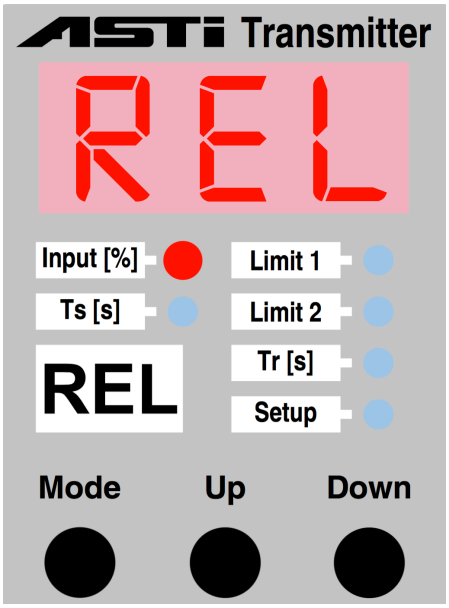
3TX–REL-DT Smart Alarm Relay & Controller Module

- 3TX-REL-DT smart alarm & controller module has 2 ea independent limits
- Tight integration with 3TX-RTU-D transmitter and all supporting mating smart digital HiQDT MODBUS RTU pH, ORP, Ion Selective (ISE), Dissolved Oxygen (D.O.) and Electrical Conductivity (EC) sensors
- Tight integration with 3TX-TOT-DT transmitter for supervision or control of total ammonium, total fluoride and total cyanide measurements
- Tight integration for display of process values in native engineered units: pH, ORP in mV, TOT and ISE in ppm, dissolved oxygen (DO) in ppm or % Saturation, Conductivity in µS/mS as well as computed units of salinity in PSU and total dissolved solids (TDS) in ppm. Ultralow range in µS units with computed units of MegaOhms (MΩ) or special ultrapure water (UPW) MΩ
- Simple On/Off as well as more sophisticated Time Proportional Control (TPC) and Proportional Frequency Control (PFC) a.k.a. Variable Pulse
- One 3TX-REL-DT controller required for each sensor to be interfaced.
- Max and/or min limits, dead bands & control modes configured separately for each of the two (2) independent Single-Pole, Single-Throw (SPST) relays
- Configurable and fully user adjustable start timer and reaction timers



FEATURES

Application

3TX-REL-DT modules are ideal for local supervision or control of parameters measured by smart digital RS-485 HiQDT MODBUS RTU sensors. Process values which are to be the basis of the supervision or control function are obtained by "snooping" on the node address of the smart sensor performing the measurement. Since the values are obtained by this "snooper" approach there must exist an isolated independent MODBUS RTU master to poll sensor performing the measurement so that the 3TX-REL-DT controller module can "snoop" the registers correspond to the process values which are the basis for the supervision or control. This master device can be the 3TX-RTU-D universal transmitter or else a different upstream master.

For the RTU touchscreen controllers there will be two master devices present in the installation; the 3TX-RTU-D transmitter is master to the smart digital sensor slave and the HMI which is master to the 3TX-RTU-D transmitter which then also simultaneously act as slave device. The 3TX-REL-DT module placed between the HMI and the 3TX-RTU-D transmitter and will "snoop" the values requested from the HMI master when the 3TX-RTU-D transmitter replies to those polling requests. Please refer to the wiring schematic later in this manual for further details on the correct configuration and setup of units.

Relay Output

The unit contains two relays; one for each limit. The relays are both connection relays, but the polarity may be inverted independently with the user parameters.

Limits

3TX-REL-DT has two limits. All settings for one limit may be altered independently of the other. Each limit may be set up as a Max or Min limit. All limits are entered in percent of full-scale units same as for the 3TX-RTU-D transmitters.

Start Timer (Ts)

The start timer is used to avoid alarms during startup. It is activated when input reaches 5%. If the timer is set to 0, supervision is performed without using the start timer.

Reaction Timers (Tr)

Each limit has a corresponding reaction timer used to avoid alarms if the limits are exceeded for short periods of time.

Control Modes

3TX-REL-DT relay controller can operate in four modes:
1) Simple supervision (alarm only requiring manual reset)
2) On/Off control with deadband (hysteresis)
3) Time Proportional Control (TPC) or
4) Proportional Frequency Control (PFC) a.k.a. Variable Pulse.

Reset

Can be accomplished via a modbus call to the appropriate register or else from the three-button 3-digit LED interface.

Power & Hold Features

Each dry contact relay has a 5A max load rating. Enabling the hold feature "disables" relays during calibration and maintenance procedures for inline sensors.

TECHNICAL SPECIFICATIONS

Mechanical

Housing:	Lexan UL94V-0 (Upper part) Noryl UL94V-0 (Lower part)
Mounting: IP	M36 for 35 mm DIN rail
Class:	Housing IP40. Connector IP20
Connector:	Max 16A. Max 2.5 mm²
	Max torque 0.6 Nm
Temp.:	Usage -15 to +50 °C (Storage -35 to +75 °C)
Weight:	200 grams (7.04 ounces)
Dimensions:	D 58 x W 36 x H 86 mm (2.3" X 1.4" X 3.4")

Electrical

Power Supply:	24VDC ±10%
Consumption:	60 mA max
Serial input:	RS-485 MODBUS RTU (non-isolated)
Relay Description:	2 each Single-Pole, Single-Throw (SPST)
Relay Rating:	250VAC / 5A (Dry Contact Type)
CE mark:	EN61326A

RoHS COMPLIANT

User Setup Parameters

No	Parameter	Description	Range	Default
P01	Lock	Software Lock	On / Off	On
P02	Snooper Node	Snooper Address to Acquire Sensor Data from network	Off, 1…247	See Default Chart
P03	Baudrate	MODbus baudrate	9,600 / 19,200	See Default Chart
P04	Lim1 Relay Type	Limit 1 (type: Lo / Hi)	Lo, Hi	See Default Chart
P05	Lim2 Relay Type	Limit 2 (type: Off, Lo, Hi)	Off, Lo, Hi	See Default Chart
P06	Relay 1 Whole	Setpoint Limit 1 – whole percent	0 .. 100	See Default Chart
P07	Relay 1 Decimal	Setpoint Limit 1 - decimal	.00 - .99	See Default Chart
P08	Relay 2 Whole	Setpoint Limit 2 – whole percent	0 .. 100	See Default Chart
P09	Relay 2 Decimal	Setpoint Limit 2 - decimal	.00 - .99	See Default Chart
P10	D.O. Units Selected	Select between ppm and % Saturation units for output	ppm or % Sat	See Default Chart
P11	Conductivity Units Selected for Output	If Conductivity Sensor Type = 6 or 9 (Standard/High) then choices are uS/cm, Salinity (PSU) or TDS If Conductivity Sensor Type = 7 (Ultralow) then choices are uS/cm, MΩ Standard or MΩ for UPW	For Sensor Type = 6 or 9 uS/cm, PSU or TDS For Sensor Type = 7 uS/cm, MΩ or UPW	See Default Chart
P12	Conductivity Sensor Cell Constant (K)	Indicates nominal cell constant for connected sensor: From K=0.01/cm to K=20.00/cm	0.01 to 20.0	Per EC Sensor
P13	Conductivity Sensor Range Mode	Scaling factor for EC sensor: "UL"=2; "Std"=200; "Hi"=2,000; "Std-tor"=1,500; "Hi-tor"=9,000	2..9,000	Per EC Sensor & Range Mode
P14	ISE Sensor Type	Formula weight (ISE sensor only)	6.94 .. 655.35	Per ISE Sensor
P15	Control Type Lim1	Control mode limit 1 (Off, 1=On/Off, 2=TPC, 3=PFC)	Off, 1, 2, 3*	See Default Chart
P16	Control Type Lim2	Control mode limit 2 (Off, 1=On/Off, 2=TPC, 3=PFC)	Off, 1, 2, 3*	See Default Chart
P17	Basic Time for Lim1	Basic time for limit 1 (If mode = TPC)	1…250s	See Default Chart
P18	Basic Time for Lim2	Basic time for limit 2 (If mode = TPC)	1…250s	See Default Chart
P19	Basic Pulse for Lim1	Basic pulse rate for limit 1 (If mode = PFC)	1…250 pulses/min	See Default Chart
P20	Basic Pulse for Lim2	Basic pulse rate for limit 2 (If mode = PFC)	1…250 pulses/min	See Default Chart
P21	Hysteresis for Lim1	Hysteresis / Proportional band for limit 1 (If P15=1/2)	1..50%^	See Default Chart
P22	Hysteresis for Lim2	Hysteresis / Proportional band for limit 2 (If P16=1/2)	1..50%^	See Default Chart
P23	Polarity for Relay1	Polarity for relay 1	n.inv, inv	See Default Chart
P24	Polarity for Relay2	Polarity for relay 2	n.inv, inv	See Default Chart
P25	Time before Lock	Minutes before P01 reset "On"	1..15	See Default Chart
P26	Slave Node Address	Slave Address to Communicate with 3TX-REL-DT	Off, 1..247	231
P27	Startup Timer	Start timer "Dead time" to accommodate for settling	0.0 – 999.9 seconds	See Default Chart
P28	Response Time Lim1	Tr 1 Response timer for limit 1	0.0 – 999.9 seconds	See Default Chart
P29	Response Time Lim2	Tr 2 Response timer for limit 2	0.0 – 999.9 seconds	See Default Chart
P30	Remote Access	Write permission for modbus communications	On / OFF	On
P31	Relay Hold	Holds last value when in this mode (relay states frozen)	On / OFF	OFF
P32	Back to default	Def = back to default, Par = keep values	Def, Par	Par

* Off means simple controller with limits and alarm relays – no control algorithm
^ Common parameter – means hysteresis if On/Off and proportional band if TPC / PFC. Range corresponds to 50% of selected range determined by sensor type. Shaded values are Read Only.

Par. No. 01 "lock" which must 'Off' to change ANY parameter.

*To access parameters, press 'Mode' key until 'Setup' LED is lit and displays 'P00'. Use 'Up' and 'Down' keys to scroll through the parameters. Select parameter with 'Mode' key, and change value using 'Up' or 'Down' keys. To exit, select '**Par. no. 00**' & press 'Mode' key*

PARAMETER DESCRIPTIONS

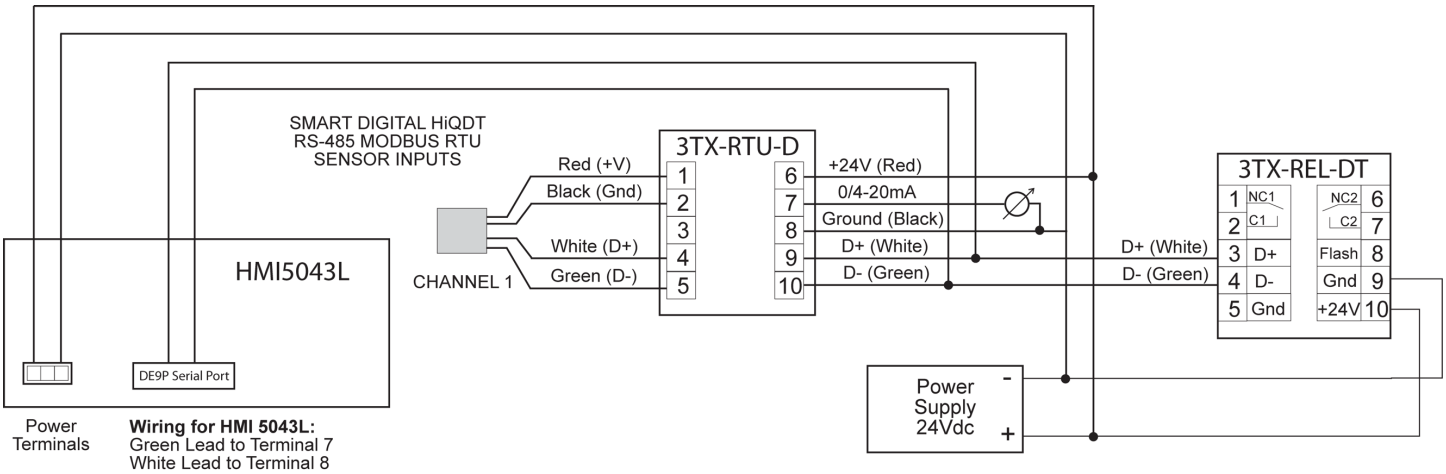
Par. no. 2 Node address of smart MODBUS RTU sensor to be used as the basis for the control for this relay module.
Par. no. 3 sets baudrate to be used. Choices are 9,600 or 19,200.
Par. no. 4 Type of limit 1: Min as "Lo" or Max as "Hi"
Par. no. 5 Type of limit 2: Off, Min as "Lo" or Max as "Hi"
Par. no. 6, 7, 8 & 9 defines low & high setpoints. Appendix provides percentages corresponding with engineered units for various sensors. Min scaling between low/high setpoints 2% full range. Excel worksheet to compute % setpoints available.
Par. no. 10 selects ppm or % saturations units to be used as basis for output & main LED display for connected D.O. sensor.
Par. no. 11 selects measured conductivity units or computed PSU, TDS or MΩ units as basis for control main LED display.
Par. no. 12 displays cell constant of EC sensor (0.01 to 20.0)
Par. no. 13 displays range mode of EC sensor (UL, Std or High)
Par. no. 14 Display formula weight of the measured ion for ISE Sensor. Anion selective sensors have the value shown flashing.
Par. no. 15 & 16 Off means simple supervision with alarm relays set to limits only. If 1, then On/Off Control is enabled. If 2, then time proportional control (TPC) is enabled. If 3, then proportional frequency control (PFC) is enabled (a.k.a. variable pulse control).
Par. no. 17 Sets basic time for limit 1 when in TPC mode (P11=2)
Par. no. 18 Sets basic time for limit 2 when in TPC mode (P12=2)
Par. no. 19 Sets basic pulse rate for limit 1 in PFC mode (P11=3)
Par. no. 20 Sets basic pulse rate for limit 2 in PFC mode (P12=3)
Par. no. 21 Set Limit 1 dead bands - In On/Off mode (P11=1) this is hysteresis - In TPC/PFC mode (P11=2/3) this is proportional
Par. no. 22 Set Limit 2 dead bands - In On/Off mode (P12=1) this is hysteresis - In TPC/PFC mode (P12=2/3) this is proportional
Par. no. 23 Polarity of relay 1: Non inverted/ Inverted ***
Par. no. 24 Polarity of relay 2: Non inverted/ Inverted ***
Par. no. 25 Number of minutes before P01 software is reactivated
Par. no. 26 Node address for communications with 3TX-REL-DT as slave device. Defaults for RTU style touchscreen controllers exist whereby the node address is hard coded for each channel as detailed in list below. Channel 1 – Node 231, Channel 2 – Node 232, Channel 3 – Node 233, Channel 4 – Node 234, Channel 5 – Node 235, Channel 6 – Node 236 For all other configurations the node address of the 3TX-REL-DT can be defined without any special restrictions as may be desired.
Par. no. 27 "Dead time" at start up to accommodate for sensor settling
Par. no. 28 & 29 Response timer for limit 1 & 2. The action of the relay will be delayed until this response timer is fulfilled. The reaction timer can be used to avoid needless relay changes in case of brief temporary excursions.
Par. no. 30 Controls whether values can be changed from connected MODBUS RTU master on slave node address port as defined in P26. If "On" values can be written via modbus & if "Off" all values are read only.
Par. no. 31 Hold feature should be enabled before performing any type of in-situ calibration or removing the sensor which serves as the basis for control from service. **All relay states will be frozen in their states at the time that hold feature is enabled. When P31 is active the last value is displayed flashing with "HLd" on the main LED mode.**

Besides the parameter list the user also has the possibility of setting the start timer and two response timers.

Parameter	Description	Range	Note
Start timer	"Dead time" at start up to accommodate for sensor settling time	0.0 – 999.9 seconds	Mirrored to Parameter P27
Tr 1	Response timer for limit 1	0.0 – 999.9 seconds	Mirrored to Parameter P28
Tr 2	Response timer for limit 2	0.0 – 999.9 seconds	Mirrored to Parameter P29
Setpoint 1	Setpoint for limit 1 is handled in parameters P06+P07 in % units	Per Sensor Type	Display Only in engineered units
Setpoint 2	Setpoint for limit 2 is handled in parameters P08+P09 in % units	Per Sensor Type	Display Only in engineered units

Note: The Start timer as well as the Response Timer for Limit 1 and 2 can all be changed from the LED interface whereas Setpoint 1 and 2 are display only in the LED mode.

TYPICAL WIRING SCHEMATIC



NOTE: Wiring scheme shown above is valid for the simplest case of a single sensor with single 3TX-RTU-D transmitter and a single 3TX-REL-DT relay controller module present. Contact the factory for assistance with the wiring for your installation with alternate number of sensors and transmitters present. For RTU style touchscreen controllers supplied complete with integral 3TX-REL-DT alarm and relay controller module all connections are pre-wired to work out of the box without modification.

Modbus Interface Input Registers

The following section describes the read protocols for the read input registers on the 3TX-REL-DT controller. The baud rate for communications is defined in parameter P03 and the node address in parameter P26. The snooper protocol used to obtain the values is described in a separate chapter and is defined by parameter P02. Note that the baudrate defined in parameter P03 must be the same baudrate used for the 3TX-REL-DT as well as the snooper node.

All input registers present even including those that do not to serve as the basis of control. The values will be the most recent values received through the snooper function. Values retrieved through Modbus call Read_Input_Register (04). **The values #6 & #7 on 3TX-REL-DT (registers 30007 & 30008) and differ from the standard HiQDT protocol and differ from what is provided from the 3TX-RTU-D transmitter. The register 30007 defines whether all registers have been obtained necessary to ensure a valid process value can be computed to serve as the basis for control. This is then particularly important for the ISE and conductivity sensor types as certain read holding registers must be obtained to properly compute and display the process values which are to be used as the basis for the alarm or control functions.**

#	Name	Range	Register
0	pH	0..18,000	30001
0	ORP mV (std.)	0..20,000	30001
0	ORP mV (wide)	0..20,000	30001
0	DO ppm	0..15,000	30001
0	ISE pIon	0..18,000	30001
0	Con	0..50,000	30001
1	Temperature (oC)	0..2,500	30002
2	mV raw (pH, ORP, ISE)	5,000..45,000	30003
2	mV raw (DO)	0..25,000	30003
2	Con raw	0..50,000	30003
3	Temperature ra w (oC)	0..2,500	30004
4	DO %, with salinity	0..15,000	30005
4	Con PSU (std./high)	0..50,000	30005
4	Con Resistivity (Ultra low)	0..50,000	30005
5	DO %, without salinity	0..15,000	30006
5	Con TDS (std./high)	0..50,000	30006
5	Con Resistivity (UPW)	0..50,000	30006
6	Sensor parameters complete 0 = No (not complete), 1 = Yes (Complete)	0, 1	30007
7	Hold status: 0 = off, 1 = on	0..1	30008

Modbus Interface Hold & Reset Alarm Features

Resetting the alarms is possible via the Modbus or else from the 3 push button 3-digit LED interface. Resetting only needs to be done if control mode is "OFF" meaning that P15 is 0 for limit 1 and P16 is 0 for limit 2. For other control modes the relay will be controlled entirely from the process value and no manual resets are possible.

#	Name	Register	Value
400	Hold (Do not use snooper values)[1]	40401	0, 1
401	Alarm/Relay status for limit 1 (0 written to reset alarm)	40402	0, 1[2]
402	Alarm/Relay status for limit 2 (0 written to reset alarm)	40403	0, 1[2]

1) If on -> measurements are ignored. Used when sensor values are not reliable (i.e. undergoing calibration,…etc)
2) Only 0 can be written. A 1 will be ignored and causes an exception 03.

Resetting via Local Interface

An alarm can be reset by holding down either the "Up" or "Down" key in each "Limit 1" or "Limit 2" LED mode. It makes no difference whether the alarm is low or high. Holding either the "Up" or "Down" key in the Limit 1 or Limit 2 LED mode will reset alarm mode. This approach is possible since the setpoints in this mode are read only and the arrow keys have no impact on the setpoint values. The setpoints must be made in parameters P06/P07 and P08/P09 as desired.

Modbus Interface Holding Registers

The following section describes the read and write protocols for the read holding registers for 3TX-REL-DT controller. Baud rate for communications is defined in parameter P03 and node address in parameter P26. Parameters are acquired through the Modbus call Read_Holding_Registers (03) and modified (written) with Write_Multiple_Registers (16).

#	Name	Register	Engineered Values	Parameter
0	Address (Snooper)	40001	Off, 1…247	P02
1	Limit 1 (type: Lo / Hi)	40002	1, 2	P04
2	Limit 2 (type: Off, Lo, Hi)	40003	0, 1, 2	P05
3	Setpoint Limit 1 - Sent as 0 to 10,000	40004	0.00-100.00%	P06/P07
4	Setpoint Limit 2 - Sent as 0 to 10,000	40005	0.00-100.00%	P08/P09
5	D.O. Units Selected (DO sensor only)	40006	0=ppm, 1=% Sat	P10
6	Conductivity units selected (Std/High Con sensor only)	40007	0=EC, 1=PSU, 2=TDS	P11
7	Conductivity units selected (Ultralow Con sensor only)	40007	0=EC, 1= MΩ, 2= MΩ UPW	P11
7	Control mode lim1 (0=Off, 1=On/Off, 2=TPC, 3=PFC)	40008	0, 1, 2, 3	P15
8	Control mode lim2 (0=Off, 1=On/Off, 2=TPC, 3=PFC)	40009	0, 1, 2, 3	P16
9	Basic time for limit 1 (If mode = TPC)	40010	1…250 seconds	P17
10	Basic time for limit 2 (If mode = TPC)	40011	1…250 seconds	P18
11	Basic pulse rate for limit 1 (If mode = PFC)	40012	1..250 pulse/min	P19
12	Basic pulse rate for limit 2 (If mode = PFC)	40013	1..250 pulse/min	P20
13	Hysteresis / Proportional band lim1 (If applicable)	40014	1…50%	P21
14	Hysteresis / Proportional band lim2 (If applicable)	40015	1…50%	P22
15	Polarity for relay 1	40016	0=n.inverted, 1=inverted	P23
16	Polarity for relay 2	40017	0=n.inverted, 1=inverted	P24
17	Minutes before P01 reset to "On"	40018	1..15	P25
18	Address (slave – 3TX-REL-DT)	40019	1…247	P26
19	Start timer "Dead time" at start up to accommodate for sensor settling time	40020	0.0 – 999.9 seconds Sent as 0 to 9,999	P27
20	Tr 1 Response timer for limit 1	40021	0.0 – 999.9 seconds Sent as 0 to 9,999	P28
21	Tr 2 Response timer for limit 2	40022	0.0 – 999.9 seconds Sent as 0 to 9,999	P29
22	EC Sensors Only – Nominal Cell Constant for sensor From K=0.01/cm to K=20.00/cm	40023	Sent as 1 to 2,000	P12
23	EC Sensors Only – Scaling factor for EC sensor: "UL"=2; "Std"=200; "Hi"=2,000; "Std-tor"=1,500; "Hi-tor"=9,000	40024	Sent as 2 to 9,000	P13
24	ISE Sensors Only - Formula weight	40025	6.94…655.35	P14

Display features

The parameters Ts, Setpoints and response timers can be adjusted from the LED modes just like the analog style 3TX-REL. The only LED mode for displaying settings is the main display mode (Input [%]).

LED mode	Key	Display value
Input [%]	Up	Sensor Type – For DO and EC sensors units selected are also indicated
	Up + Mode	SW revision
	Down	Temperature value of connected sensor (if register required for this data is polled)
	Down + Mode	Fabrication date

When Relay Hold is active (P31="On") the last value is displayed flashing with "HLd" on the main LED mode.

Modbus Snooper Function

The 3TX-REL-DT will in addition to normal slave behavior on address as defined in parameter P26 also "reads" on the address defined by parameter P02. This functionality only reads and stores the values. The 3TX-REL-DT is slave on the network and hence cannot request values form the P02 address. Therefore correct (live) values depend on the master requesting the values from the sensor. When a parameter is acquired, it is stored in EEPROM. The EEPROM value is read upon power up and used until a live value is received.

To ensure proper function of controller the following registers MUST be polled on the smart digital sensor at the node address as defined in parameter P02 by the MODBUS RTU master on the network (see details below):

pH, ORP, Wide ORP
Register(s) Required 30001
Register(s) Recommend 30002, 30003, 30004

Dissolved Oxygen (D.O.)
Register(s) Required 30001, 30005, 30006
Register(s) Recommend 30002, 30003, 30004

Ion Selective (ISE)
Register(s) Required 30001, 40020
Register(s) Recommend 30002, 30003, 30004

Electrical Conductivity (EC)
Register(s) Required 30001, 30005, 30006, 40019, 40020
Register(s) Recommend 30002, 30003, 30004

3TX-TOT-DT
Register(s) Required 30001, 40020
Register(s) Recommend 30002, 30003, 30004, 30005, 30006

Node Address Scheme when using with Touchscreen HiQDT PLC Controller

When 3TX-REL-DT Alarm Relay Controller is used with Touchscreen HiQDT PLC Controller then the **P02 snooper node address** MUST be set as defined in the table below.

Snooper Channel Number	1	2	3	4	5	6
pH sensor	1	41	81	121	161	201
Standard ORP sensor	2	42	82	122	162	202
Wide Range ORP Sensor	3	43	83	123	163	203
Dissolved Oxygen Sensor	4	44	84	124	164	204
Ion Selective (ISE) Sensor	5	45	85	125	165	205
Conductivity (EC) Sensor	6	46	86	126	166	206

COMMISSIONING AND SETUP:
ONLY the HiQDT Windows software or Handheld Communicator (HHC) can change the node address of the HiQDT smart digital RS-485 MODBUS RTU sensors (see respective manuals for details).

When 3TX-REL-DT Alarm Relay Controller is used with Touchscreen HiQDT PLC Controller then the **P26 slave node address** is defined by the channel number and MUST be set as defined in the table below.

Relay Channel Number	1	2	3	4	5	6
P26 Slave Node Address	231	232	233	234	235	236

NOTE: If 3TX-REL-DT relay module option is requested at time of order and channel configuration is predefined then then all relevant node addresses can be preset at factory such that touchscreen controller will work immediately out of the box.

Control Functions & Modes

On/Off control
When measurement crosses the setpoint, the relay will open and not close again until measurement exceeds the hysteresis.

Hysteresis Band
A hysteresis band (a.k.a. dead band) always lies above a Min & below a Max limit.

Proportional Band
Range where variable control is performed. A proportion band lies above a minimum and below a maximum limit.

Proportional Frequency Control (PFC a.k.a. Variable Pulse)
If the measurement lies outside the proportional band the relay will pulsate with the basic frequency. Inside the proportional band the frequency is changed linearly towards zero as the measurement approaches the setpoint.

Basic Frequency
Basic frequencies for Limit 1 & 2 may be set from 1 to 250 pulse per minute. This is valid in the PFC control mode only.

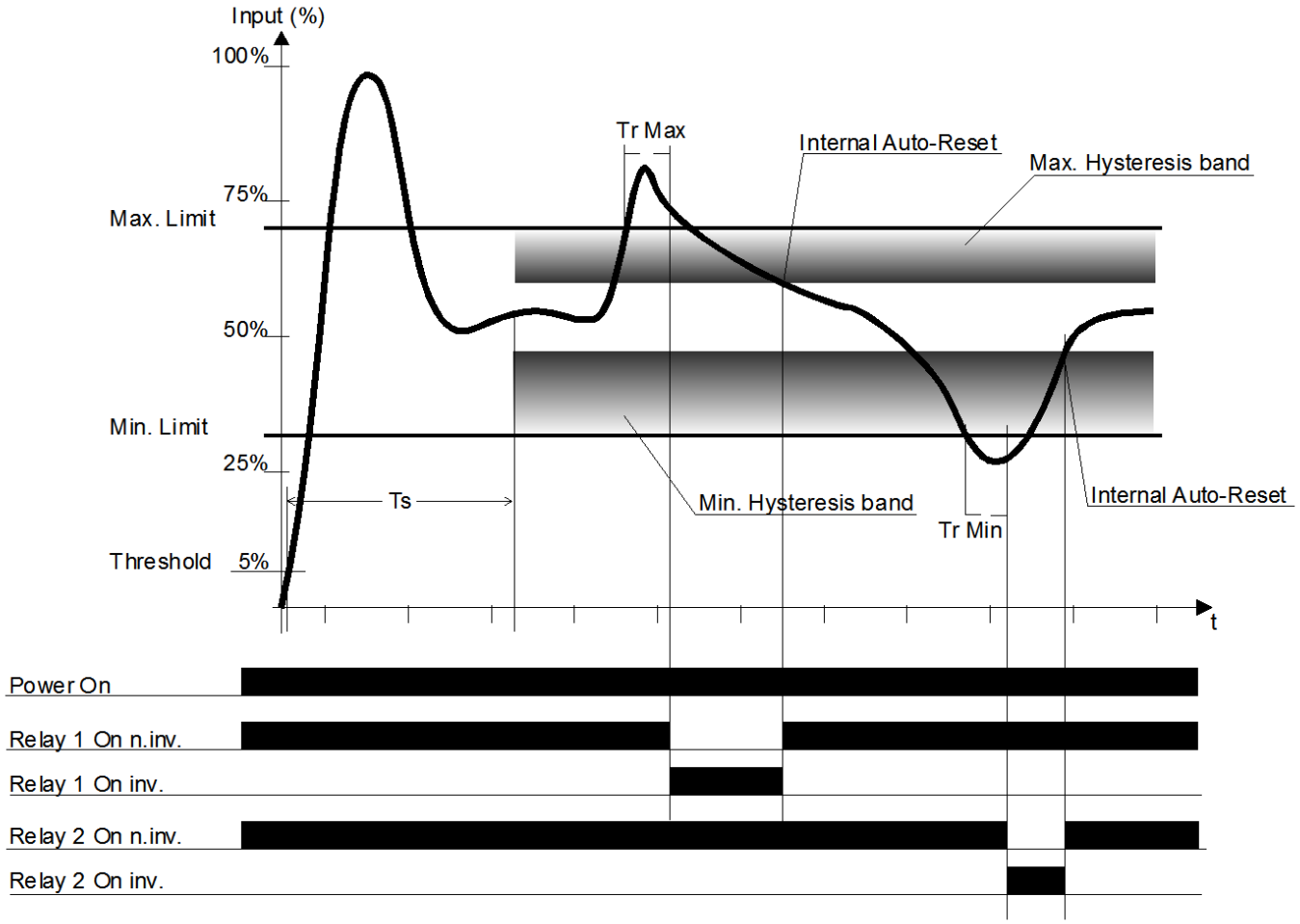
Time Proportional Control (TPC)
The time is constant and equal to the basic time. Instead, the duty cycle is changed according to the same principle as for PFC control. If the measurement lies outside the proportional band the relay is closed permanently and open permanently if the limit is exceeded.

Basic Time
Basic time for Limit 1 & 2 may be set from 1 to 250 seconds. This is valid in the TPC control mode only.

Control examples
On/Off control may be used for alarms and simple control of pumps. Proportional frequency control is primarily designed for the control of dosing pumps. Proportional time control may be used for control where more fine approach is required than simple on/off control offers.

Examples are provided for the use of time proportional control (TPC) and On/Off control for the pH parameter. These are just illustrations of available features in the controller module. Before implementation well experienced control personnel should be consulted and advised prior to any actual field commissioning.

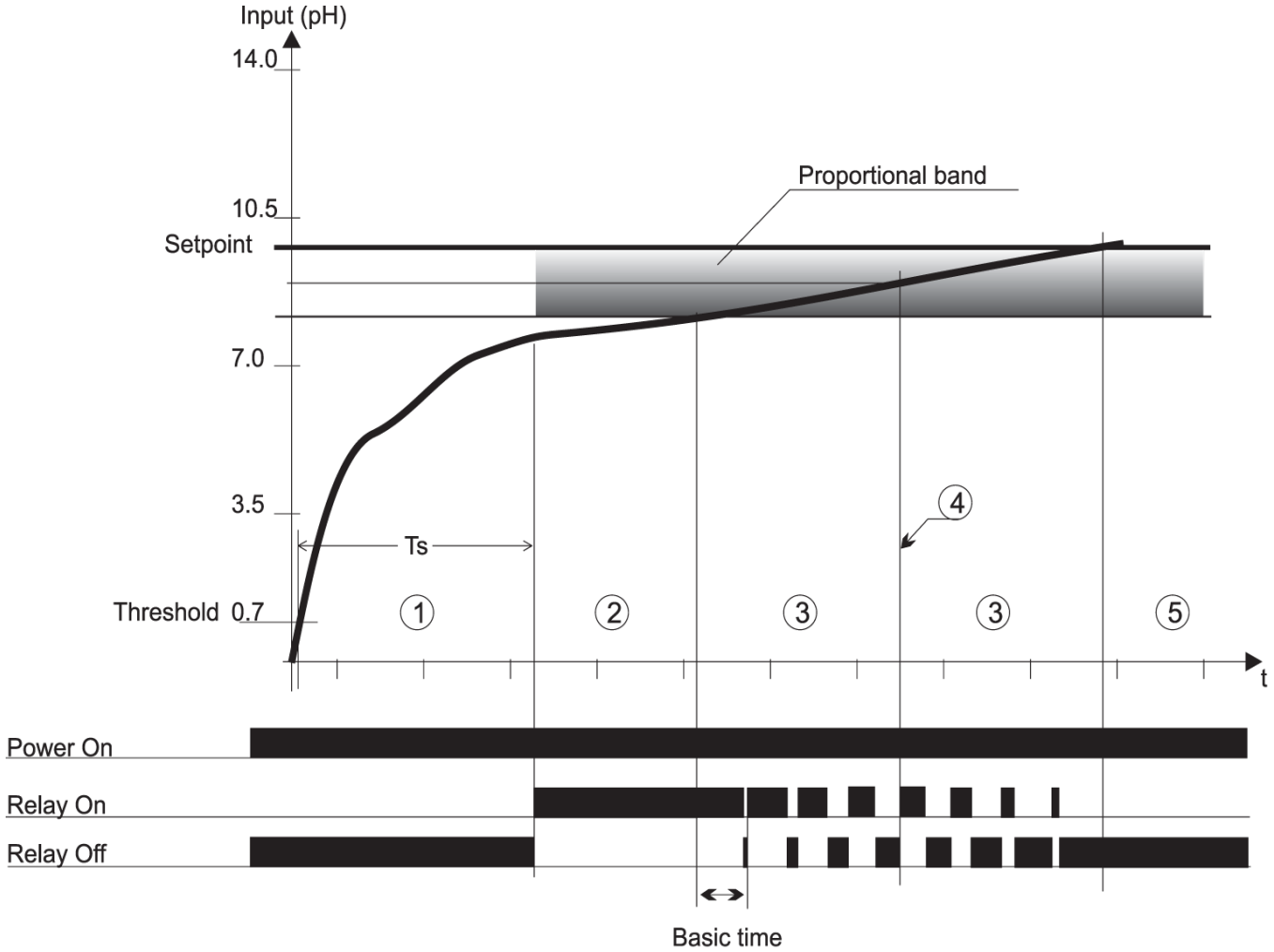
Example of On/Off Control Scheme



On/Off control mode is enabled when P15/P16 = 1; Hysteresis dead band is set with P21/P22

Example of Time Proportional Control (TPC) Scheme

Figure below shows principle of how TPC algorithm works. Curve depicts a process where a certain pH value (setpoint) is required. This example is taken from conditioning of heating water from a district heating plant, where the required pH value lies on 9.8 pH.



TPC control mode is enabled when P15/P16 = 2; The proportional band is set with P21/P22

Limit: Hi (Max limit) or Lo (Min limit); Here a max limit is needed.
Control mode: TPC
Setpoint: Requested pH value; Here 9.8pH
Proportional band: Band where the actual regulation is performed; Here 1 pH unit
Basic time: "Cycle time" for TPC algorithm; In figure shown on bottom left of this page, this is the time for the relay on + time for relay off
Start timer: Startup time for the sensor to settle

When the measured value crosses 5% of the measuring range (here corresponding to 0.7pH) the startup timer is activated to avoid false readings during settling time of the sensor. This time should be selected large enough to give the sensor time to settle, but not much longer than this, since the supervision and control will be disabled in this period. The relay is off in this condition (see period 1 on figure).

After expiration of the startup timer the 3TX-REL-DT starts to control. In the example, the measured value lies below the setpoint minus the proportional band (Period 2) and the relay will be continuously on to use maximum conditioning fluid.

When the measured value exceeds the setpoint minus the proportional band the values is said to lie within the proportional band (Period 3) and the on-time of the relay is regulated proportional to the distance up to the setpoint. This is illustrated with the two "bars" below the curve, where it is shown that the on-time drops as the value comes closer to the setpoint. At the point (4) the value is exactly in the middle of the proportional band where the on-time and off-time of the relay are equal (The relay is on half the time).

Finally, when the setpoint is reached the relay is kept off and will not be set on again until the measured value drops below the setpoint. This is illustrated with period (5)

Defaults for 3TX-REL-DT by Sensor Type

Find below the default values for each parameter based upon the sensor type which is connected. The values can be modified from the modbus interface or the local interface as desired. **In order to have the default values differ from those shown below such special configurations must be requested to the factory at time of order.**

Parameter	#	pH	ORP	Wide	DO ppm	DO %	ISE	uS/mS uS	Con PSU MΩ	Con TDS MΩ UP	TOT
		1	2	3	4	5	6	7	8	9	10
Snooper Node	2	1	2	3	4	4	5	6	6	6	8
Baudrate	3	19200	19200	19200	19200	19200	19200	19200	19200	19200	19200
Limit 1 type	4	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Lo
Limit 2 type	5	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi
Setpoint1 whole	6	11	0	0	0	0	22	0	0	0	22
Setpoint1 decimal	7	11	0	0	0	0	22	0	0	0	22
Setpoint2 whole	8	88	100	100	100	100	44	100	100	100	44
Setpoint2 decimal	9	89	0	0	0	0	44	0	0	0	44
DO units	10	0	0	0	0	1	0	0	0	0	0
Cond units	11	0	0	0	0	0	0	0	1	2	0
Control mode 1	15	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Control mode 2	16	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Base time 1	17	10	10	10	10	10	10	10	10	10	10
Base time 2	18	10	10	10	10	10	10	10	10	10	10
Base pulse rate 1	19	60	60	60	60	60	60	60	60	60	60
Base pulse rate 2	20	60	60	60	60	60	60	60	60	60	60
Hysteresis 1	21	14	100	100	40	40	100	50	50	50	100
Hysteresis 2	22	14	100	100	40	40	100	50	50	50	100
Relay polarity 1	23	inv	inv	inv	inv	inv	inv	inv	inv	inv	inv
Relay polarity 2	24	inv	inv	inv	inv	inv	inv	inv	inv	inv	inv
Softlock timeout	25	60	60	60	60	60	60	60	60	60	60
Slave Node	26	231	231	231	231	231	231	231	231	231	231
Start time	27	10	10	10	10	10	10	10	10	10	10
Response time 1	28	20	20	20	20	20	20	20	20	20	20
Response time 2	29	20	20	20	20	20	20	20	20	20	20

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Measurement	**pH**	**Setup Parameter**
Configuration	**1**	**Factory Defaults**
Sensor Type	**1**	**N/A**
Default Node	**1**	**P02**
Default Baudrate	**19,200**	**P03**
Limit 1 Type	**Low**	**P04**
Limit 2 Type	**High**	**P05**
Default Low Whole	**11**	**P06**
Default Low Decimal	**11**	**P07**
Default Hi Whole	**88**	**P08**
Default Hi Decimal	**89**	**P09**

Integer Limits	Engineered pH Limits
0	**-2.000**
18,000	**16.000**

% of Full Range	Engineered pH Units	RTU Integer
0.00%	-2.000	0
5.56%	-1.000	1000
11.11%	0.000	2000
16.67%	1.000	3000
22.22%	2.000	4000
27.78%	3.000	5000
33.33%	4.000	6000
38.89%	5.000	7000
44.44%	6.000	8000
50.00%	7.000	9000
55.56%	8.000	10000
61.11%	9.000	11000
66.67%	10.000	12000
72.22%	11.000	13000
77.78%	12.000	14000
83.33%	13.000	15000
88.89%	14.000	16000
94.44%	15.000	17000
100.00%	16.000	18000

11.11%	**0.000**	**Default Lim1 Setpoint**	**P06/P07**
88.89%	**14.000**	**Default Lim2 Setpoint**	**P08/P09**

CHANGING pH VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Relay Setpoints should be at least 1,000 MODBUS RTU steps apart.

Measurement	**ORP**	**Setup Parameter**
Configuration	**2**	**Factory Defaults**
Sensor Type	**2**	**N/A**
Default Node	**2**	**P02**
Default Baudrate	**19,200**	**P03**
Limit 1 Type	**Low**	**P04**
Limit 2 Type	**High**	**P05**
Default Low Whole	**0**	**P06**
Default Low Decimal	**0**	**P07**
Default Hi Whole	**100**	**P08**
Default Hi Decimal	**0**	**P09**

Integer Limits	Engineered ORP Limits
0	**-1,000.0**
20,000	**1,000.0**

% of Full Range	Engineered ORP Units	RTU Integer
0.00%	-1,000.0	0
5.00%	-900.0	1000
10.00%	-800.0	2000
15.00%	-700.0	3000
20.00%	-600.0	4000
25.00%	-500.0	5000
30.00%	-400.0	6000
35.00%	-300.0	7000
40.00%	-200.0	8000
45.00%	-100.0	9000
50.00%	0.0	10000
55.00%	100.0	11000
60.00%	200.0	12000
65.00%	300.0	13000
70.00%	400.0	14000
75.00%	500.0	15000
80.00%	600.0	16000
85.00%	700.0	17000
90.00%	800.0	18000
95.00%	900.0	19000
100.00%	1,000.0	20000

0.00%	**-1,000.0**	**Default Lim1 Setpoint**	**P06/P07**
100.00%	**1,000.0**	**Default Lim2 Setpoint**	**P08/P09**

CHANGING ORP VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

Measurement	Wide ORP	Setup Parameter
Configuration	3	Factory Defaults
Sensor Type	3	N/A
Default Node	3	P02
Default Baudrate	19,200	P03
Limit 1 Type	Low	P04
Limit 2 Type	High	P05
Default Low Whole	0	P06
Default Low Decimal	0	P07
Default Hi Whole	100	P08
Default Hi Decimal	0	P09

Integer Limits	Engineered ORP Limits
0	-2,000.0
20,000	2,000.0

% of Full Range	Engineered ORP Units	RTU Integer
0.00%	-2,000.0	0
5.00%	-1,800.0	1000
10.00%	-1,600.0	2000
15.00%	-1,400.0	3000
20.00%	-1,200.0	4000
25.00%	-1,000.0	5000
30.00%	-800.0	6000
35.00%	-600.0	7000
40.00%	-400.0	8000
45.00%	-200.0	9000
50.00%	0.0	10000
55.00%	200.0	11000
60.00%	400.0	12000
65.00%	600.0	13000
70.00%	800.0	14000
75.00%	1,000.0	15000
80.00%	1,200.0	16000
85.00%	1,400.0	17000
90.00%	1,600.0	18000
95.00%	1,800.0	19000
100.00%	2,000.0	20000

0.00%	-2,000.0	Default Lim1 Setpoint	P06/P07
100.00%	2,000.0	Default Lim2 Setpoint	P08/P09

CHANGING ORP VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

Measurement	Dissolved Oxygen ppm	Setup Parameter
Configuration	4	Factory Defaults
Sensor Type	4	N/A
Default Node	4	P02
Default Baudrate	19,200	P03
Limit 1 Type	Low	P04
Limit 2 Type	High	P05
Default Low Whole	0	P06
Default Low Decimal	0	P07
Default Hi Whole	100	P08
Default Hi Decimal	0	P09
DO Units for Output	ppm	P10

Integer Limits	Engineered DO ppm Limits
0	0.00
15,000	150.00

% of Full Range	Engineered DO ppm Units	RTU Integer
0.00%	0.00	0
6.67%	10.00	1000
13.33%	20.00	2000
20.00%	30.00	3000
26.67%	40.00	4000
33.33%	50.00	5000
40.00%	60.00	6000
46.67%	70.00	7000
53.33%	80.00	8000
60.00%	90.00	9000
66.67%	100.00	10000
73.33%	110.00	11000
80.00%	120.00	12000
86.67%	130.00	13000
93.33%	140.00	14000
100.00%	150.00	15000

0.00%	0.00	Default Lim1 Setpoint	P06/P07
100.00%	150.00	Default Lim2 Setpoint	P08/P09

CHANGING DO ppm VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

Measurement	Dissolved Oxygen % Saturation	Setup Parameter
Configuration	5	Factory Defaults
Sensor Type	4	N/A
Default Node	4	P02
Default Baudrate	19,200	P03
Limit 1 Type	Low	P04
Limit 2 Type	High	P05
Default Low Whole	0	P06
Default Low Decimal	0	P07
Default Hi Whole	100	P08
Default Hi Decimal	0	P09
DO Units for Output	% Sat with Salinity Correction	P10

Integer Limits	Engineered DO % Sat Limits
0	0.0
15,000	1,500.0

% of Full Range	Engineered DO % Sat Units	RTU Integer
0.00%	0.0	0
6.67%	100.0	1000
13.33%	200.0	2000
20.00%	300.0	3000
26.67%	400.0	4000
33.33%	500.0	5000
40.00%	600.0	6000
46.67%	700.0	7000
53.33%	800.0	8000
60.00%	900.0	9000
66.67%	1,000.0	10000
73.33%	1,100.0	11000
80.00%	1,200.0	12000
86.67%	1,300.0	13000
93.33%	1,400.0	14000
100.00%	1,500.0	15000

0.00%	0.0	Default Lim1 Setpoint	P06/P07
100.00%	1,500.0	Default Lim2 Setpoint	P08/P09

CHANGING DO % SATURATION VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

Measurement Configuration	ISE or TOTAL ISE 6 or 10	Setup Parameter Factory Defaults	NOTE 6 = ISE while 10 = TOTAL ISE
Sensor Type	5 or 8	N/A	5 = ISE while 8 = TOTAL ISE
Default Node	5 or 8	P02	5 = ISE while 8 = TOTAL ISE
Default Baudrate	19,200	P03	9,600 or 19,200
Limit 1 Type	Low	P04	See notes below for limits
Limit 2 Type	High	P05	See notes below for limits
Default Low Whole	22	P06	See notes below for limits
Default Low Decimal	22	P07	See notes below for limits
Default Hi Whole	44	P08	See notes below for limits
Default Hi Decimal	44	P09	See notes below for limits

CHANGE VALUE BELOW TO MATCH P19 FROM 3TX-REL-DT TRANSMITTER AFTER ISE SENSOR IS CONNECTED & NODE IS CONFIGURED

Integer Limits	Engineered pION Limits	if P19 Value is:	19.00
0	-2.000		
18,000	16.000	THEN OUTPUT IS FOR 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

44.44%	6.000	ppm Low Set	0.01900	P08/P09
22.22%	2.000	ppm High Set	190.00000	P06/P07

% FULL RANGE COMPUTED FOR PPM VALUES ENTERED TO THE RIGHT

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

44.44%	6.000	Default Lim2 Setpoint in pION (Low Setpoint in ppm)
22.22%	2.000	Default Lim1 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	ISE or TOTAL ISE	Setup Parameter	NOTE
Configuration	6 or 10	Factory Defaults	6 = ISE while 10 = TOTAL ISE
Sensor Type	5 or 8	N/A	5 = ISE while 8 = TOTAL ISE
Default Node	5 or 8	P02	5 = ISE while 8 = TOTAL ISE
Default Baudrate	19,200	P03	9,600 or 19,200
Limit 1 Type	Low	P04	See notes below for limits
Limit 2 Type	High	P05	See notes below for limits
Default Low Whole	22	P06	See notes below for limits
Default Low Decimal	22	P07	See notes below for limits
Default Hi Whole	44	P08	See notes below for limits
Default Hi Decimal	44	P09	See notes below for limits

CHANGE VALUE BELOW TO MATCH P19 FROM 3TX-REL-DT TRANSMITTER AFTER ISE SENSOR IS CONNECTED & NODE IS CONFIGURED

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

if P19 Value is: 18.04

THEN OUTPUT IS FOR 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

44.44%	6.000	ppm Low Set	0.01804	P08/P09
22.22%	2.000	ppm High Set	180.40000	P06/P07

% FULL RANGE COMPUTED FOR PPM VALUES ENTERED TO THE RIGHT

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

44.44%	6.000	Default High Setpoint in pION (Low Setpoint in ppm)
22.22%	2.000	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	ISE or TOTAL ISE	Setup Parameter	NOTE
Configuration	6 or 10	Factory Defaults	6 = ISE while 10 = TOTAL ISE
Sensor Type	5 or 8	N/A	5 = ISE while 8 = TOTAL ISE
Default Node	5 or 8	P02	5 = ISE while 8 = TOTAL ISE
Default Baudrate	19,200	P03	9,600 or 19,200
Limit 1 Type	Low	P04	See notes below for limits
Limit 2 Type	High	P05	See notes below for limits
Default Low Whole	22	P06	See notes below for limits
Default Low Decimal	22	P07	See notes below for limits
Default Hi Whole	44	P08	See notes below for limits
Default Hi Decimal	44	P09	See notes below for limits

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

CHANGE VALUE BELOW TO MATCH P19 FROM 3TX-REL-DT TRANSMITTER AFTER ISE SENSOR IS CONNECTED & NODE IS CONFIGURED

if P19 Value is: 40.08

THEN OUTPUT IS FOR CALCIUM

% of Full Range	Engineered pION Units	RTU Integer	ppm units
0.00%	-2.000	0	4008000
5.56%	-1.000	1000	400800
11.11%	0.000	2000	40080
16.67%	1.000	3000	4008
22.22%	2.000	4000	400.8
27.78%	3.000	5000	40.08
33.33%	4.000	6000	4.008
38.89%	5.000	7000	0.4008
44.44%	6.000	8000	0.04008
50.00%	7.000	9000	0.004008
55.56%	8.000	10000	0.0004008
61.11%	9.000	11000	0.00004008

44.44%	6.000	ppm Low Set	0.04008	P08/P09
22.22%	2.000	ppm High Set	400.80000	P06/P07

% FULL RANGE COMPUTED FOR PPM VALUES ENTERED TO THE RIGHT

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

44.44%	6.000	Default High Setpoint in pION (Low Setpoint in ppm)
22.22%	2.000	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	Conductivity	Setup Parameter
Configuration	7	Factory Defaults
Sensor Type	6 or 7 or 9	N/A
Default Node	6	P02
Default Baudrate	19,200	P03
Limit 1 Type	Low	P04
Limit 2 Type	High	P05
Default Low Whole	0	P06
Default Low Decimal	0	P07
Default Hi Whole	100	P08
Default Hi Decimal	0	P09
Units for Output	Con	P11

STANDARD RANGE MODE * - All values are given in microSiemens/cm

Range Scaling Factor	200	P13		P06/P07		P08/P09
Cell Constant P12	Max Conductivity	Resolution	0/4mA Low Setpoint	% of Full Range	20mA High Setpoint	% of Full Range
0.01	200	0.004	0.00	0.00%	200.00	100.00%
0.02	400	0.008	0.00	0.00%	400.00	100.00%
0.05	1,000	0.02	0.00	0.00%	1,000.00	100.00%
0.10	2,000	0.04	0.00	0.00%	2,000.00	100.00%
0.20	4,000	0.08	0.00	0.00%	4,000.00	100.00%
0.50	10,000	0.2	0.00	0.00%	10,000.00	100.00%
1.00	20,000	0.4	0.00	0.00%	20,000.00	100.00%
2.00	40,000	0.8	0.00	0.00%	40,000.00	100.00%
3.00	60,000	1.2	0.00	0.00%	60,000.00	100.00%
5.00	100,000	2	0.00	0.00%	100,000.00	100.00%
10.00	200,000	4	0.00	0.00%	200,000.00	100.00%
20.00	400,000	8	0.00	0.00%	400,000.00	100.00%

HIGH RANGE MODE * - All values are given in microSiemens/cm

Range Scaling Factor	2,000	P13		P06/P07		P08/P09
Cell Constant P12	Max Conductivity	Resolution	0/4mA Low Setpoint	% of Full Range	20mA High Setpoint	% of Full Range
0.01	2,000	0.04	0.00	0.00%	1,000.00	50.00%
0.02	4,000	0.08	0.00	0.00%	2,000.00	50.00%
0.05	10,000	0.2	0.00	0.00%	5,000.00	50.00%
0.10	20,000	0.4	0.00	0.00%	10,000.00	50.00%
0.20	40,000	0.8	0.00	0.00%	20,000.00	50.00%
0.50	100,000	2	0.00	0.00%	50,000.00	50.00%
1.00	200,000	4	0.00	0.00%	100,000.00	50.00%
2.00	400,000	8	0.00	0.00%	200,000.00	50.00%
3.00	600,000	12	0.00	0.00%	300,000.00	50.00%
5.00	1,000,000	20	0.00	0.00%	500,000.00	50.00%
10.00	2,000,000	40	0.00	0.00%	1,000,000.00	50.00%
20.00	4,000,000	80	0.00	0.00%	2,000,000.00	50.00%

ULTRALOW RANGE MODE * - All values are given in microSiemens/cm

Range Scaling Factor	**2**	**P13**		**P06/P07**		**P08/P09**
Cell Constant P12	Max Conductivity	Resolution	0/4mA Low Setpoint	% of Full Range	20mA High Setpoint	% of Full Range
0.01	2	0.00004	0.00	0.00%	2.00	100.00%
0.02	4	0.00008	0.00	0.00%	4.00	100.00%
0.05	10	0.0002	0.00	0.00%	10.00	100.00%
0.10	20	0.0004	0.00	0.00%	20.00	100.00%
0.20	40	0.0008	0.00	0.00%	40.00	100.00%
0.50	100	0.002	0.00	0.00%	100.00	100.00%
1.00	200	0.004	0.00	0.00%	200.00	100.00%
2.00	400	0.008	0.00	0.00%	400.00	100.00%
3.00	600	0.012	0.00	0.00%	600.00	100.00%
5.00	1,000	0.02	0.00	0.00%	1,000.00	100.00%
10.00	2,000	0.04	0.00	0.00%	2,000.00	100.00%
20.00	4,000	0.08	0.00	0.00%	4,000.00	100.00%

NOTE 1: Difference between Low & High Analog Setpoints should be at least 2% of the Full Range Apart

NOTE 2: Minimum Recommend Scaling is 4.00% of the full range if the low setpoint is 0.00%.

NOTE 3: For High Range Mode the maximum recommended High 20mA Setpoint is 50% of Full Range

Measurement	Conductivity	Setup Parameter
Configuration	8	Factory Defaults
Sensor Type	6 or 7	N/A
Default Node	6	P02
Default Baudrate	19,200	P03
Limit 1 Type	Low	P04
Limit 2 Type	High	P05
Default Low Whole	0	P06
Default Low Decimal	0	P07
Default Hi Whole	100	P08
Default Hi Decimal	0	P09
Units for Output	PSU or MegaOhm	P11

Integer Limits	Engineered PSU / MOhm Limits
0	0.000
50,000	50.000

% of Full Range	Engineered PSU / MOhm Units	RTU Integer
0.00%	0.000	0
10.00%	5.000	5000
20.00%	10.000	10000
30.00%	15.000	15000
40.00%	20.000	20000
50.00%	25.000	25000
60.00%	30.000	30000
70.00%	35.000	35000
80.00%	40.000	40000
90.00%	45.000	45000
100.00%	50.000	50000

0.00%	0.000	Default Low Setpoint	P06/P07
100.00%	50.000	Default High Setpoint	P08/P09

CHANGING PSU VALUES GET % SCALING COMPUTED (SENSOR TYPE 6)

0.00%	0.000	Default Low Setpoint	P06/P07
40.00%	20.000	Default High Setpoint	P08/P09

CHANGING MOhm VALUES GET % SCALING COMPUTED (SENSOR TYPE 7)

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

NOTE 2: Units are PSU for Sensor Type 6 or 9 and MegaOhms for Sensor Type 7

Measurement	**Conductivity**	**Setup Parameter**
Configuration	**9**	**Factory Defaults**
Sensor Type	**6 or 7**	**N/A**
Default Node	**6**	**P02**
Default Baudrate	**19,200**	**P03**
Limit 1 Type	**Low**	**P04**
Limit 2 Type	**High**	**P05**
Default Low Whole	**0**	**P06**
Default Low Decimal	**0**	**P07**
Default Hi Whole	**100**	**P08**
Default Hi Decimal	**0**	**P09**
Units for Output	**TDS or MegaOhms for UPW**	**P11**

Integer Limits	**Engineered TDS ppm Limits**	***Engineered TDS ppt Limits***
0	**0**	***0.00***
50,000	**100,000**	***100.00***

% of Full Range	**Engineered TDS Units**	**RTU Integer**
0.00%	0	0
5.00%	5,000	2500
10.00%	10,000	5000
15.00%	15,000	7500
20.00%	20,000	10000
25.00%	25,000	12500
30.00%	30,000	15000
35.00%	35,000	17500
40.00%	40,000	20000
45.00%	45,000	22500
50.00%	50,000	25000
55.00%	55,000	27500
60.00%	60,000	30000
65.00%	65,000	32500
70.00%	70,000	35000
75.00%	75,000	37500
80.00%	80,000	40000
85.00%	85,000	42500
90.00%	90,000	45000
95.00%	95,000	47500
100.00%	100,000	50000

0.00%	**0**	**Default Low Setpoint**	**P06/P07**
100.00%	**100,000**	**Default High Setpoint**	**P08/P09**

CHANGING TDS VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

NOTE 2: Units are TDS for Sensor Type 6 or 9 and MegaOhms for UPW for Sensor Type 7

Integer Limits	Engineered MOhm for UPW Limits
0	0.000
50,000	50.000

% of Full Range	Engineered MOhm for UPW Units	RTU Integer
0.00%	0.000	0
10.00%	5.000	5000
20.00%	10.000	10000
30.00%	15.000	15000
40.00%	20.000	20000
50.00%	25.000	25000
60.00%	30.000	30000
70.00%	35.000	35000
80.00%	40.000	40000
90.00%	45.000	45000
100.00%	50.000	50000

0.00%	**0.000**	**Default Low Setpoint**	**P06/P07**
40.00%	**20.000**	**Default High Setpoint**	**P08/P09**

CHANGING MOhm FOR UPW VALUE ABOVE GET % SCALING COMPUTED

NOTE 1: Low & High Analog Setpoints should be at least 1,000 MODBUS RTU steps apart.

NOTE 2: Units are TDS for Sensor Type 6or 9 and MegaOhms for UPW for Sensor Type 7