 10.00 pH buffers for all calibration types & corrects for temperature induced changes to pH buffers
- Automatic Temperature Compensation (ATC) with user adjustable coefficient



### Programming

*3TX-HiQ has 3 digit display & 6 LEDs to setup & display values. 'Mode' key is used to navigate. Programming is done by 3 keys front panel. The 'Mode' toggles and 'Up' or 'Down' are used to scroll & select. Parameters entered for display & modification via 'Mode' & the values are changed using 'Up' or 'Down' buttons.*

## FEATURES

The 3TX-HiQ Family of Transmitters Consists Of:

### Measurement Module(s):

**3TX-HiQ-pH: Intelligent pH & ORP transmitter for Iotron™ smart digital pH sensors or ORP sensors; Both the scalable analog 0-20mA or 4-20mA & MODbus outputs are standard**

### Complementary Modules:

- 3TX-REL:** Alarm & relay controller for simple supervision, On/Off, or Time Proportional Control (TPC) or Control Modes
- 3TX-DAT:** Field datalogger, local display & MODbus-Master for 63 each MODbus outputs from 3TX transmitter modules
- 3TX-TOT:** Computes pH compensated "Total ISE" from Free ISE & pH analog inputs, 0/4-20mA analog & MODbus output

### Smart Digital 3TX-HiQ Measurement Platform

The 3TX-HiQ-pH includes all features from previous 3TX-pH transmitters used with analog pH/ORP sensors. Additional features are only available on the 3TX-HiQ-pH smart digital platform. Nearly all features require only the smart digital Iotron™ pH/ORP sensor & mating 3TX-HiQ-pH transmitter. A few features such as saving a configuration or calibration history to file also require use of a free Windows software.

### Digital Sensor Input

The 3TX-HiQ-pH interfaces smart digital Iotron™ pH & ORP sensors via a 100% digital communications to ensure integrity of signal even in noisy process environments. Platinum TC element obtains temperature readings used to compensate pH readings. Integral smart digital HiQ sensor board facilitates all digital functionality. Smart digital HiQ type Iotron™ pH & ORP sensors can only be used with 3TX-HiQ-pH transmitter to achieve listed features. Cable lengths up to 610 meters (2,000 feet) supported. Quick disconnect snap connectors standard.

### Both Analog & Digital Outputs come Standard

The 3TX-HiQ-pH comes with 0/4-20mA scalable, proportional and reversible analog output and digital MODBUS RS-485 RTU multidrop communications. The minimum analog scaling is 1 pH unit or 100mV for ORP mode. Analog output is galvanically isolated from input with 3KV rated optocoupler. The MODBUS RS-485 RTU has a standard resolution 0.01pH units or 1mV for ORP (DAT compatible mode) or 0.001pH units or 0.1mV for ORP (high resolution mode). The Windows 3TX datalogger, SCADA or 3TX-DAT field datalogger can obtain pH/ORP values & temperature from up to 247 each 3TX transmitters simultaneously at up to 6500 feet (2 km).

## TECHNICAL SPECIFICATIONS

### Mechanical

Housing:	Lexan UL94V-0 (Upper part) Noryl UL94V-0 (Lower part)
Mounting:	M36 for 35 mm DIN rail
IP Class:	Housing IP40. Connector IP20
Connector:	Max 16A. Max 2.5 mm <sup>2</sup> Max torque 0,6 Nm
Temp.:	Usage -15 to +50 °C (Storage -35 to +75 °C)
Weight:	75 grams (2.64 ounces)
Dimensions:	D 58 x W 36 x H 86 mm (2.3" X 1.4" X 3.4")
CE mark:	EN61326A



### Electrical

Power Supply:	24VDC ±10%
Consumption:	60 mA max
pH/mV Range:	-2 to +16 for pH, ±1000mV for ORP
Sensor Input:	Smart Iotron™ pH & ORP Sensors
Accuracy:	±0.2% Excluding Sensor (Ideal)
Temp Sensor:	Integral Platinum TC Element
Temp Range:	-40 to +210°C ± 0.3°C
Temperature	Selectable Manual or Automatic
Compensation:	Temperature Compensation (ATC)
Analog Output:	0-20mA or 4-20mA, max. 500Ω
Digital Output:	MODBUS RS-485 RTU
Output Hold:	Automatic when in calibration mode

## BENEFITS OF USING ASTI IOTRON™ SMART DIGITAL SENSORS

- **Intelligent management of sensor calibrations, service-life & transmitter configurations** for efficient commissioning & maintenance. All aspects of installation are portable from the shop to the field.
- **100% pure digital communications** means reliable operation even in noisy process environments.
- **No degradation in signal** even with very long cable runs **up to max of 610 meters (2,000 feet)**
- Bridging connections & modifying installations is easy and done without loss of signal quality with **NEMA 6P & IP67 quick disconnect waterproof and corrosion-resistant snap connectors**. Simple plug and play operation for intelligent maintenance planning & smart management of sensor installations and stocking.
- **Low-cost snap digital extension cables** facilitate consolidation of transmitters into a single panel enclosure where very many remote field installations can all be conveniently all viewed at once.
- **Smart 3TX-HiQ software identifies the type of sensor connected** to confirm it is compatible for the mating transmitter. There exists no possibility of ever interfacing the wrong sensor type.
- **3TX-HiQ-pH smart configuration feature** automatically recognizes & differentiates between pH & ORP sensors. The relevant settings are automatically adjusted if existing setup is incompatible.
- **Min and max temperatures are** digitally stamped on sensor for process condition tracking. This feature allows tracking of process excursions even if just a single 4-20mA output for pH/ORP is used & no second analog temp output exists. MODBUS output always sends BOTH the pH/ORP value and the temperature.
- **Input terminal wiring is identical** for all smart digital 3TX-HiQ measurement modules. All smart sensors have exactly the same color coding & wiring to input terminals on mating 3TX-HiQ transmitter.
- **All Extension cables for HiQ sensors are intercompatible**. Uniform extension cables minimize stocking. Separate field installation guide details all available options to commission & exchange sensors in the field.
- **HiQ configuration system provides systematic & advanced management of field installations** including detailed tracking of both current and previous complete transmitter configurations for each installation point without the high cost and complexity of HART®, Profibus or FOUNDATION™ fieldbus alternatives.

## SENSORS FOR USE WITH 3TX-HiQ-pH SMART DIGITAL TRANSMITTER

- **!!NEW!! Ultra-Rugged Construction ZEUS™ pH Sensors** for Tough Inline, Immersion or Submersible Use
- **Entire line of proven Iotron™ inline, immersion, submersible, twist lock, sanitary, HOT-TAP retractable pH & ORP sensors** made by ASTI are **ALL available** for use with 3TX-HiQ-pH intelligent transmitter
- The new rugged low-profile **impact & break resistant parabolic pH glass element** optimized for use in **slurries & high viscosity applications** (X3XX series) is available as a smart digital sensor for 3TX-HiQ-pH
- The novel **extreme dehydration resistant** style reference technology that allows for **prolonged exposure to dry conditions** and **intermittent wet & dry use** also available as smart digital sensor for 3TX-HiQ-pH

## 3TX-HiQ-pH SMART DIGITAL pH & ORP MEASUREMENT SYSTEM FEATURES

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.

Calibration & configuration features of smart digital Iotron™ pH & ORP plug and play sensors allow intelligent management of sensor calibrations and 3TX-HiQ-pH transmitter configurations all managed in the field to facilitate a simple and fully portable installation scheme. The sensor may be calibrated anywhere (lab, shop or field) and interfaced with any 3TX-HiQ-pH in field to yield instant calibrated pH/ORP and temperature measured values since the calibration values are automatically loaded immediately after connection. No user action of any kind whatsoever is required on the mating 3TX-HiQ-pH transmitter after the sensor is connected to extension cable or panel mount connector built into enclosure. Customized 3TX-HiQ-pH transmitter configurations can be created in the field and downloaded to sensor (P47 downloads config from 3TX-HiQ-pH to sensor). The configuration stored on the smart sensor can be uploaded to the 3TX-HiQ-pH transmitter (P50 uploads config from sensor to transmitter) to clone transmitters with the identical configurations. The configuration loaded on sensor can be saved to file with free ASTI HiQ Windows software to serve as a backup or to else to track transmitter configuration for each installation. Conversely, a configuration file originally saved from the ASTI HiQ Windows software can be loaded onto the smart sensor which can then be loaded to any 3TX-HiQ transmitter desired by calling P50.

As a precaution, the parameter P48 can be used to create a shadow back-up copy of the current working configuration before uploading any new configuration. If necessary, this shadow backup copy can be restored by invoking a P49 call (see parameter list). While calibration values are always automatically loaded, changes to the configuration require an affirmative user action.

### INITIAL INSTALLATION DATE, LAST DATE IN FIELD SERVICE & TOTAL SERVICE TIME

The initial installation date for the sensor is set the first time when it is connected to any 3TX-HiQ-pH transmitter (shown as read only parameter P27). To calibrate or use the sensor in your lab or shop without having this initial installation date or last used in field date stamped, this can be done by performing the calibration/measurement with the free ASTI HiQ software rather than the 3TX-HiQ-pH transmitter (see Windows manual for further details on features and usage). The last date in field service (P28) will always be tracked after the initial installation date has been set after first connection to a 3TX-HiQ-pH transmitter. Note that the internal clock that monitors the total number of days in service is not dependent upon the initial installation date (P27) or last date in service (P28) values. The time in service (shown as ready only parameter P29) is incremented inside the sensor itself continuously so that the number of days installed in field service value is for the actual real-time usage. In this way if the sensor is disconnected this incrementing of the time in service stops and when connected to any 3TX-HiQ-pH transmitter the incrementing of time in service resumes. The total field use time is shown in days (P29) is equally accurate for a sensor in continuous service or intermittent service for situations such as when the sensor is taken in & out of service for cleaning & re-calibration and/or swapped between different transmitters.

### AUTOMATIC INTELLIGENT CONFIGURATION MANAGEMENT FOR CONNECTED SENSOR TYPE

When a smart digital Iotron™ pH & ORP type sensor is connected to the 3TX-HiQ-pH, the sensor type (pH or ORP) is automatically determined and the working configuration is checked for compatibility. For example, if the configuration was previously set for a pH sensor and an ORP type sensor is connected instead, the necessary changes will be made to the relevant parameters to their ASTI default values to ensure compatibility with the connected sensor. If you have a specific customized configuration that you have loaded onto this ORP sensor, this can be uploaded to the transmitter with a call to P50 (see parameter list and instructions on following pages). Conversely if you connected the wrong type of sensor by mistake and the transmitter auto-switched the parameters, the previous configuration can be recalled from the shadow copy made with P48 and the restore invoked with P49.

### AUTOMATIC pH CALIBRATION INSTRUCTIONS

- Using the 'Mode' button toggle to the 'Offset' or 'Slope' LED calibration mode
- **Enter autocal mode by simultaneously holding 'Up' & 'Down' in Offset or Slope LED mode.** The display then toggles between dashes on the left & right LED until autoread algorithm is complete. If all criterion of autoread algorithm were met the autobuffer recognition feature then displays the suggested pH buffer. If all autoread criteria were not met then an 'Err' message is returned.
- To accept the suggested pH buffer value from the auto buffer recognition feature press the 'Mode' key. Alternatively you can use the 'Up' or 'Down' keys to pick a different pH buffer followed by pressing 'Mode' key. If the user selected pH buffer exceeds the calibration limits for the given offset or slope mode then an 'Err' message will also be shown and the calibration aborted.
- If P08 three-point calibration (dual-slope) mode is enabled, the calibration will need to be performed twice in the Slope LED mode. Once for a pH buffer below 7 (only 4.00 in autocal) and once above 7 (9.18 or 10.00 in autocal). Intelligent calibration features on the 3TX-HiQ-pH transmitter automatically assign acidic slope (P17) and alkaline slope (P18) based upon buffers used in autocal.
- The pH buffer value shown is nominal rather than the actual exact value of the pH buffer at the current temperature. Intelligent calibration on the 3TX-HiQ-pH includes automatic retrieval of the exact value for the pH buffer at any temperature from 0 to 60°C as sensed by the integral platinum temperature element for the 4.00, 6.86, 7.00, 9.18 & 10.00 buffers. The pH buffer solution bottle shows the exact value of pH value of the buffer at various temperatures (see graph for visualization of temperature dependence). The exact values of these pH buffers are programmed in the 3TX-HiQ-pH for intelligent, automatic & accurate pH calibration.
- If autocal procedure was successful then 'YES' is displayed or else an 'Err' message is displayed if the autocal failed at any stage.
  - For offset LED mode the 6.86 and 7.00 pH buffers are the available choices in the automatic calibration mode
  - For slope LED mode the 4.00, 9.18 and 10.00 pH buffer are the available choices in the automatic calibration mode
  - To calibrate to any pH buffer or grab sample value not available in the autocal mode use the manual pH calibration mode
- Windows software performs all auto calibration features detailed above without setting/changing initial install or last used date.

### MANUAL pH CALIBRATION INSTRUCTIONS

- Use the 'Mode' button to toggle to the 'Offset' LED and calibrate to first desired value using 'Up' and 'Down' keys. For this offset calibration the typical pH buffer employed are 6.86 or 7.00 although in manual mode it is not necessary to use any specific pH buffer or value for the offset calibration. In manual mode the offset calibration can be performed anywhere from -2 to +16 pH.
- Use the 'Mode' button to toggle to the 'Slope' LED and use 'Up' and 'Down' keys until the display reads the second desired value. This is most typically pH buffer 4.00 for applications that are typically acidic to neutral and pH buffer 9.18 or 10.00 for applications that are typically neutral to alkaline.
- Set P08 to 'On' when process measurement frequently crosses the pH7 condition. This enables a three-point calibration mode that allows for a dual slope operation. Parameter P17 is then used for acidic range & P18 is activated and is used for the alkaline range.
  - The pH sensor is calibrated at three points to create the dual slope operating scheme:
    - One calibration typically near pH 7 in 'Offset' LED mode → This becomes the P16 mV offset
    - Second calibration in pH buffer below pH7 in 'Slope' mode → This becomes Slope 1 for Acidic Conditions
    - Third calibration in pH buffer above pH7 in 'Slope' mode → This becomes Slope 2 for Alkaline Conditions
  - You must exit the 'Slope' mode after completing the acidic slope calibration (below pH7) by pressing the 'Mode' button before re-entering to performing the second 'Slope' calibration for the alkaline (above pH7) calibration.
- The sensor offset and slope values resulting from calibration can be both viewed as well as manually entered/adjusted using the parameters **P16, P17 & P18** (see parameter table list for details). All calibration settings are stored inside the ASTI smart digital pH sensor in EEPROM so sensor can be powered down or moved to a different transmitter without loss of calibration. The result is a true plug and play sensor with intelligent management of current live working as well as historical calibration values.
- A grab sample offset type calibration is done with sensor left in service and allowed to stabilize. A grab sample is analyzed offscale by the prefer method. The inline field reading is made to agree with any grab sample analysis. The value of the sensor installed in service is adjusted in 'Offset' calibration mode to agree with the reference determined value.

### ORP CALIBRATION INSTRUCTIONS

The ORP sensors can only undergo an 'Offset' type calibration performed in manual mode. Automatic calibration mode is disabled for ORP sensors. Toggle to 'Offset' LED mode with 'Mode' and use the 'Up' and 'Down' buttons to adjust mV reading to match desired value of ORP standard solutions or else to agree with an offline determined ORP reference value of the inline process media. Negative values will be shown as flashing. The live working mV offset calibration for ORP sensor can be viewed and adjusted in P16. \*

**A two (2) second averaging exists for in ALL calibrate modes and a ten (10) second averaging for the pH/ORP measure mode.**

### TEMPERATURE CALIBRATION INSTRUCTIONS

The temperature is calibrated by pushing the 'Up' or 'Down' buttons when in the temperature display (°C) mode. \*

### HISTORICAL CALIBRATION VALUES (DISPLAY / READ ONLY PARAMETERS)

- The working mV offset \* (P16), slope1 (P17) & slope2 (P18) can be viewed whether you perform automatic or manual calibrations. **If P01 lock is 'Off', the live P16-P18 values can also be manually adjusted but this is only recommend for experienced users.**
- The historical calibration values can only be viewed and downloaded to file via the free ASTI HiQ Windows software
- Use P34 to define which calibration in the stack will be shown for mV offset (P35), slope1 (P36), slope2 (P37) and temp (P38)
- The historical mV offset \* calibrations shown with P35 (Valid for pH sensors & ORP sensors)
- The historical slope1 calibrations shown with P36 (Only valid for pH sensors)
- The historical slope2 calibrations shown with P37 (Only valid for pH sensors when P08 three-point / dual slope mode is enabled)
- The historical temperature offset calibrations shown with P38 (Valid for all measurement and modes)
- The date associated with each calibration can be viewed as a display feature (see note \*\*\*\* in PARAMETER SET - PART 2 section)

### DISPLAY FEATURES IN MAIN pH/MV LED MODE:

- The absolute mV value \* of sensor is displayed with 'Down' key in pH/mV LED mode.
- The current mA output from the programmed scaling can be displayed by pressing the 'Up' key in pH/mV LED display mode.
- Production date & software revision of 3TX-HiQ displayed with standard method detailed in the 3TX FAQ documentation.

### DISPLAY FEATURES THAT REQUIRE 3TX-HiQ TO HAVE P01 SOFTWARE LOCK 'ON' TO BE ENABLED

- If 'Down' button in °C LED mode is pushed, the temperature offset in °C units \* for current temperature offset calibration is shown.
- If 'Down' button in 'Offset' LED mode is pushed, the current offset calibration in units of mV \* (P16) is shown (for pH & ORP).
- If 'Down' button in 'Slope' LED mode is pushed, the current slope for the live pH value is shown in units of mV per decade. The Slope1 (P17) is shown unless both P18 (dual slope mode) is enabled & the current pH value is above 7, in which case P18 is shown.

\* Negative values shown as flashing.

## SETUP & PROGRAMMING - PARAMETER SET - PART 1

**If softwarelock (Setup param #1) is "On" all of the parameters can only be read. Set P01 Software Lock to "Off" to change values. The P01 software lock will automatically reset back to "On" if no key is pressed for 60 seconds.**

No	Parameter	Description	Range	Default
01	Lock	Software Lock	On / Off	On
02	Address	MODbus	Off, 1...247	Off
03	Sensor Item Number	Defines all sensor options	1-9,999 (>999 displayed with flashing)	Per Sensor
04	Sensor Serial Number	Unique traceable string for sensor	Per HiQ serial number scheme	Per Sensor
05	Temp. Compensation	Correct slope as function of Temp	Auto, Set	Auto
06	Manual Temp. Comp.	Fixed Temperature Compensation	-40 to +210°C *	25
07	Offset from GMT	Hours offset from GMT RTC	-12 (hours) to +12 (hours) *	Per Sensor
08	3-Point Calibration Option	Dual slope feature is enabled (see P18)	Off (2-Point cal), On (3-Point cal)	On
09	mV Range Selector for ORP mode	Available mV Range Modes	Ful (±1000), Neg (-1000 to 0) or Pos (0 to +1000)	Ful ±1000
10	MODbus output mode	Set the mode for compatibility with DAT datalogger or for max resolution	Maximum Resolution <i>pHE</i> mode or <i>DAT</i> compatible mode (1000 Steps only)	DAT
11	Output Mode	Type of output	4-20mA, 0-20mA	4-20
12	Output Style	Standard or Inverted Modes	Non-inverted, inverted	n.inv
13	0/4mA pH Set	Low Setpoint for pH analog output	-2.0 to +15.0 pH *	0.0
14	20mA pH Set	High Setpoint for pH analog output	-1.0 to +16.0 pH *	14.0
15	Step Change	mV Increment for Calibration	0=0.2, 1=0.5, 2=1.0, 3=2.0	1 (0.5mV)
16	mV Offset Calibration	mV@pH7 for pH / mV Offset for ORP	±250 mV *	0
17	Slope 1	mV per pH (for pH sensors only)	30 to 90	59.2
18	Slope 2	mV per pH (when P08 is "On" only)	30 to 90	59.2
19	0/4mA Offset	Trim Low	±9.99% *	0.00
20	20mA Gain	Trim High	±9.99% *	0.00
21	Energy Save	Energy Save	On / Off	Off
22	Baudrate	MODbus	9,600/19,200	19,200
23	Show two significant figures above 9.99 pH	Substitutes integar part of pH scale with letter when greater than 9.99	Off or On; If set to "On" then 10=A, 11=b, 12=C, 13=d, 14=E, 15=F, 16=g	Off
24	0/4mA ORP Set	Low Setpoint for ORP analog output	-999 to +900 * (limits set per P09)	P09
25	20mA ORP Set	High Setpoint for ORP analog output	-900 to +999 * (limits set per P09)	P09

\* Negative numbers shown as flashing

**Par. no. 2** sets HiQ module address for MODbus communication.  
**Par. no. 3** displays sensor item number from connected sensor.  
**Par. no. 4** displays sensor serial number from connected sensor.  
**Par. no. 5** sets the temperature compensation mode to either 'Set' (manal) or 'Aut' (ATC) automatic for HiQ digital pH sensors.  
**Par. no. 6** sets the temp when ATC mode is manual (set) in P05.  
**Par. no. 7** Offsets the time zone from GMT. Check P41-P45 to ensure that your P07 adjustment resulted in desired local time.  
**Par. no. 8** If 3-Point Slope is "Off", one slope (P17) will be used in all pH ranges (-2 to +16). If 3-Point Slope is "On", the sensor will have two slopes; one slope (P17) for the acidic -2 to +7 pH range and another slope (P18) for the alkaline +7 to +16 pH range.  
**Par. no. 9** Range mode for ORP sensor; "ful" range is ±1000mV, the "nEg" range -1000 to 0mV or the "PoS" range is 0 to +1000mV. P24 & P25 set analog output scaling for these range mode limits.  
**Par. no. 10** is used to set the MODBUS output mode to either the maximum resolution 'pHE' mode or the 'DAT' compatible mode.  
**Par. no. 11** sets the analog output to either 0-20 mA or 4-20 mA.  
**Par. no. 12** Set analog output to be non-inverted (proportional & linear, 0-20mA or 4-20mA) or else inverted (20-0mA or 20-4mA).  
**Par. no. 13 & 14** defines pH for 0/4mA setpoint (P13) & for 20mA setpoint (P14). P13 & P14 must be at least one (1.0) pH unit apart.  
**Par. no. 15** Variable to define the mV change for each time "Up" or "Down" button is depression when calibration is performed.

**Par. no. 16** View & edit working sensor mV offset  
**Par. no. 17** View & edit working slope1 (pH only). If P08 is "OFF" slope 1 used for -2 to +16 pH. If P08 is "ON" (3-Point/Dual Slope) then slope1 is for -2 to +7 pH only & P18 is used for alkaline slope.  
**Par. no. 18** View & edit working sensor slope2 for 7-16 pH range. This is valid only if P08 is ON, or else just blank "----" no value.  
**Par. no. 19** Offset adjustment for 0/4mA low analog output trim.  
**Par. no. 20** Gain adjustment for 20mA high analog output trim.  
**Par. no. 21** After 10 min display shows flashing bar when enabled.  
**Par. no. 22** Sets MODbus baudrate to 9,600 or 19,200  
**Par. no. 23** Show two significant figures when pH is 10 or greater  
**Par. no. 24 & 25** Defines mV for 0/4mA setpoint (P24) & 20mA setpoint (P25) for analog output with ORP sensor. The P24 & P25 setpoints must be at least 100mV apart. Defaults/limits set by P09.

- Parameters shaded in **grey** downloaded to sensor as configuration parameters when P47 is invoked on HiQ or else uploaded from sensor to HiQ transmitter when P50 is invoked (see next page)
- Parameters shaded in **light green** are ONLY stored on Smart Iotron™ pH & ORP sensor & these HiQ parameters are read only
- Parameters shaded in **dark red** ONLY stored on Digital Iotron™ pH & ORP sensors & HiQ parameter can be viewed & modified
- Parameters shaded in **dark green** are ONLY stored on the HiQ transmitter & these HiQ parameters are display/read only

## SETUP & PROGRAMMING - PARAMETER SET - PART 2

If softwarelock (Setup param #1) is "On" all of the parameters can only be read. Set P01 Software Lock to "Off" to change values. The P01 software lock will automatically reset back to "On" if no key is pressed for 60 seconds.

No	Parameter	Description	Range	Default
26	Manufacture Date ***	Date dispatched from ASTI factory	See date display scheme	Per Sensor
27	Initial Installation Date ***	Date when first connected to HiQ	See date display scheme	Per Sensor
28	Last used date in field ***	Last date connected to HiQ	See date display scheme	Per Sensor
29	Day in field service	Days in use after installation date	0-65,535 (>999 displayed as flashing)	Per Sensor
30	ASTI Invoice for sensor	ASTI Invoice for sensor connected	0-65,535 (>999 displayed as flashing)	Per Sensor
31	Sampling Frequency	Set sampling frequency in Hz unit	0.5, 1.0, 2.0 and 4.0	4.0
32	Temp Comp Coefficient	Set temp compensation coefficient	Units are $\mu\text{V}$ per $^{\circ}\text{C}$ (000-999)	198
33	Sensor Board Software	Revision of sensor board connected	From sensor (READ ONLY)	Per Sensor
34	Calibration Number	View with P35-P38 (read only)	From 1 to 5 per position in FIFO ring buffer	1
35	mV Offset ****	mV@pH7 for pH & mV Offset for ORP	$\pm 250$ mV * (READ ONLY)	Per Cal
36	Slope 1 ****	mV per pH (when P03=pH)	30 to 90 (READ ONLY)	Per Cal
37	Slope 2 ****	mV per pH (when P08=On)	30 to 90 (READ ONLY)	Per Cal
38	Temperature Cal ****	Shows temp offset cal in $^{\circ}\text{C}$ units	$\pm 25.0^{\circ}\text{C}$ * (READ ONLY)	Per Cal
39	Min Temp in Use	Shows lowest temp in field use	Min $-40^{\circ}\text{C}$ * (READ ONLY)	Per Sensor
40	Max Temp in Use	Shows highest temp in field use	Max $210^{\circ}\text{C}$ (READ ONLY)	Per Sensor
41	RTC, Year	Display Only - Year	00-255 $\rightarrow$ 2000-2255 (READ ONLY)	Per HiQ
42	RTC, Month	Display Only - Month	01-12 (READ ONLY)	Per HiQ
43	RTC, Date	Display Only - Date	01-31 (READ ONLY)	Per HiQ
44	RTC, Hour	Display Only - Hour	00-23 (READ ONLY)	Per HiQ
45	RTC, Minute	Display Only - Minute	00-59 (READ ONLY)	Per HiQ
46	Reset All Sensor Cals **	All sensor calcs reset to ASTI defaults	'Cur'= No Action, 'Rst/Cal'=Reset sensor calcs	Cur
47	Load config onto sensor	Load settings for <i>grey</i> param to sensor	'Cur'= No Action, 'Cfg/Sen'=Cfg to sensor	Cur
48	Make shadow copy **	Backup settings for <i>grey</i> params	'Cur'= No Action, 'Cpy/Cfg'=Backup config	Cur
49	Restore to Shadow Copy **	Restores settings to P48 shadow copy	'Cur'= No Action, 'Rst/Cfg'=Reset to Backup	Cur
50	Load config from sensor **	Load <i>grey</i> param settings from sensor	'Cur'= No Action, 'Lod/Sen'=Cfg from sensor	Cur
51	Reset All **	Resets all param back to ASTI defaults	'Cur'= No Action, 'Def/Rst'=Reset ALL values	Cur

\* Negative numbers shown as flashing

**Par. no. 26** display the date of manufacture at ASTI factory. \*\*\*  
**Par. no. 27** display date first connected to 3TX-HiQ. **Windows software calibrates sensor without setting first install date.** \*\*\*  
**Par. no. 28** display date sensor last used with HiQ transmitter. \*\*\*  
**Par. no. 29** display total number of equivalent days (24hr periods) the sensor has been installed into field service with  $\pm 2\%$  accuracy.  
**Par. no. 30** display ASTI invoice number associated with sensor.  
**Par. no. 31** Sets sampling frequency of sensor in Hz. If timeout error is reported from 3TX-HiQ, reduce the sampling rate.  
**Par. no. 32** Sets the coefficient for temperature compensation of pH values. **Contact ASTI before changing this value.**  
**Par. no. 33** Display software revision of connected sensor.  
**Par. no. 34** Defines set of historical calibrations to be viewed with P35-P38 in read only mode. P34 defines the position in the FIFO circular ring buffer that is used to store the calibrations. Note that each calibration stack is completely separate. The P34 parameter only sets the calibration reference number in the stack. The dates corresponding with each of the calibrations (mV offset, slope1, slope 2, temperature) may differ for each calibration even when the P34 setting is identical. Date of the historical calibration provided as a display feature (see \*\*\* note for details). P34 is the only param that can be changed without setting P01 lock to 'Off'.  
**Par. no. 35** View historical mV offsets as defined by P34. \*\*\*\*  
**Par. no. 36** View historical slope 1 values (pH mode only). \*\*\*\*  
**Par. no. 37** View historical slope 2 values (When P08="On") \*\*\*\*  
**Par. no. 38** View historical temp offset calibrations in  $^{\circ}\text{C}$  \*\*\*\*

**Par. no. 39** Display lowest temp experienced by sensor in use  
**Par. no. 40** Display highest temp experienced by sensor in use  
**Par. no. 41** Shows year, **Par. no. 42** shows month, **Par. no. 43** shows date, **Par. no. 44** shows hours & **Par. no. 45** shows minutes.  
**Par. no. 46** Reset all live working calibrations on sensor, as shown in P16, P17, P18 &  $^{\circ}\text{C}$  LED, back to ASTI factory default values. \*\*  
**Par. no. 47** Parameters shaded in *grey* are downloaded to sensor as configuration parameters when when P47 call is invoked.  
**Par. no. 48** Parameters shaded in *grey* are loaded into a shadow copy, which can be used to revert to this configuration with P49 \*\*  
**Par. no. 49** Restores config to version from P48 shadow copy \*\*  
**Par. no. 50** Uploads configuration from sensor to HiQ transmitter. The current cofiguration values will be overwritten! Use P48 to make a backup shadow copy of configuration before using P50. \*\*  
**Par. no. 51** Reset **ALL** parameters to ASTI factory default values \*\*

\*\* The configuration stored on smart digital sensor are unchanged by invoking these parameters

\*\*\* Date format: "H"+last two digits of year, then "m.dd" where "m" is month shown as 1-9 for Jan-Sept, then A=Oct, b=Nov, C=Dec & "dd" is day of month (October 8<sup>th</sup> 2015 shown as "H15" followed by "b.08")

\*\*\*\* Date associated with calibration is accessed by pushing the 'Up' button while value is shown. Date format is same as per note \*\*\* above.

\*\*\*\* Calibration reference number (P34) associated with P35-P38 calibrations accessed by pushing 'Down' button while value is shown.



## RS-485 MODBUS RTU OUTPUT OPTIONS

The 3TX-HiQ-pH comes standard with MODBUS output. The 3TX-HiQ-pH may be used as a slave for 3TX-DAT field datalogger (when P10=DAT compatible mode) or as a slave in any MODBUS type SCADA data acquisition system (in any mode). All configurations possible are compatible with free ASTI Windows Datalogger Software for 3TX transmitters with MODBUS.

### With 3TX-DAT

If 3TX-HiQ-pH is used with 3TX-DAT, baud rate on the MODbus and address of the 3TX-HiQ-pH should be noted. **The baud rate (P22)** must be set to the baud rate of the 3TX-DAT. Whether a baud rate of 19,200 or 9,600 is not important, as long as all units on the MODbus network are set to use the same baud rate.

**The node address (P02)** must be unique in the network; Two units cannot have the same address. In a network with 3TX-DAT as the master, all addresses must be assigned in series; i.e. if 3 units are connected to 3TX-DAT, the addresses 1, 2 & 3 must be assigned to three units. The order of addresses is not important. 3TX-DAT MODbus fieldlogger supports up to 63 each 3TX nodes.

### In a SCADA system

**The baud rate (P22)** must match the baud rate of the SCADA system. **The node address (P02)** must be unique in network; Up to 247 each 3TX transmitters can be connected on single network.

### MODbus Scaling

The 3TX-HiQ-pH operates in two MODBUS output modes. The first mode is P10='DAT' yielding the same pH/ORP & temp outputs as analog 3TX-pH units. The second P10='pHE' high-resolution mode yields the same outputs for pH/ORP as analog 3TX-pHE (but the temp output range is different). The MODbus scaling may differ from 0/4-20 mA analog scaling. Low & high scaling, number of steps & resolution detailed in the tables below.

*When P10 is set to 'DAT' compatible mode both the measurement & temperature sent as 0-1,000 steps (1024 offset for 2<sup>nd</sup> temp value):*

Smart Sensor Connected to 3TX-HiQ-pH	If P09 reads this: (Valid for ORP Sensors Only)	Input for DAT / 3TX Windows Datalogger	Scale (low) will be fixed at:	Scale (high) will be fixed at:	Effective Resolution:
pH	N/A	3TX-pH (pH)	0.00 pH	14.00 pH	0.014pH
ORP	Neg	3TX-pH (-1000 mV)	-1000 mV	0 mV	1mV
ORP	Pos	3TX-pH (+1000 mV)	0 mV	+1000 mV	1mV
ORP	Ful	3TX-pH (±1000 mV)	-1000 mV	+1000 mV	2mV

*When P10 is set to 'pHE' high resolution mode then pH is sent as 0-18,000 steps and ORP/mV is sent as 0-20,000 steps:*

Smart Sensor Connected to 3TX-HiQ-pH	If P09 reads this: (N/A for this mode)	Input for 3TX Windows Datalogger	Scale (low) will be fixed at:	Scale (high) will be fixed at:	Effective Resolution:
pH	N/A	3TX-HiQ-pH (pH)	-2.000 pH	+16.000 pH	0.001pH
ORP	N/A	3TX-HiQ-pH (mV)	-1000.0 mV	+1000.0 mV	0.1mV

The second MODbus value sent from the 3TX-HiQ-pH is always temperature. When P10='DAT' the temperature range is 0-210°C with 1,000 steps sent as 1024-2024. When P10='pHE' the temperature range is also 0-210°C with 1,000 steps but is sent as 0-1,000 without the 1024 offset used in the DAT compatible MODBUS output mode. Both 'DAT' and 'pHE' settings for parameter P10 MODBUS output mode selector yield an effective resolution of 0.2°C with an uncertainty is ± 0.3°C. If you need to output the temperature value below zero (from -40 to 0°C) via MODBUS please contact the ASTI factory for assistance with this requirement.



## ORDERING INFORMATION FOR 3TX-HiQ INTELLIGENT TRANSMITTERS

ENCLOSURE TYPE CODING & DETAILED DESCRIPTION	
CODE	DESCRIPTION
3TX-0M	3TX Transmitter with No Enclosure
3TX-DIN	3TX Transmitter with No Enclosure; Preinstalled onto 35mm DIN-Rail
3TX-2MW	3TX Transmitter(s) in IP65 Enclosure; Up to 2 Total Modules ( <b>Wall Installations Only</b> )
3TX-2M	3TX Transmitter(s) in IP65 Enclosure; Up to 2 Total Modules (Wall or Pipe Installations)
3TX-3MP	3TX Transmitter(s) in NEMA 4X CSA/UL Rated Enclosure; ½-DIN <b>Panel</b> ; Max 3 Modules ( <b>Panel Bracket assy</b> )
3TX-3MF	3TX Transmitter(s) in NEMA 4X CSA/UL Rated Enclosure; Up to 3 Total Modules (Wall or Pipe Installations)
3TX-4MW	3TX Transmitter(s) in IP65 Enclosure; Up to 4 Total Modules ( <b>Wall Installations Only</b> )
3TX-4M	3TX Transmitter(s) in IP65 Enclosure; Up to 4 Total Modules (Wall or Pipe Installations)
3TX-6MW ***	3TX Transmitter(s) in IP65 Enclosure; Up to 6 Total Modules (Wall or Pipe Installations)
3TX-6M ***	3TX Transmitter(s) in IP65 Enclosure; Up to 6 Total Modules (Wall or Pipe Installations)
3TX-7MF ***	3TX Transmitter(s) in NEMA 4X CSA/UL Rated Enclosure; Up to 7 Total Modules (Wall or Pipe Installations)
3TX-9MF ***	3TX Transmitter(s) in NEMA 4X CSA/UL Rated Enclosure; Up to 9 Total Modules (Wall or Pipe Installations)
MEASUREMENT MODULES (FROM 1 TO 9 TOTAL, PRICE IS PER EACH MODULE)	
CODE	DESCRIPTION
-HiQ-pH	Intelligent Digital pH & ORP Transmitter for Use with Iotron™ Smart Digital pH Sensors or ORP Sensors Standard with both scalable 0-20mA or 4-20mA analog output and RS-485 MODBUS RTU multidrop digital output
ADD-ON MODULES FOR MEASUREMENT MODULES IN ENCLOSURE ASSEMBLIES	
CODE	DESCRIPTION
-PS	100 to 240 VAC 50/60 Hz Universal Power Supply Adapter for Line Powered Operation
-PS/BAT	Dual Isolated & Regulated 24VDC Power Supply Step-Up Converter for operation from 5V, 6V & 9V Batteries
-SW	On/Off Power Switch (½ Width of power supply module and ¼ width of standard 3TX transmitter)
-REL	Programmable Alarm & Relay Controller with tight integration with all 3TX measurement modules for easy setup Standard with simple supervision, On/Off, Time Proportional Control (TPC) or Variable Pulse Control Modes
-TOT	pH compensated "Total ISE" from ISE & pH inputs, 0/4-20mA analog & MODbus digital outputs
-DAT	RS485 Datalogger & MODbusmaster for 3TX; Download & Setup via RS232 / USB on Windows PC

2" NPT Pipe mounting bracket kits supplied separately. For 3MP, 3MF, 6MW & 7MF enclosures the power supply is not counted as a module for space purposes. **Refer to documentation for 3TX transmitter for use with analog sensors for all 3TX measurement modules not listed here.** The 3TX transmitter measurement modules for analog sensors and the 3TX-HiQ transmitter modules for digital sensors can be mixed and matched into any enclosure without limitation. The female panel mount snap connector is only available for the 3TX-HiQ units.

\* All enclosures come standard with ½" MNPT cable glands installed for sensor inputs and transmitter outputs. The base enclosure cost includes this feature standard.

\*\* Enclosures for use with 3TX-HiQ transmitter can be supplied with female panel mount snap connector installed into the input side of the enclosure as an option. This option is designated by adding -XH to the end of the enclosure part number where X is the number of female panel mount snap connectors desired for the given enclosure. There exists a surcharge to the base enclosure cost for each snap connector that is installed. The number of snap connector cannot exceed the number of 3TX modules supported for the enclosure type. Examples are given below for elucidation of this -XH snap connector female panel mount option available for the HiQ digital sensors. The standard cable gland and snap connector inputs can be mixed and matched as desired. The analog 3TX transmitter modules can likewise be mixed and matched with digital 3TX-HiQ style transmitter modules although the snap input option is only supported on the HiQ transmitters. All seals for the transmitter outputs are always cable glands.

\*\*\* For 2" NPT pipe mounting installations, an additional adapter plate is required for 6MW, 6M, 7MF & 9MF enclosures (inquire to factory for details). The 2M, 3MF, and 4M enclosures support pipe mounting without an adapter plate. The 2MW, 4MW and 3MP enclosures are not supported for pipe mounting (with or without adapter plate).

**Model: 3TX-2MW-2H-HiQ-pH-HiQ-pH**

Description: Dual Channel Transmitter with Weatherproof Enclosure; 2 each female snap panel mount connectors installed for HiQ sensors; 2 each 3TX-HiQ-pH Intelligent pH & ORP transmitters for Iotron™ smart digital pH/ORP sensors; No AC Power Supply, 3-wire 24VDC Power Operation

**Model: 3TX-3MF-1H-HiQ-pH-DO-D-PS-SW**

Description: Dual Channel Transmitter Assembly in NEMA 4X CSA/UL rated Enclosure for Wall or Pipe Mounting Installations (3 Modules Max); 1 each 3TX-HiQ-pH Intelligent pH & ORP transmitter for IOTRON™ smart digital pH/ORP sensors; 1 each DO transmitter for galvanic type DO sensors with Scalable Analog & MODbus Output for DO ppm, Percent Saturation & Temperature; Universal 100-240 VAC Power Supply; On/Off Toggle Switch

**Model: 3TX-3MP-HiQ-pH-REL-DAT-PS**

Description: Single Channel 3TX-HiQ-pH Intelligent pH & ORP transmitter for Iotron™ smart digital pH/ORP sensors; ½-DIN NEMA 4X Panel Mount Enclosure with cable glands for inputs & outputs; Programmable alarm/relay controller & MODBUS datalogger; Universal 100-240 Power Supply

**Model: 3TX-6MW-2H-ISE-NH4-A-HiQ-pH-TOT-HiQ-pH-CON-0.1/5.0-D-DO-D-PS**

Description: Five Channel Measurement Transmitter Assy with IP65 Weatherproof Enclosure (Max 6 Modules); 1 each Ammonium ISE Module with Analog Output; 2 each 3TX-HiQ-pH Intelligent pH & ORP transmitter for IOTRON™ smart digital pH/ORP sensors; 1 each TOT module to compute total ammonia (NH<sub>3</sub>+NH<sub>4</sub><sup>+</sup>) with Analog & MODbus Outputs; 1 each conductivity transmitter for K=0.1/cm cells; Analog & MODBUS outputs; 1 each DO transmitter with Scalable Analog & MODbus Outputs for DO ppm, % Saturation & Temperature; Universal 100-240 VAC Power Supply

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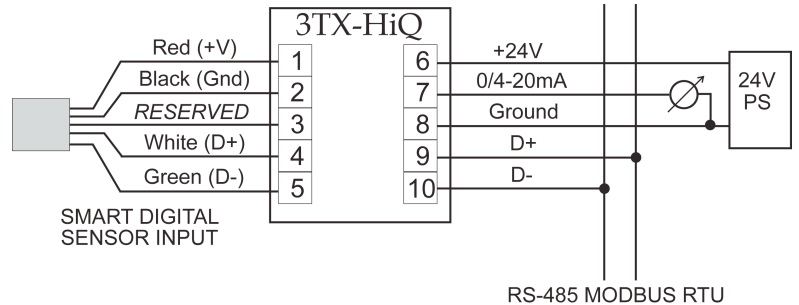


## 3TX-HiQ Intelligent Transmitters for Smart Digital Sensors Measurement Platform Recommended Field Installation Guide

**Tinned leads connected to the 3TX-HiQ can be from:**

- “A” - leads from panel mount connector installed into transmitter enclosure (done at ASTI factory) *or*
- “B” - female snap to tinned lead cable extensions with sealing glands installed into transmitter enclosure (done either at install site or time of commissioning).
- In “A” or “B” installation approach above the wiring to transmitter need be done only once. Subsequent sensor exchanges in field for cleaning, recalibration or replacement do not require interfacing with the input terminals on the transmitter board in any manner.

**Wiring of Tinned Leads to 3TX-HiQ Transmitter**



### FIELD INSTALLATION SCHEMES - PART 1

**Please review the first two pages of the 3TX FAQ before wiring-up or powering on any of the 3TX modules.**

Installation approaches for genuine Smart Digital Iotron™ pH & ORP type HiQ sensors are detailed in the following pages.

**BASE HiQ pH & ORP SENSOR CONFIGURATION:**

All smart digital Iotron™ pH and ORP HiQ style sensors for use with 3TX-HiQ-pH transmitters come standard with 6 meters (20 feet) of integral cable and include quick disconnect male terminated IP67 & NEMA 6P rugged field ready connector. Shorter cable lengths of 1.5 meters (5 feet) and 3 meters (10 feet) are also available but there is no difference in cost for these shorter sensor cable lengths.

Installation requiring cable runs longer than 6 meters (20 feet) can be achieved using the approach #2 & #3 options for field installation detailed below. Best practice is to use the well stocked standard sensor cable lengths and cable extension options for the lowest cost and best availability of your 3TX-HiQ-pH installation. Longer cable lengths can also be achieved by use of the **special order options indicated in green** in PART 2 of this guide but this approach may lead to longer lead times for fabrication.

**Approach # 1**

*Directly connect male snap termination of smart sensor to female panel mount installed on 3TX-HiQ transmitter enclosure*  
→ Length of cable ordered for sensor must be sufficient to interface to enclosure for this approach. Standard 6 meter length (20 feet) with optional shorter 3 meters (10 feet), 1.5 meters (5 foot) lengths also available for the exact same HiQ option adder cost.

**Approach # 2**

*Use snap to snap cable extensions terminating into female panel mount plug installed on 3TX-HiQ transmitter enclosure*  
→ Length of cable between sensor and snap to snap cable extension(s) must be sufficient to interface to enclosure for this approach. The use of multiple snap to snap cable extensions is ASTI factory supported and will not result in signal degradation so long as the maximum 610 meters (2,000 feet) of total cable length is not exceeded.

**Approach # 3**

*Use female snap to tinned leads cable extensions with sealing cable glands installed into enclosure for 3TX-HiQ transmitter*  
→ Female snap to tinned lead cable extensions can be mated with the sensor male snap connector or else to a snap to snap cable extension. If the female snap to tinned leads cable extensions is employed, it should always be used as the final portion of the installation so that this cable interface the 3TX-HiQ transmitter input terminal board (see wiring schematic option “B” above).

**GENERAL NOTE:**

The sensor terminations are always male snap connector. The female snap to male snap cable extensions and female snap to tinned leads cable extensions can be used in any combination without signal degradation so long as the maximum supported 610 meters (2,000 feet) of total cable length is not exceeded.

## FIELD INSTALLATION SCHEMES – PART 2

Find detailed below the standard and special order cable length installation options using the HiQ smart digital platform.

### Integral Cable Length Options for HiQ Sensors

- All HiQ style sensors come standard with male snap connector. Standard integral cable length is 6 meters (20 feet).
- Shorter 3 meters (10 feet) or 1.5 meters (5 feet) integral sensor cable lengths also terminating with male snap connector available for same price as standard 6 meter (20 foot) length. Specify shorter lengths by -HiQ-1.5m or -HiQ-3.0m coding. If standard -HiQ option is invoked the sensor is supplied with standard 6 meters (20 feet) of cable & male snap connector.
- **12 meters (40 feet) of integral sensor cable with male snap connector available as a *special order option (-HiQ-12m)*.**

### Female Snap to Male Snap Cable Extension Options

3 meters (10 feet)	HiQ4F-3m-HiQ4M
6 meters (20 feet)	HiQ4F-6m-HiQ4M
12 meters (40 feet)	HiQ4F-12m-HiQ4M
<b>24 meters (80 feet)</b>	<b>HiQ4F-24m-HiQ4M – Special Order Option Only</b>

### Female Snap to Tinned Leads Cable Extension Options

1.5 meters (5 feet)	HiQ4F-1.5m-TL
3 meters (10 feet)	HiQ4F-3m-TL
6 meters (20 feet)	HiQ4F-6m-TL
<b>12 meters (40 feet)</b>	<b>HiQ4F-12m-TL – Special Order Option Only</b>

### POSSIBLE TOTAL CABLE LENGTH INSTALLATIONS USING APPROACH #1, #2 or #3

**Approach # 1:** Sensor with integral cable only with male snap connected directly to female panel mount:  
STANDARD is 6m (20ft) with shorter 1.5 meters (5 feet), 3 meters (10 feet) cable lengths also available for same price  
→ **12m (40ft) integral cable length terminating with male snap connector also available as Special Order Option**

**Approach # 2:** Sensor with integral cable and female to male snap cable extension connected to female panel mount:

	<b>+3 meters</b>	<b>+6 meters</b>	<b>+12 meters</b>	<b>+24 meters</b>
With 1.5m (5ft) integral sensor cable:	4.5m (15 feet)	7.5m (15 feet)	13.5m (45 feet)	<b>25.5m (85 feet)</b>
With 3m (10 ft) integral sensor cable:	6.0m (20 feet)	9.0m (30 feet)	15m (50 feet)	<b>27.0m (90 feet)</b>
With 6m (20 ft) integral sensor cable:	9.0m (30 feet)	12m (40 feet)	18m (60 feet)	<b>30.0m (100 feet)</b>
<b>With 12m (40 ft) integral sensor cable:</b>	<b>15m (50 feet)</b>	<b>18m (60 feet)</b>	<b>24m (80 feet)</b>	<b>36.0m (120 feet)</b>

**Approach # 3:** Sensors with integral cable and female snap to tinned leads cable extension to 3TX-HiQ input terminals:

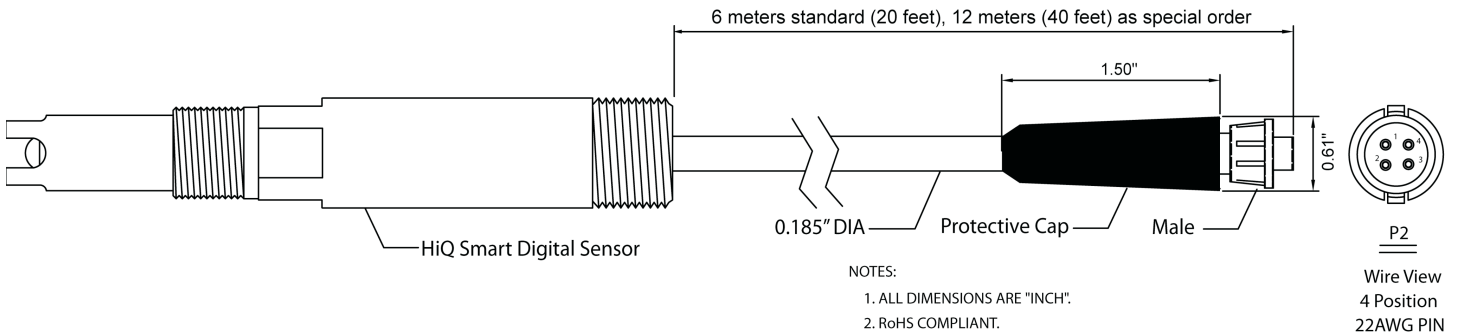
	<b>+1.5 meters</b>	<b>+3 meters</b>	<b>+6 meters</b>	<b>+12 meters</b>
With 1.5m (5ft) integral sensor cable:	3m (10 feet)	4.5m (15 feet)	7.5m (15 feet)	<b>13.5m (45 feet)</b>
With 3m (10 ft) integral sensor cable:	4.5m (15 feet)	6m (20 feet)	9m (30 feet)	<b>15m (50 feet)</b>
With 6m (20 ft) integral sensor cable:	7.5m (15 feet)	9m (30 feet)	12m (40 feet)	<b>18m (60 feet)</b>
<b>With 12m (40 ft) integral sensor cable:</b>	<b>9m (30 feet)</b>	<b>12m (40 feet)</b>	<b>18m (60 feet)</b>	<b>24m (80 feet)</b>

Standard installations requiring cable lengths longer than 18 meters (60 feet) or *special order style installations requiring cable lengths longer than 36 meters (120 feet)* are achieved by using multiple female snap to male snap cable extensions. This can increase the total cable length in increments of 3m (10 feet), 6m (20 feet) & 12m (40 feet) or **24m (80 feet) with special order snap to snap cable extensions**. The snap to snap & snap to tinned leads cable extensions can be used together in any combination without signal degradation provided the **maximum supported 610 meters (2,000 feet) total cable length is not exceeded**.

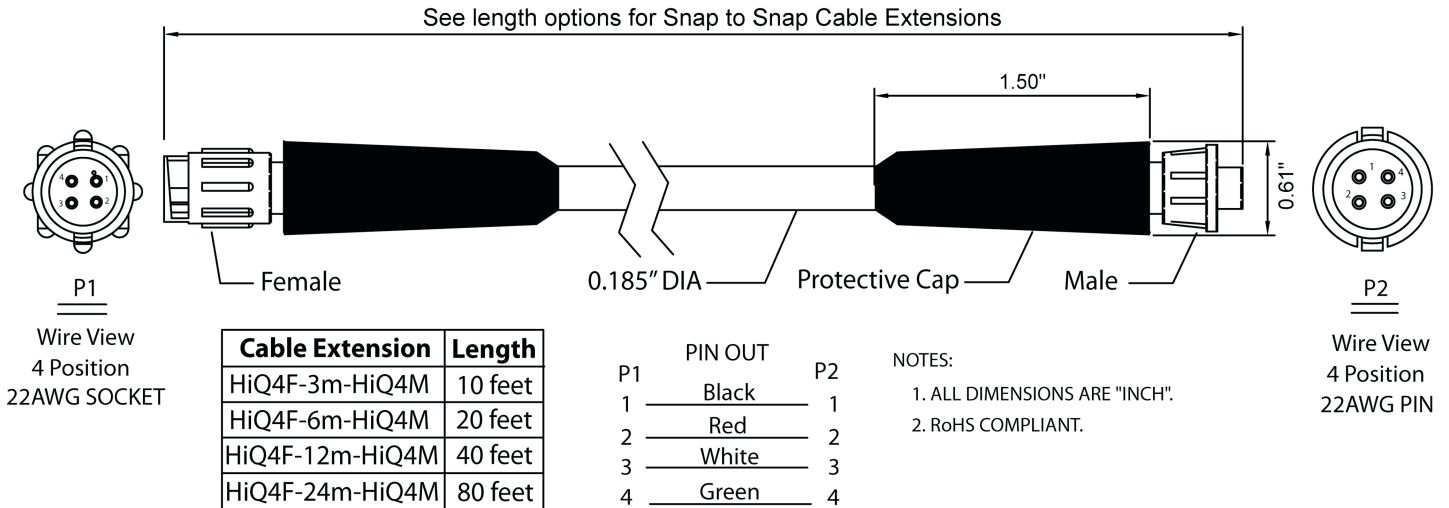
**Items denoted in GREEN are special orders. This means that there may be limited availability and/or extended lead times for purchase of these items or to invoke these options. Contact ASTI factory or distributor for further details.**

## FIELD INSTALLATION SCHEMES - PART 3

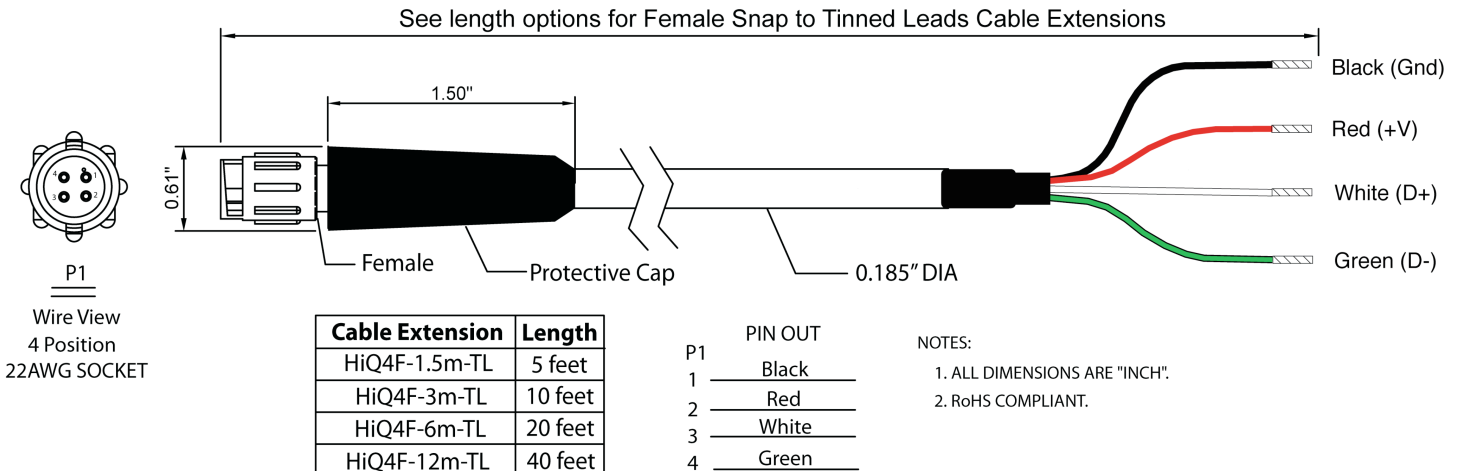
Detail drawing for standard smart digital HiQ sensor male snap connector cable termination (-HiQ-Xm):



Detail drawing for female snap to male snap HiQ4F-Xm-HiQ4M cable extensions:



Detail drawing for female snap to tinned leads HiQ4F-Xm-TL cable extensions:

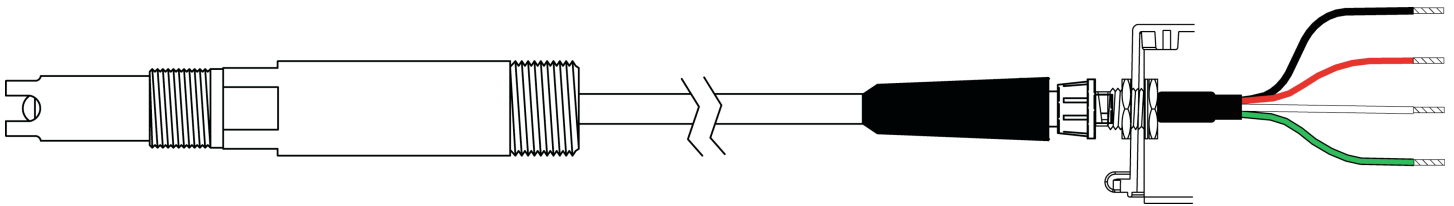


## FIELD INSTALLATION SCHEMES - PART 4

The terminal assignments for red, black, white & green colored leads are detailed on page 1 of this installation guide. Care should be taken when making these connections to follow the terminal assignments exactly to avoid damaging the HiQ sensor or transmitter. No connection of any kind should be made to the factory-reserved input terminal 3.

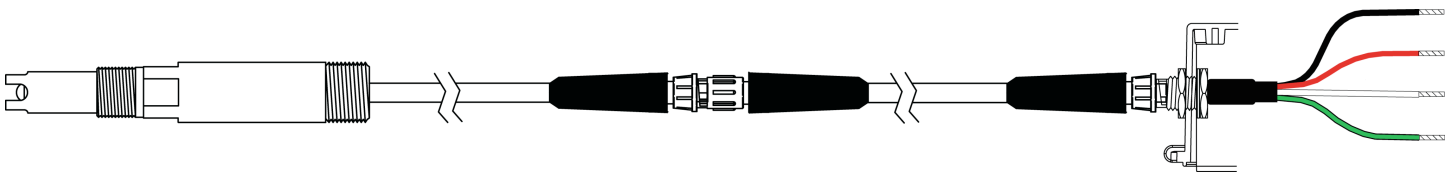
### Assembly Drawing for Installation Approach # 1:

Smart digital HiQ sensor with male snap connector is interfaced directly to female panel mount snap connector that has been installed into enclosure assembly. This approach requires the max distance between sensor & transmitter is no more than 6 meters (20 feet) for the standard digital HiQ sensors or 12 meters (40 feet) for the special order long cable version.



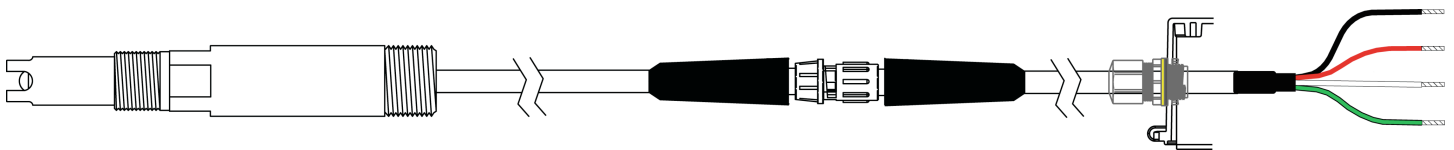
### Assembly Drawing for Installation Approach # 2:

Smart digital HiQ sensor terminated with male snap connector is bridged with snap to snap (HiQ4F-Xm-HiQ4M) cable extension which is interfaced to female panel mount snap connector that has been installed into enclosure assembly. Multiple snap-to-snap extension cables can be employed as desired at time of commissioning or any time thereafter.



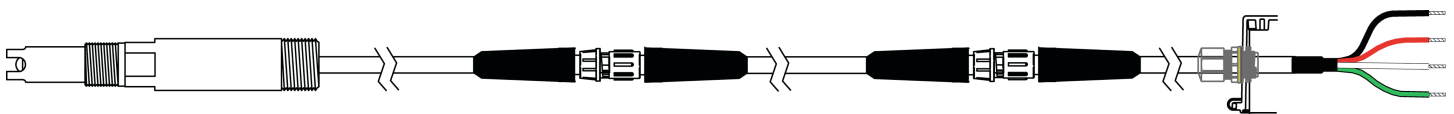
### Assembly Drawing for Installation Approach # 3:

Smart digital HiQ sensor terminated with male snap connector is bridged with snap to tinned leads (HiQ4F-Xm-TL) cable extension. The tinned leads are interfaced to 3TX-HiQ terminals & sealing cable gland is installed in enclosure assembly to secure the cable. This approach is typically used for retrofit installation where a cable gland has already been installed.



### Assembly Drawing for Installation Approach # 3 (Special)

Smart digital HiQ sensor terminated with male snap connector is bridged with both snap to snap (HiQ4F-Xm-HiQ4M) cable extension and snap to tinned leads (HiQ4F-Xm-TL) cable extensions. The tinned leads are ultimately interfaced to 3TX-HiQ terminals and sealing cable gland is installed in enclosure assembly. See page 1 for terminal assignments.



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## 3TX-HiQ Digital Measurement System Troubleshooting Guide & FAQ

### **!!! WARNING !!!**

**The 3TX-HiQ digital transmitters are ONLY for use with genuine ASTI supplied IOTRON™ smart digital HiQ sensors. Connecting any other sensor (analog or digital) may permanently damage the 3TX-HiQ transmitter and/or improper sensor. If there should be any doubt as to whether you are connecting a genuine ASTI supplied IOTRON™ HiQ digital sensor to the 3TX-HiQ digital transmitter, please inquire to the ASTI factory for verification.**

The smart digital HiQ sensors are designed for a seamless and simple plug and play type operation with the intelligent digital 3TX-HiQ transmitters. In the case that any exception occurs a variety of diagnostic information may be displayed in the form of error codes reported on the 3TX-HiQ LED display. Instructions about what should be done if any of these error codes or diagnostic messages are displayed is provided below to assist with troubleshooting initial commissioning as well as ongoing maintenance of your installation.

The troubleshooting steps below are meant for use together with the specific 3TX-HiQ transmitter documentation in question as well as the general shared 3TX FAQ documentation rather than just as a standalone guide. Error codes are shown flashing on the display in the format "X.Y" where "X" is from 1 to 10 and "Y" can vary from 0 to 9. The exact coding designations are generally only relevant for internal uses by the ASTI factory. In particular the "Y" portion of the error code can be safely ignored unless specifically requested for remote diagnostic troubleshooting assistance purposes.

### **NO SENSOR CONNECTED OR IMPROPER WIRING ERRORS**

If no genuine IOTRON™ smart digital HiQ digital sensor is connected, it is expected that one or more error will be reported including the 2.Y type error code. If there is an HiQ digital sensor connected but it is not interfaced to the correct type of mating HiQ transmitter you will get a 3.Y measurement type mismatch error. It is very important to make sure that the four leads from the smart digital HiQ sensor are properly wired to the terminals on the 3TX-HiQ transmitter to prevent damage to the electronics. Please see page one (1) for the color coding and terminal designations of the four leads. Since the HiQ digital measurement system employs a NEMA 6P rated quick disconnect termination, the tinned lead connections need only be made correctly once to the HiQ transmitter.

### **COMMUNICATION ERRORS**

If an HiQ digital sensor is properly connected and an error code of the type 1.Y, 4.Y, 5.Y, 6.Y, 9.Y or 10.Y is received then these indicate that some form of a communication exception has occurred. Such errors are quite rare. If observed at all they are typically quite brief in duration signifying a very brief transient temporary communication issue. If these error codes starting with 1, 4, 5, 6 or 9 persist this indicates that there was some damage to the electronics inside the HiQ digital sensor and it must be replaced. Typically some ground loop or electrical/installation issue is responsible for this damage.

### **DATE STAMPING ERRORS**

If an error code of the type 7.Y or 8.Y is received then these indicate that some form of an error has occurred related to setting the field activation or the last date of field use. These errors are also extraordinarily rare and indicate either an improper configuration or else a corruption to that portion of the EEPROM (very unlikely). If the issue is simply an improper configuration this can be resolved at the ASTI factory. The sensor item number, serial number, invoice number and dispatch date will be requested for approval of any such return. All of this information can be obtained from the HiQ transmitter to which the digital sensor is connected by looking at the appropriate parameters (see transmitter manual).

### **GENERAL TROUBLESHOOTING TIPS**

- Ensure that all snap connections with the extension cables are secure and that none of the pins are damaged.
- Ensure that there is good integrity of PVC insulation on leads & cable jacket for both sensor and/or extension cables.
- Disconnect and reconnect the digital sensor via the snap connection. Allow ~5 to 10 seconds before reconnecting.
- Cycle the power to the transmitter and swap out the extension cable for a unit that is known to be working.
- Connect a genuine HiQ digital sensor known to be working to ensure 3TX-HiQ transmitter is functioning normally.



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