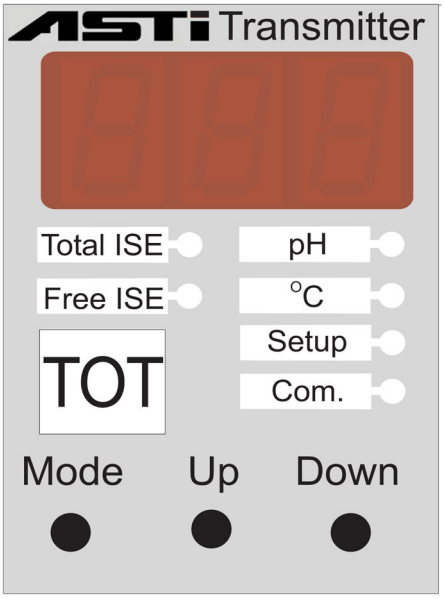
3TX–TOT-DT pH Compensation Module for Total ISE

- 3TX-TOT-DT module computes Total ISE using pH compensation algorithm using smart RS-485 MODBUS RTU HiQDT ISE sensor & pH sensor as inputs
- Total Ammonium ($NH_3 + NH_4^+$), Total Fluoride ($HF + F^-$) or Total Cyanide ($HCN + CN^-$) computed depending on type of ISE sensor which is connected
- Computed Total ISE value sent via isolated 4-20mA analog output as well as RS-485 MODBUS RTU digital communications for computed total ISE plus process readings, analytic data & calibrations from all connected sensors
- Simultaneously functions as MODBUS RTU master to smart HiQDT MODBUS RTU sensors connected to 3TX-RTU-D transmitters and MODBUS RTU slave to upstream PLC. ALL sensor registers can be made accessible from MODUS RTU slave port meaning completely transparent communications with sensor inputs
- Automatically detects type of ISE sensor connected and selects appropriate pH compensation algorithm to be used. Automatic ranging for ISE values from 0.01ppm up to 999,000ppm (999 kilo-ppm) and anywhere in between.
- Display mA output based upon computed Total ISE value and scaling for analog output. See display features for additional values which can be shown.



FEATURES

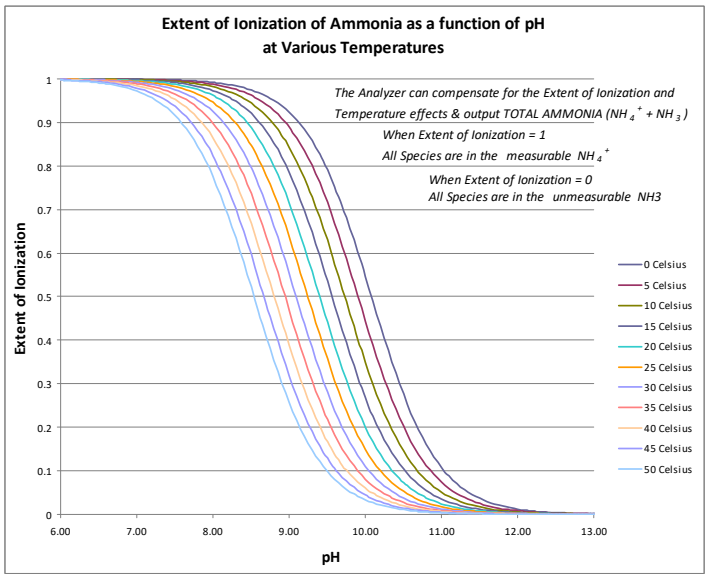
SMART UNIVERSAL TRANSMITTER:
3TX-TOT-DT pH compensation module computes the Total Ammonium ($NH_3 + NH_4^+$) or Total Fluoride ($HF + F^-$) or Total Cyanide ($HCN + CN^-$). The type of ISE sensor that is connected automatically determines the type of pH compensation curve used to compute the Total ISE value.

COMPLEMENTARY 3TX MODULES FOR 3TX-TOT-DT:
3TX-REL: Alarm & Relay controller with simple supervision, On/Off or Time Proportional Control (TPC) Modes

SMART DIGITAL MODBUS RTU SENSOR INPUT
3TX-RTU-D interfaces smart digital HiQDT MODBUS RTU sensors for low-noise operation. **Cable lengths up to 1,000 meters (3,280 feet) with all sensors terminated with NEMA 6P rated waterproof snap connectors.**

HIGHLY CONFIGURABLE ANALOG OUTPUT
3TX-TOT-DT provides scalable, proportional and reversible 4-20mA or 0-20mA analog current loop output for total ISE with linear scaling in ppm units. Selectable non-inverted or inverted polarity. Analog output is galvanically isolated from input using 3KV rated optocoupler.

PROGRAMMING
The module is programmed by 3 keys on the front panel. The 'Mode' toggles and the 'Up' or 'Down' scroll through parameters. The parameter is altered via the 'Mode' and the value is changed using the 'Up' or 'Down'. **Parameter P01 is a "lock" which must be set to 'Off' to change ANY parameter including setup options and scaling limits.**



The graph above shows the effects of pH and temperature on the extent of ionization for the weak base, ammonia. The dissolved ammonia gas is converted into the ionized ammonium ion, which is measured by the ISE sensor. The extent of ionization reveals the percent of the weak base which can be measured. When the extent of ionization is 1.00, then 100% is in the measurable form. When the extent of ionization is 0.00, then 0% is in the measurable form. The 3TX-TOT-DT module computes, displays & transmit what would be 100% of the weak acid or base activity, even if only a small fraction is actually in the measurable form.

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^2 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

RoHS COMPLIANT

Electrical

Power Supply:	24VDC ±10%
Typical Power Consumption:	60mA max
Input Ranges:	Per Sensor Type
Sensor Inputs for Total ISE:	Smart Digital HiQDT MODBUS RTU ISE & pH Sensors
Temp Sensor:	Integral Platinum TC Element
Temp Range:	-40 to +210°C ± 0.3°C
Analog Output:	0-20mA or 4-20mA, max. 500Ω
Output Hold:	Automatic if sensor is not connected

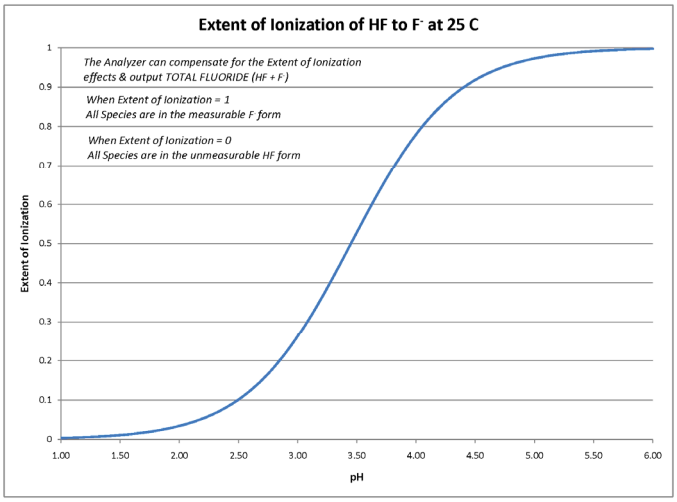
BENEFITS OF USING MATING SMART DIGITAL HiQDT RS-485 MODBUS RTU SENSORS

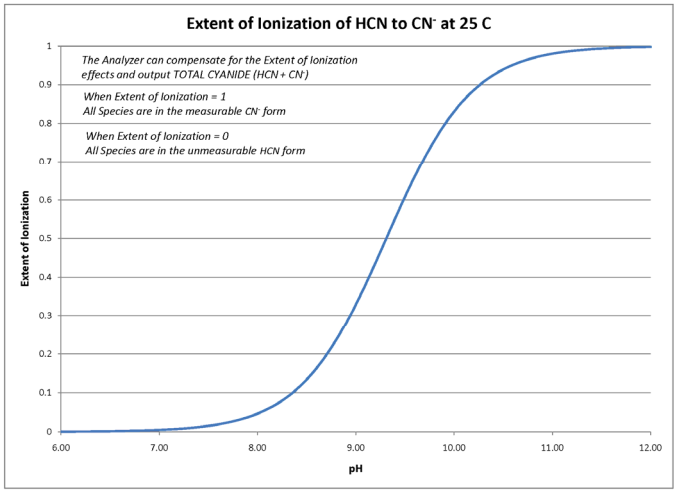
- **Integral RS-485 MODBUS RTU interfaces all-modern PLC controllers & data acquisition systems.**
- **Communicator provides easy management of field installations** without the cost of a mating transmitter. This is ideal for locations where a local display is not necessary or possible due to installation limitations.
- **Intelligent management of sensor calibrations and service life-cycle** for efficient commissioning & maintenance. All aspects of installation are completely portable from the shop to the field site location.
- **Days in use** value is stamped for calibrations that are performed. This allows for predictive scheduling of maintenance in the PLC to ensure the accurate measurement in the field based upon user defined criteria.
- **All digital sensors ensure** reliable operation even in noisy process environments unlike analog sensors.
- **No degradation in digital communications** with very long cable runs. **Max 1,000 meters (3,280 feet) for pH, ORP, ISE & DO sensors & Max 610 meters (2,000 feet) for conductivity sensors with 3TX-TOT-DT**
- Bridging connections & modifying installations easily without loss of signal quality with **NEMA 6P & IP67 rated quick disconnect waterproof and corrosion-resistant dual snap connector**. 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 very many HiQDT sensors outputs into one panel enclosure where very many remote field installations can all be conveniently all viewed at once.
- **Intelligent HiQDT handheld communicator software identifies type of sensor connected** & autoloads correct features. There exists no possibility of accidentally using the wrong set of options or settings.

SMART MODBUS RTU SENSORS FOR USE WITH 3TX-TOT-DT UNIVERSAL TRANSMITTER

- **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-RTU-D universal smart transmitter
- The very rugged low-profile **impact & break resistant parabolic pH glass element** optimized for use in **slurries & high viscosity applications** (X3XX series) is **ONLY** available for the smart digital type sensors
- The novel **extreme dehydration resistant** style reference technology that allows for **prolonged exposure to dry conditions** and **intermittent wet & dry use** is **ONLY** available for the smart digital type sensors
- **Entire line of proven Iotron™** inline, immersion, submersible, twist lock, sanitary, HOT-TAP retractable **ion selective (ISE) sensors** made by ASTI are **ALL available** in the smart digital HiQDT type configuration
- **Rugged Industrial AST-DO-UNIVERSAL Galvanic Dissolved Oxygen Sensors** for inline, immersion, submersible, twist lock, sanitary, HOT-TAP retractable installations are available in HiQDT configuration
- **Entire line of proven industrial** inline, immersion, submersible, twist lock, sanitary, HOT-TAP retractable **2-electrode contacting conductivity** are **ALL available** in the smart digital HiQDT type configuration
- **Waterproofing Option "A", "B", "C", "G", "H" or "IT" is recommended for any** HiQDT smart digital sensor with integral RS-485 MODBUS RTU digital output for immersion or fully submersible installations.

The graphs to the right show the impact of pH on the extent of ionization of various weak acids as a function of pH. Unlike the graph on the first page for the conversion of the weak base ammonia to ammonium ion as function of pH shown at various temperatures, all of the graphs to the right are shown at a single temperature for a simpler visualization of these effects at the common 25 degrees Celsius condition. As short explanation of the chemistry behind the pH compensation to compute total ISE that the 3TX-TOT-DT performs is below to understand the conditions under which this module should be used in conjunction with the 3TX-RTU-D transmitters for these measurement types.





The extent of ionization defines the percent of the species of interest for the weak base (typically ammonia) or the weak acid (typically HF, HCN) is converted into the form which the ion selective sensor can detect, which is the free ionized species. On the vertical axes this extent of ionization is 0.00 when none of the species is in the measurable form for the ion selective sensor. In such cases, it is not possible to use pH compensation since none of the species can be measured by the ISE sensor at all. When the extent of ionization is 1.00 then all of the weak base or weak acid is in the ionized form that can be detect by the ISE sensor and so not pH compensation is required because all NH_3 gas is in the NH_4^+ ion form, all HF gas is in the F^- ion form and all HCN gas is in the CN^- ion form. The portion in the measurable form at that given pH and temperature (the extent of ionization) is called the "Free ISE". The "Total ISE" computed by the 3TX-TOT-DT module makes it as though all 100% were in the measurable form. A simple example is given below:

Samples conditions are Temp: 25.0 °C, pH: 3.45

Extent of Ionization at this pH & Temp for the HF/F- system is 0.50

Free ISE: 35.0 ppm Fluoride (F-)
Computed Total ISE: 70.0 ppm Fluoride (F-)

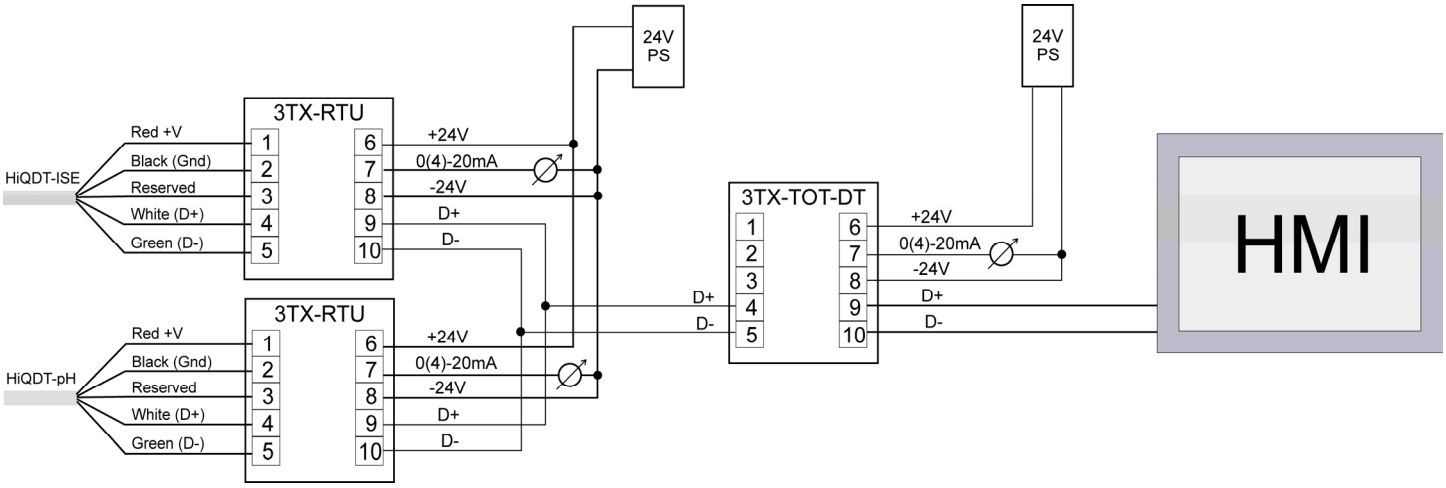
The 3TX-TOT module uses built-in algorithms to compute the extent of ionization for the system of interest (NH_3, HF, HCN) at the current pH and temperature. The Total ISE is found by simply taking the Free ISE and diving it by this computed extent of ionization. The resulting Total ISE shows what would be the ion activity detected if all of the species were in the measurable form.

For the 3TX-TOT-DT module the only things required for configuration are to define the node address of the connected ISE sensor on the 3TX-RTU-D transmitter on parameter P03 and the node address of the connected pH sensor on the 3TX-RTU-D transmitter on parameter P04. Naturally all devices must share the same baudrate as defined in parameter P02. All input measurements as well as the computed Total ISE value can be sent for further use in other data acquisition or control devices via the RS-485 MODBUS RTU digital output as documented in the following pages. In addition, the selectable 0-20mA or 4-20mA analog current loop can send the total ISE value linear in ppm units with either standard non-inverted or else inverted style output configurations. The wiring schematics on the following two pages detail all of the supported configurations including the simplest single total ISE setup, redundant dual total ISE setup as well as configurations where additional parameters such as ORP, conductivity or dissolved oxygen are also to be measured by other sensors in the same installation point or from other remote locations.

If the 3TX-TOT-DT module was purchased part of a complete 3TX field assembly, then the user parameters will have been preconfigured at the ASTI factory in the most suitable manner possible based upon the information provided for your system. As such, quite often very few of the parameters may need to be modified to begin using your 3TX-TOT-DT module.

Wiring for Total ISE Measurement System in Base Configuration

1 each 3TX-TOT-DT pH Compensation Module & 2 each 3TX-RTU-D Transmitters for Free ISE and pH Sensor Inputs



Node Address for 3TX-RTU-D Transmitters with Six Channel Touchscreen Controllers (Channels 4, 5 & 6 are not used in this configuration but can be added at a later time)

Channel Number	1	2	3
pH Sensor		P02=1 P21=41	
Ion Selective (ISE) Sensor	P02=5 P21=5		

Node Address for 3TX-TOT-DT Transmitters with Six Channel Touchscreen Controllers (Channels 4, 5 & 6 are not used in this configuration but can be added at a later time)

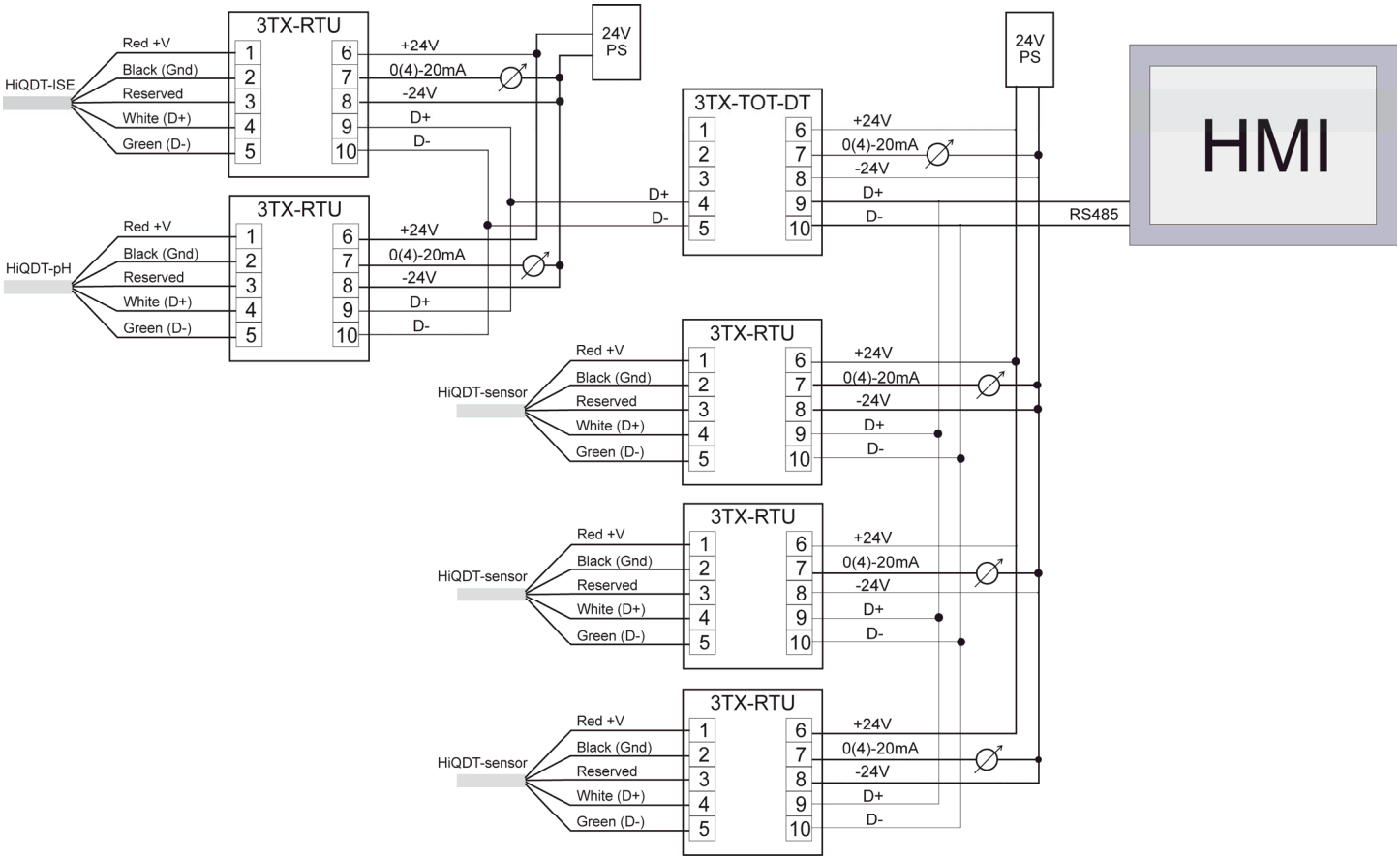
Channel Number	1	2	3
Total ISE pH Compensation Module			P03=5, P04=41 P21=88

!! Important Special Note !!

The node address for parameter P21 on each 3TX-RTU-D transmitters MUST be unique at all times in order to ensure proper function. If the P21 node address is the same for any two transmitters then normal communications with the toucshcreen controller will not be possible!

Wiring for Total ISE Measurement System in Augmented Configuration (Part 1 of 2)

1 each 3TX-TOT-DT pH Compensation Module & 2 each 3TX-RTU-D Transmitters for Free ISE and pH Sensor Inputs + Up to 3 each 3TX-RTU-D Transmitters for measurement of additional parameters and/or locations



Node Address for 3TX-RTU-D Transmitters with Six Channel Touchscreen Controllers (See Following Page for Details about configuring Channels 4, 5 & 6)

Channel Number	1	2	3
pH Sensor		P02=1 P21=41	
Ion Selective (ISE) Sensor	P02=5 P21=5		

Node Address for 3TX-TOT-DT Transmitters with Six Channel Touchscreen Controllers (See Following Page for Details about configuring Channels 4, 5 & 6)

Channel Number	1	2	3
Total ISE pH Compensation Module			P03=5, P04=41 P21=88

!! Important Special Note !!

The node address for parameter P21 on each 3TX-RTU-D transmitters MUST be unique at all times in order to ensure proper function. If the P21 node address is the same for any two transmitters then normal communications with the toucshcreen controller will not be possible!

Wiring for Total ISE Measurement System in Augmented Configuration (Part 2 of 2)

Node Address for 3TX-RTU-D Transmitters with Six Channel Touchscreen Controllers

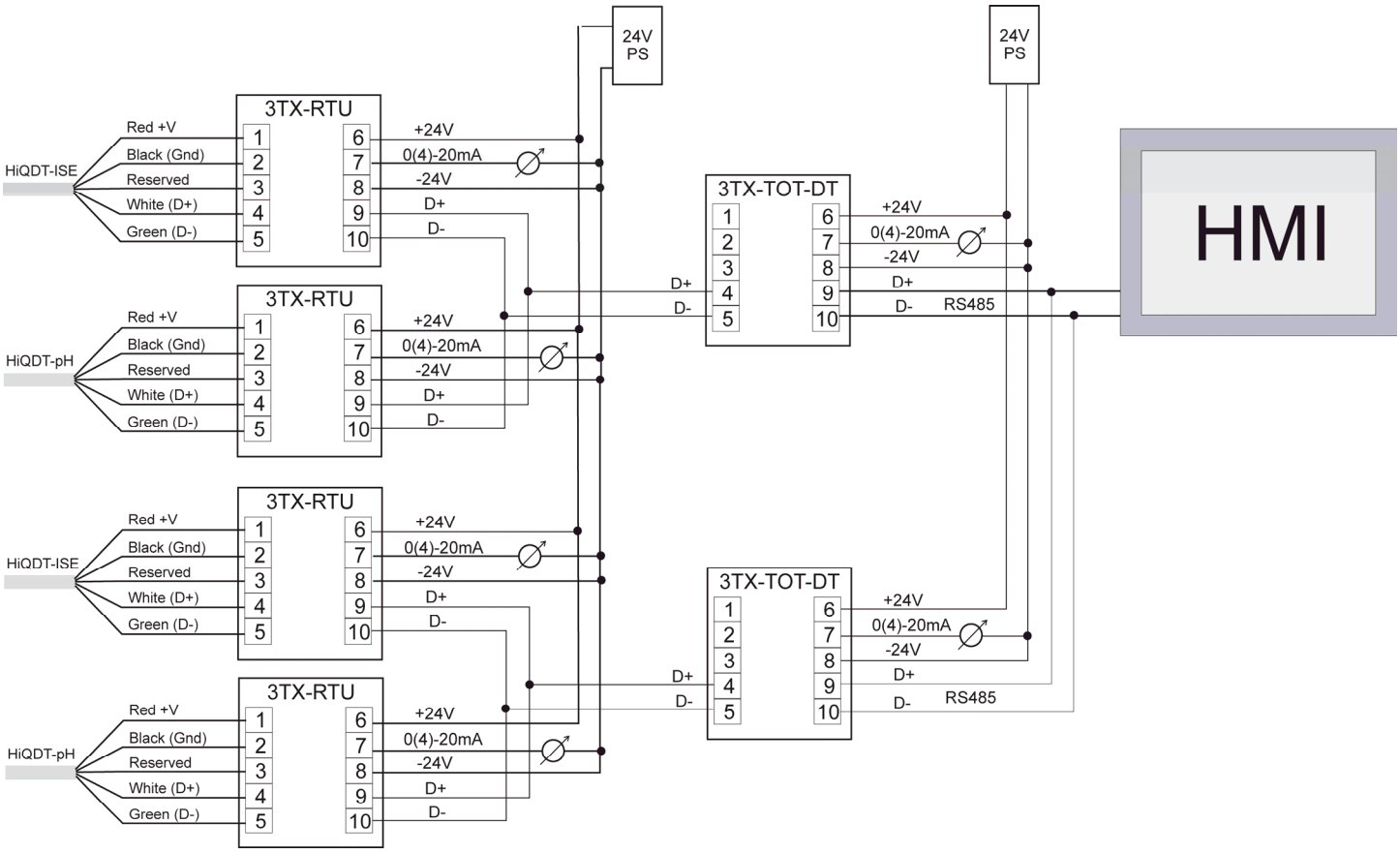
Channel Number	4	5	6
pH Sensor	P02=1 P21=121	P02=1 P21=161	P02=1 P21=201
Standard ORP Sensor	P02=2 P21=122	P02=2 P21=162	P02=2 P21=202
Wide Range ORP Sensor	P02=3 P21=123	P02=3 P21=163	P02=3 P21=203
Dissolved Oxygen Sensor **using ppm units**	P02=4 P10=ppm P21=124	P02=4 P10=ppm P21=164	P02=4 P10=ppm P21=204
Dissolved Oxygen Sensor **using % Saturation units**	P02=4 P10=%Sat P21=124	P02=4 P10=%Sat P21=164	P02=4 P10=%Sat P21=204
Ion Selective (ISE) Sensor	P02=5 P21=125	P02=5 P21=165	P02=5 P21=205
Standard/High Range Conductivity Sensor P13 is 200 or 2000 **using EC units (uS or mS)**	P02=6 P11=Con P21=126	P02=6 P11=Con P21=166	P02=6 P11=Con P21=206
Standard/High Range Conductivity Sensor P13 is 200 or 2000 **using PSU units**	P02=6 P11=PSU P21=126	P02=6 P11=PSU P21=166	P02=6 P11=PSU P21=206
Standard/High Range Conductivity Sensor P13 is 200 or 2000 **using TDS units**	P02=6 P11=tdS P21=126	P02=6 P11=tdS P21=166	P02=6 P11=tdS P21=206
Ultralow Range Conductivity Sensor P13 is 2 - **EC units (uS)**	P02=6 P11=Con P21=126	P02=6 P11=Con P21=166	P02=6 P11=Con P21=206
Ultralow Range Conductivity Sensor P13 is 2 - **MΩ units**	P02=6 P11=rES P21=126	P02=6 P11=rES P21=166	P02=6 P11=rES P21=206
Ultralow Range Conductivity Sensor P13 is 2 - **MΩ UPW units**	P02=6 P11=UP P21=126	P02=6 P11=UP P21=166	P02=6 P11=UP P21=206

!! Important Special Note !!

The node address for parameter P21 on each 3TX-RTU-D transmitters MUST be unique at all times in order to ensure proper function. If the P21 node address is the same for any two transmitters then normal communications with the toucshcreen controller will not be possible!

Wiring for Total ISE Measurement System for Two (2) Simultaneously Installations

1 each 3TX-TOT-DT pH Compensation Module & 2 each 3TX-RTU-D Transmitters for Free ISE and pH Sensor Inputs +
1 each 3TX-TOT-DT pH Compensation Module & 2 each 3TX-RTU-D Transmitters for Free ISE and pH Sensor Inputs



NOTE: The two total ISE installations measured in the configuration detailed in the wiring schematic above can be either redundant (two sets of ISE & pH sensors in the same tank or line) or from two separate installation points or locations as preferred.

Node Address for 3TX-RTU-D Transmitters with Six Channel Touchscreen Controllers

Channel Number	1	2	3	4	5	6
pH Sensor		P02=1 P21=41			P02=1 P21=161	
Ion Selective (ISE) Sensor	P02=5 P21=5			P02=5 P21=125		

Node Address for 3TX-TOT-DT Transmitters with Six Channel Touchscreen Controllers

Channel Number	1	2	3	4	5	6
Total ISE pH Compensation Module			P03=5, P04=41 P21=88			P03=125, P04=161 P21=208

!! Important Special Note !!
The node address for parameter P21 on each 3TX-RTU-D transmitters MUST be unique at all times in order to ensure proper function. If the P21 node address is the same for any two transmitters then normal communications with the toucshcreen controller will not be possible!

User Setup Parameters

No	Parameter	Description	Range	Default
P01	Lock	Software Lock	On / Off	On
P02	Master Baudrate	MODbus baudrate of ALL Connected HiQDT Sensors	9,600 / 19,200	Per Order
P03	Master ISE Address	Node Address of Connected HiQDT **ISE** RTU Sensor	Off, 1…247	Per Order
P04	Master ISE Address	Node Address of Connected HiQDT **pH** RTU Sensor	Off, 1…247	Per Order
P05	Analog Output Type	Toggle for Current Loop Type	4-20mA, 0-20mA	Per Order
P06	Analog Output Mode	Select Polarity of Analog Output	noninverted, inverted	Per Order
P07	0/4 mA Whole	Scale Low setpoint for output – Whole Percent	0% to 98%	Per Order
P08	0/4 mA Dec.	Scale Low setpoint for output – Decimal Point 0-97.XX	XX.00% - XX.99%	Per Order
P09	20 mA Set	Scale High setpoint for output – Whole Percent	2% to 100%	Per Order
P10	20 mA Set	Scale High setpoint for output – Decimal Point 2-99.XX	XX.00% - XX.99%	Per Order
P11	0/4mA Offset	Trim Low	±9.99% *	Per Factory Cal
P12	20mA Gain	Trim High	±9.99% *	Per Factory Cal
P13	Sampling Rate	Set sampling frequency in seconds	0.5, 1.0, 2.0 and 4.0	Per Order
P14	Display Sensor Type	8 = TOTAL ISE for 3TX-TOT-RTU Module	8	Fixed
P15	Formula Weight	Formula Weight of Measured Ion of ISE Sensor *NOTE: The appropriate pH compensation algorithm is automatically selected based upon ISE sensor type*	19.00 = Fluoride 18.04 = Ammonium 26.02 = Cyanide	Per ISE Sensor
P16	pH Compensation	nH3,HF,HCN,HS	Defined by ISE Sensor	Per ISE Sensor
P17	Slave Node Address	Node Address of Upstream TOT Master Device	Off, 1…247	Per Order
P18	Slave Baudrate	MODbus baudrate of Upstream TOT Master Device	9,600 / 19,200	Per Order
P19	Output Hold	Current State of Analog Output Hold Feature	Off, On	Off
P20	Write Lock	Write Permissions for Upstream TOT Master Device	Off, TOT, All	All
P21	Back to Default	Reset to Default	Def=Reset, Par=NoReset	Par
P22	Parity of Slave Node	Even, None	Even, None	Even

** Negative values will be shown as flashing.* *Shaded portions of chart above indicate display only parameters.*

SPECIAL MODBUS REGISTERS AVAILABLE ONLY ON 3TX-TOT-DT

Access to 3TX-TOT-DT modbus registers gained through MODBUS function code (03) READ HOLDING REGISTERS. Nine (9) values are available when requesting process values. Each of these registers corresponds to a user parameter on the 3TX-TOT-DT transmitter. If parameter P20 is set to "TOT" or "All" then it is also possible to write to these registers as well as read through MODBUS function code (16) preset multiple registers. Values can be called starting at any index and any number of values can be requested so long as it does not exceed the total number available from starting index of call. Values sent in succession from starting index of the call. If only one value is requested, then just the starting index is sent.

Name	Range	Engineered Values	Register	Parameter
Analog Output Hold Feature	0,1	0="Off", 1="On"	40401	P19
Analog Output Set for 0-20mA or 4-20mA	0,1	0=0-20mA, 1=4-20mA	40402	P05
Toggle non-inverted or inverted output	0,1	0= non.inv, 1=inverted	40403	P06
Low 0/4mA Setpoint for Analog Output	0..9,800	0.00% to 98.00%	40404	P07/P08
High 20mA Setpoint for Analog Output	200..10,000	2.00% to 100.00%	40405	P09/P10
Master ISE Address	1…247	1…247	40406	P03
Master pH Address	1…247	1…247	40407	P04
Modbus Slave Node Address	1..247	1..247	40408	P17
N/A	N/A	N/A	40409	N/A
Write Enable for 3TX-TOT-DT Module	0,1,2	0=Off, 1=TOT, 2=All	40450	P20

Note 1: Registers 40401 to 40409 correspond to Index 400 to 408, Register 40450 corresponds to Index 449.
Note 2: Register 40450 is read only.

IMPLEMENTATION APPROACH #1 – OBTAIN PROCESS VALUES ONLY (1)

Access to **READ** core process values is gained through MODBUS function code (04) READ INPUT REGISTERS. Eight (8) values are available when requesting process values. Values can be called starting at any index and any number of values can be requested so long as it does not exceed the total number available from the starting index of the call. Values are sent in succession from the starting index of the call. If only one value is requested, then just the starting index is sent.

#	Name	Range	Engineered Values	Register	Index
1	Computed pH Compensated Total ISE sent in pION units	0..18,000	-2.000 to +16.000	30001	0
2	Measured Free ISE sent in pION Units	0..18,000	-2.000 to +16.000	30002	1
3	Measured pH	0..18,000	-2.000 to +16.000	30003	2
4	Measurement °C (from ISE Sensor)	0..2,500	-40.0 to +210.0 °C	30004	3
5	pK at current temperature for Total ISE	0..18,000	-2.000 to +16.000	30005	4
6	Extent of Ionization	0..1,000	0.0 to 100.0 %	30006	5
7	Sensor Connection Status	0,1	0 = Not Connected, 1 = Connected	30007	6
8	mA Output from 3TX-TOT-DT Transmitter	0..2,000	0.00 to 20.00	30008	7

i.e. <node> <code> <index> <#values>

NOTE FOR HiQDT-ISE Ion Selective Sensors:
Please Appendix 0 in HiQDT MODBUS implementation guide for instructions on how to convert from the scientific pION units used by this sensor to the common ppm units. The analog output scaling setpoints are sent in % of full scale corresponding to pION units.

Display Features

- **For Sensor Type 8 TOTAL ISE** - the "TOTAL ISE" LED will be continuous illuminated unless otherwise indicated below
  - 0.00-9.99, 10.0-99.9, 100-999 ppm units displayed same as per 3TX-ISE transmitter
    - **kilo-ppm units displayed with LED flashing to signify kilo-ppm scale is in use same as per 3TX-ISE-kilo**
      - 1.00-9.99 (1,000-9,990 ppm), 10.0-99.9 (10,000-99,900 ppm) and 100-999 (100,000-999,000 ppm)
    - If the 'Down' button is pressed, then the pK of the pH compensation algorithm currently used is shown *
      - If 'Down' button is held for 3 to 5 seconds, then the percent (%) extent of ioniziation will be shown *
    - If the 'Up' button is pressed, then the mA for the total ISE pH compensated process value will be shown
      - If 'Up' button held for 3 to 5 seconds, pION value of TOTAL ISE pH compensated value is shown
- **For Sensor Type 1 pH** - the "pH" LED will be continuous illuminated unless otherwise indicated below
  - -2.00 to -0.01 displayed as 2.00 to 0.01 flashing
  - 0.00 to 9.99 displayed not flashing with two decimal points
  - 10.0 to 16.0 display with one decimal point
    - If the 'Down' button is pressed, then the temperature of connected sensor is shown *
      - If 'Down' button is held for 3 to 5 seconds, then the absolute mV will be shown *
- **For Sensor Type 5 Ion Selective (ISE)** - the "ISE" LED will be continuous illuminated unless otherwise indicated below
  - 0.00-9.99, 10.0-99.9, 100-999 ppm units displayed same as per 3TX-ISE transmitter
    - **kilo-ppm units displayed with LED flashing to signify kilo-ppm scale is in use same as per 3TX-ISE-kilo**
      - 1.00-9.99 (1,000-9,990 ppm), 10.0-99.9 (10,000-99,900 ppm) and 100-999 (100,000-999,000 ppm)
    - If the 'Down' button is pressed, then the temperature of connected sensor is shown *
      - If 'Down' button is held for 3 to 5 seconds, then the absolute mV will be shown *
    - If 'Up' button held is pressed then the pION value is shown with same scheme used display the pH
- Production data (yy.m) displayed by pressing 'Down' & 'Mode' simultaneously in main Total ISE LED display mode. The month will display as 1..9 and then A for October, B for November and C for December. i.e. October 2011 will display as "11.A".
- Revision of software is displayed by pressing the 'Up' 'Mode' simultaneously in main Total ISE LED display mode.

** Negative values will be shown as flashing.*

ORDERING INFO FOR 3TX-TOT-DT SMART TOTAL ISE 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 (**Wall Installations Only**)
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 (**Panel Bracket assy**)
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 (**Wall Installations Only**)
3TX-4M	3TX Transmitter(s) in IP65 Enclosure; Up to 4 Total Modules (Wall or Pipe Installations)
3TX-5MF	3TX Transmitter(s) in NEMA 4X CSA/UL Rated Enclosure; Up to 5 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**
-TOT-DT	Universal Total ISE Transmitter using Smart Digital HiQDT MODBUS RTU ISE & pH Sensors as inputs for computation Standard with isolated, scalable & reversible 0-20mA or 4-20mA analog current loop output & RS-485 MODBUS RTU TYPE: The default sensor type and all user configurable parameters can be customized to be any values of desired so long as this is done at time of order. Upon reset of transmitter default values requested at time of order will be restored.
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 Converter for operation from 5V Batteries or USB Power Supply
-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

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.*** *3TX transmitter measurement modules for analog sensors and the 3TX-RTU-D, 3TX-HiQ-pH & 3TX-TOT-DT transmitter modules for smart digital sensors can be mixed and matched into any enclosure without limitation. The female panel mount snap connector is only available for the 3TX-RTU-D & 3TX-HiQ-pH transmitters.*

* Enclosures standard with ½" MNPT cable glands for sensor inputs & transmitter outputs. Base enclosure cost includes this feature standard.

** Enclosures for use with 3TX-RTU-D 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 were 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 HiQDT digital sensors. The standard cable gland and snap connector inputs can be mixed and matched as desired. Analog 3TX transmitter can likewise be mixed and matched with digital 3TX-RTU-D style transmitter modules although the snap input option is only supported on the 3TX-RTU-D & 3TX-HiQ-pH transmitters. All seals for the transmitter outputs are always cable glands.

*** For 2" NPT pipe mounting additional adapter plate is required for 6MW, 6M, 7MF & 9MF enclosures. The 2M, 4M, 3MF & 5MF enclosures support pipe mounting without adapter plate while 2MW, 4MW, 6MW & 3MP enclosures are not supported for pipe mounting (not even with adapter plate).

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Measurement	TOTAL ISE	Setup Parameter	NOTE
Sensor Type	8	P14	Read Only
Default Node	88	P17	Adjustable from 01 to 247
Default Baudrate	19,200	P18	9,600 or 19,200
Default Output Type	4-20mA	P05	0-20mA or 4-20mA
Default Polarity	non inverted	P06	non-inverted or inverted
Default Low Whole	18	P07	See notes below for limits
Default Low Decimal	22	P08	See notes below for limits
Default Hi Whole	45	P09	See notes below for limits
Default Hi Decimal	99	P10	See notes below for limits

CHANGE VALUE BELOW TO MATCH
P15 FROM 3TX-TOT-DT TRANSMITTER AFTER ISE
SENSOR IS CONNECTED & NODE IS CONFIGURED

Integer Limits	Engineered pION Limits
0	-2.000
18,000	16.000

if P15 Value is: 19.00

THEN OUTPUT IS FOR TOTAL FLUORIDE

% of Full Range	Engineered pION Units	RTU Integer	ppm units
0.00%	-2.000	0	1900000
5.56%	-1.000	1000	190000
11.11%	0.000	2000	19000
16.67%	1.000	3000	1900
22.22%	2.000	4000	190
27.78%	3.000	5000	19
33.33%	4.000	6000	1.9
38.89%	5.000	7000	0.19
44.44%	6.000	8000	0.019
50.00%	7.000	9000	0.0019
55.56%	8.000	10000	0.00019
61.11%	9.000	11000	0.000019

45.99%	6.279	ppm Low Set	0.01000	P09/P10
18.22%	1.279	ppm High Set	1000.00000	P07/P08

% FULL RANGE COMPUTED FOR PPM VALUES ENTERED TO THE RIGHT

CHANGE ppm VALUES ABOVE TO DESIRED VALUES FOR LOW & HIGH SETPOINTS

45.99%	6.279	Default High Setpoint in pION (Low Setpoint in ppm)
18.22%	1.279	Default Low Setpoint in pION (High Setpoint in ppm)

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.
NOTE 2: 0 ppm not a valid number for low setpoint since there exists no corresponding pION value.
NOTE 3: The logic of the high & low setpoints is inverted because while they are set in pION units the analog output itself is linear in ppm units. That is to say that the "high setpoint" in pION units is really the "low setpoint" in ppm units. Conversely the "low setpoint" in PION units is then really the "high setpoint" in ppm units. Contact factory if there should be any questions or concerns.

Measurement	TOTAL ISE	Setup Parameter	NOTE
Sensor Type	8	P14	Read Only
Default Node	88	P17	Adjustable from 01 to 247
Default Baudrate	19,200	P18	9,600 or 19,200
Default Output Type	4-20mA	P05	0-20mA or 4-20mA
Default Polarity	non inverted	P06	non-inverted or inverted
Default Low Whole	18	P07	See notes below for limits
Default Low Decimal	9	P08	See notes below for limits
Default Hi Whole	45	P09	See notes below for limits
Default Hi Decimal	87	P10	See notes below for limits

CHANGE VALUE BELOW TO MATCH
P15 FROM 3TX-TOT-DT TRANSMITTER AFTER ISE SENSOR IS CONNECTED & NODE IS CONFIGURED

Integer Limits	Engineered pION Limits
0	-2.000
18,000	16.000

if P15 Value is: 18.04

THEN OUTPUT IS FOR TOTAL AMMONIUM

% of Full Range	Engineered pION Units	RTU Integer	ppm units
0.00%	-2.000	0	1804000
5.56%	-1.000	1000	180400
11.11%	0.000	2000	18040
16.67%	1.000	3000	1804
22.22%	2.000	4000	180.4
27.78%	3.000	5000	18.04
33.33%	4.000	6000	1.804
38.89%	5.000	7000	0.1804
44.44%	6.000	8000	0.01804
50.00%	7.000	9000	0.001804
55.56%	8.000	10000	0.0001804
61.11%	9.000	11000	0.00001804

45.87%	6.256	ppm Low Set	0.01000	P09/P10
18.09%	1.256	ppm High Set	1000.00000	P07/P08

% FULL RANGE COMPUTED FOR PPM VALUES ENTERED TO THE RIGHT

CHANGE ppm VALUES ABOVE TO DESIRED VALUES FOR LOW & HIGH SETPOINTS

45.87%	6.256	Default High Setpoint in pION (Low Setpoint in ppm)
18.09%	1.256	Default Low Setpoint in pION (High Setpoint in ppm)

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.
NOTE 2: 0 ppm not a valid number for low setpoint since there exists no corresponding pION value.
NOTE 3: The logic of the high & low setpoints is inverted because while they are set in pION units the analog output itself is linear in ppm units. That is to say that the "high setpoint" in pION units is really the "low setpoint" in ppm units. Conversely the "low setpoint" in PION units is then really the "high setpoint" in ppm units. Contact factory if there should be any questions or concerns.

Measurement	TOTAL ISE	Setup Parameter	NOTE
Sensor Type	8	P14	Read Only
Default Node	88	P17	Adjustable from 01 to 247
Default Baudrate	19,200	P18	9,600 or 19,200
Default Output Type	4-20mA	P05	0-20mA or 4-20mA
Default Polarity	non inverted	P06	non-inverted or inverted
Default Low Whole	18	P07	See notes below for limits
Default Low Decimal	97	P08	See notes below for limits
Default Hi Whole	46	P09	See notes below for limits
Default Hi Decimal	75	P10	See notes below for limits

CHANGE VALUE BELOW TO MATCH
P15 FROM 3TX-TOT-DT TRANSMITTER AFTER ISE SENSOR IS CONNECTED & NODE IS CONFIGURED

Integer Limits	Engineered pION Limits
0	-2.000
18,000	16.000

if P15 Value is: 26.02

THEN OUTPUT IS FOR TOTAL CYANIDE

% of Full Range	Engineered pION Units	RTU Integer	ppm units
0.00%	-2.000	0	2602000
5.56%	-1.000	1000	260200
11.11%	0.000	2000	26020
16.67%	1.000	3000	2602
22.22%	2.000	4000	260.2
27.78%	3.000	5000	26.02
33.33%	4.000	6000	2.602
38.89%	5.000	7000	0.2602
44.44%	6.000	8000	0.02602
50.00%	7.000	9000	0.002602
55.56%	8.000	10000	0.0002602
61.11%	9.000	11000	0.00002602

46.75%	6.415	ppm Low Set	0.01000	P09/P10
18.97%	1.415	ppm High Set	1000.00000	P07/P08

% FULL RANGE COMPUTED FOR PPM VALUES ENTERED TO THE RIGHT

CHANGE ppm VALUES ABOVE TO DESIRED VALUES FOR LOW & HIGH SETPOINTS

46.75%	6.415	Default High Setpoint in pION (Low Setpoint in ppm)
18.97%	1.415	Default Low Setpoint in pION (High Setpoint in ppm)

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.
NOTE 2: 0 ppm not a valid number for low setpoint since there exists no corresponding pION value.
NOTE 3: The logic of the high & low setpoints is inverted because while they are set in pION units the analog output itself is linear in ppm units. That is to say that the "high setpoint" in pION units is really the "low setpoint" in ppm units. Conversely the "low setpoint" in PION units is then really the "high setpoint" in ppm units. Contact factory if there should be any questions or concerns.