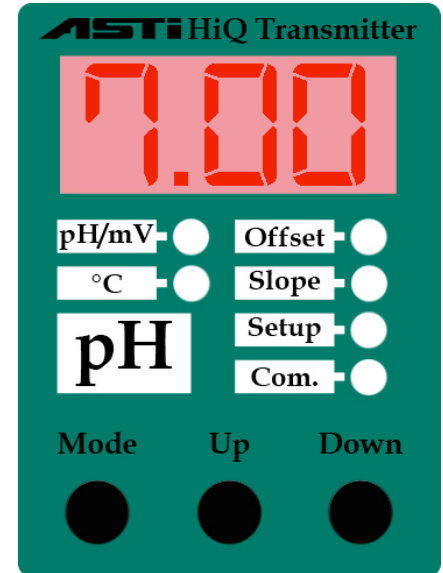


## *3TX-HiQ-pH Transmitter for Smart Digital pH & ORP Sensors*

- 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 cals reset to ASTI defaults	'Cur'= No Action, 'Rst/Cal'=Reset sensor cals	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 RS-485 MODBUS RTU output implemented as follows: 8-bit, even parity with 1 stop bit. A special order version is available with no parity. 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 P10 mode. All possible P10 configurations 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 the 3TX-pH transmitters. 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. MODbus scaling may differ from 0/4-20 mA analog scaling. Low & high scaling, number of steps & resolution is 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 is always temperature. When P10='DAT' the temperature range is 0-210°C with 1,000 steps sent as 1024-2024 yielding a resolution of 0.2°C with an uncertainty is ± 0.3°C. When P10='pHE' the temperature range is -40 to +210 °C with 2,500 steps sent as 0-2,500 yielding a resolution of 0.1°C with an uncertainty is ± 0.3°C. To interface the P10='pHE' style configuration with the ASTI Windows Datalogger Software for 3TX transmitters with MODBUS output the version must be 2.5 or higher.

The 3TX-HiQ-pH contains 2 values; pH/mV and temperature. Access is gained through function code 04 *Read\_Input\_Registers*.

### Read\_Input\_Registers

Function code	Start address	Number of values
04	1	1 or 2

Value 1 is pH/mV and value 2 is temperature. The measurements are always transmitted in sequence; If 2 values are chosen both pH/mV and temperature are transmitted. If the value for temperature is wanted, 2 values must be requested. When P10 is set to 'DAT' mode both values are rated 0-1000 corresponding to the range, but the temperature has an offset of 1024; i.e. 0-14pH is transmitted as 0-1000 and 0-210°C as 1024- 2024. The DAT is a compatibility mode that restricts the pH and temperature resolution and range that can be transmitted via MODBUS. To transmit all possible ranges for pH, ORP & temperature at the maximum resolution, set P10='pHE' mode. This mode sends the highest resolution possible for all values but will make the output incompatible with DAT field datalogger. Please see the tables below for details on scaling and resolution for all configurations.

The 3TX-HiQ-pH gives access to different diagnostic values via function code 08 *Diagnostics*, as shown in the following.

### Diagnostics

Function Code	Sub Code (HEX)	Description
08	00	Return Query Data
	0A	Clear counters and diagnostics register
	0B	Return Bus Message Count
	0C	Return Bus Com Error count
	0D	Return Exception Error count
	0E	Return Slave Message count
	0F	Return Slave No Response count
	12	Return Bus Character Overrun count



## 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 Panel; 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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