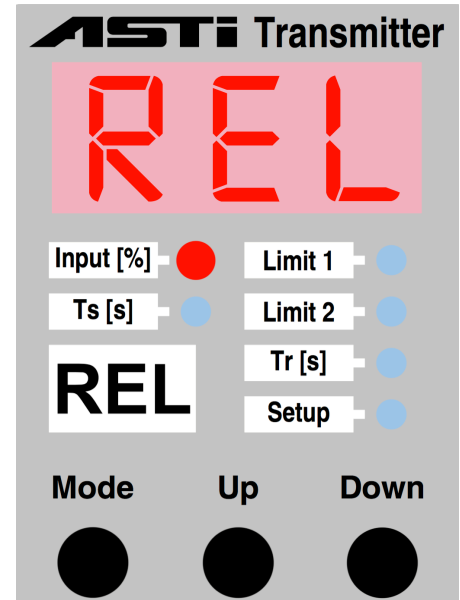


3TX-REL Alarm Relay and Controller Module

- 3TX-REL is a versatile alarm & controller module with 2 independent limits
- Tight integration with 3TX-pH, 3TX-ISE, 3TX-DO, 3TX-CON and 3TX-TOT for simple setup with available ranges & scaling limits built right into REL
- Tight integration for display & scaling in native measurement units: pH, ORP in mV, TOT/ISE in ppm, DO in ppm/ %Sat, Conductivity in $\mu\text{S}/\text{mS}$
- Supports intelligent 3TX-HiQ-pH for smart digital pH & ORP sensors
- 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 required for use with each analog input from 3TX module
- Analog input: 0-20mA or 4-20mA from 3TX modules, user selectable
- 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
- 24VDC power operation, 5A max load/rating for each dry contact relay
- Hold function in 3TX measurement modules effectively “disables” relays during calibration and maintenance procedures for inline sensors
- DIN rail only option for small installations or complete with weatherproof NEMA 4X or IP65 enclosures, max. 7 each 3TX modules in single enclosure



FEATURES

Application

3TX-REL modules are ideal for supervising mA signals. This unit is fully compatible with the output provided by all 3TX measuring transmitters (3TX-pH, 3TX-ISE, 3TX-DO & 3TX-CON) as well as 3TX-TOT module for total ISE. Simple On/Off and programmable control functionality is possible with 3TX-REL. New 3TX-HiQ-pH transmitter is also natively supported with setup options on 3TX-REL.

Analog Input

The input is an analog current loop, and may be set up to either 0-20mA or 4-20mA. 3XT-REL can be scaled exactly match the analog output from 3TX-pH, 3TX-ISE, 3TX-DO, 3TX-CON, 3TX-TOT and new 3TX-HiQ-pH modules.

Digital Input

The 3TX-REL may be configured to both positive and negative logic on the digital inputs. Using parameter no. 21, the input may be set to either active high or active low. With positive logic, accepted input voltage is 5 to 30VDC. Negative logic is achieved by connecting the input to ground; for example by using a switch. The supervision may be blocked by activating the S2 input.

Relay Output

The unit contains two relays, one for each limit. The relays are both connection relays, but the polarity may be inverted independently using parameters no. 19 and 20 when in simple supervision and On/Off control mode.

Limits

The 3TX-REL integrates 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 can be entered in the native unit of the measurement module to which it is connected (pH, ORP/mV, ppm/mEq or $\mu\text{S}/\text{mS}$).

Start Timer (Ts)

The start timer may be used to avoid alarms during startup of an unstable process. It is activated when the 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

The 3TX-REL module can operate in four modes: 1) Simple supervision (alarm function only); 2) On/Off control with deadband; 3) Time Proportional Control (TPC) or 4) Proportional Frequency Control (PFC a.k.a. Variable Pulse).

Reset

During simple supervision (i.e. control mode is “Off”) an alarm may be reset in two ways: 1) by activating the external reset input (S1 – terminal 3) or 2) by pressing the ‘Mode’ key in the “input” display mode. A reset requires the alarm condition to be cleared.

TECHNICAL SPECIFICATIONS

Mechanical

Housing:	Lexan UL94V-0 (Upper part) Noryl UL94V-0 (Lower part)
Mounting: IP Class:	M36 for 35 mm DIN rail 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:	200 grams (7.04 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
Input Current Range:	(0)4-20mA, 70Ω
Digital input:	Pos. logic: 5-30VDC; Neg. logic: 0V
Input S1:	External reset
Input S2:	Alarm block
Relay Description:	2 each Single-Pole, Single-Throw (SPST)
Relay Rating:	250VAC / 5A (Dry Contact Type)



PARAMETERS

Function and Settings

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.

Par. no. 2. If set to "On" the Relay is held and this is signaled by flashing input LED. This is also called the "relay hold feature".

Par. no. 3. Type of input is selected either 0-20mA or 4-20mA.

Par. no. 4. Type of limit 1: Min as "Lo" or Max as "Hi"

Par. no. 5. Type type of limit 2: Off, Min as "Lo" or Max as "Hi"

Par. no. 6. Analog input type: % generic units (0-100%), pH (0-14), ORP (±1000mV max), Conductivity (per Cell), ISE (ppm or mEQ) or dissolved oxygen (DO) ppm (Do.P) or % saturation (Do.S)

Par. no. 7. When P05 is ISE, sets the full range analog output on 3TX-ISE or 3TX-TOT. 'Lo' is 0-10 ppm, 'Mi' is 0-100 ppm & 'Hi' is 0-999 ppm. For scaling limits & options see REL supplement.

Par. no. 8. When P05 is CON, said nominal cell that defines full range and minimum scaling options available on the 3TX-CON measurement module analog output. The 3TX-REL input scaling supplement for details full range & scaling for each cell option.

Par. no. 9. Defines value of low 0mA or 4mA input setpoint. See the 3TX-REL analog input configuration supplement for details.

Par. no. 10. Defines value of the 20mA input setpoint. Please see the 3TX-REL analog input configuration supplement for details.

Par. no. 11 & 12. 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. 13. Sets basic time for limit 1 when in TPC mode (P11=2)

Par. no. 14. Sets basic time for limit 2 when in TPC mode (P12=2)

Par. no. 15. Sets basic pulse rate for limit 1 in PFC mode (P11=3)

Par. no. 16. Sets basic pulse rate for limit 2 in PFC mode (P12=3)

Par. no. 17. 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. 18. 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. 19. Polarity of relay 1: Non inverted/ Inverted ***

Par. no. 20. Polarity of relay 2: Non inverted/ Inverted ***

Par. no. 21. Digital input set to be active high (Hi) or low (Lo).

Par. no. 22. Calibrate trim offset of 4mA current input. Select low value in scaling on 3TX input and adjust value to match.

Par. no. 23. Calibration of trim span of 20mA current input. Select high value in scaling on 3TX input & adjust the value to match.

Par. no. 24. Displays result of 0mA or 4mA trim offset calibration done in P22 in X.XX% units. This is a view only parameter.

List of Parameters

No	Parameter	Description	Range	Default
01	Lock	Software Lock	On / Off	On
02	Hold	Relay on Hold	On / Off	Off
03	Input	Analog input	0-20 or 4-20 mA	0-20
04	Limit 1	Type of limit	Lo, Hi	Hi
05	Limit 2	Type of limit	Off, Lo, Hi	Lo
06	Units from analog input	Input Type & Mode for 3TX Module	%, pH, ORP, * CON, ISE, Do.P or Do.S	%
07	ISE/TOT Mode	Select Range Input for ISE or TOT	'Lo' 0-10, 'Mi' 0-100, 'Hi' 0-999	Lo
08	Conductivity Range	Conductivity Cell from 3TX-CON	L01, 0.01, 0.02 L0.1, 0.1, 0.2, 0.2H, L1.0, 1.0, 2.0, 2.0H, 10, 20	1.0
09	4mA Scale	Reading @ 4mA	Per Input Type	Auto
10	20mA Scale	Reading @ 20mA	Per Input Type	Auto
11	Lim1 Mode	Set Control mode	Off, 1, 2, 3	Off
12	Lim2 Mode	Set Control mode	Off, 1, 2, 3	Off
13	Time Lim1	Time for Limit 1	1...250s	10
14	Time Lim2	Time for Limit 2	1...250s	10
15	Pulse Lim1	Pulse Rate Limit 1	1..250 pulse/min	60
16	Pulse Lim2	Pulse Rate Limit 2	1..250 pulse/min	60
17	Hysteresis 1	Dead Band Limit 1	1...50% **	10%
18	Hysteresis 2	Dead Band Limit 2	1...50% **	10%
19	Polarity for Relay 1	Relay is inverted or standard	n.inverted, inverted	n.inv
20	Polarity for Relay 2	Relay is inverted or standard	n.inverted, inverted	n.inv
21	Digital Logic	Set digital input mode/logic	Negative (Lo), Positive (Hi)	Lo
22	Trim Low	Cal 4mA Input	As Defined *	-
23	Trim High	Cal 20mA Input	As Defined *	-
24	% Trim Low	4mA Offset	± 9.99% *	****
25	% Trim High	20mA Gain/Span	± 9.99% *	****
26	Back to Default	Reset to Default	Def=Reset, Par=NoReset	Par

Par. no. 25. Displays the result of 20mA trim span calibration done in P23 in X.XX% units. This is a view only parameter.

Par. no. 26. Feature to reset the analyzer back to factory default.

* Negative numbers shown as flashing

** Value is 50% of range determined by P06 and scale parameters P09 & P10

*** Relay polarity does not apply in TPC mode (P11/P12=2) or PFC mode (P11/P12=3)

**** Default values per 4mA and 20mA trim calibrations performed at ASTI factory.

Control Functions & Modes

On/Off control

When the measurement crosses the chosen setpoint, the relay will open and not close again until the measurement exceeds the hysteresis band.

Hysteresis Band

A hysteresis band (a.k.a. dead band) always lies above a Min & below a Max limit. This is P17 for Limit 1 & P18 for Limit 2 in On/Off mode.

Proportional Band

The proportional band is a range where a variable control is performed. A proportion band lies above a minimum and below a maximum limit. This is P17 for Limit 1 & P18 for Limit 2 in TPC control mode.

Basic Frequency

The basic frequencies for Limit 1 & 2 may be set from 1 to 250 pulse per minute (default 60). This is valid in the PFC control mode only.

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.

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 limit is exceeded.

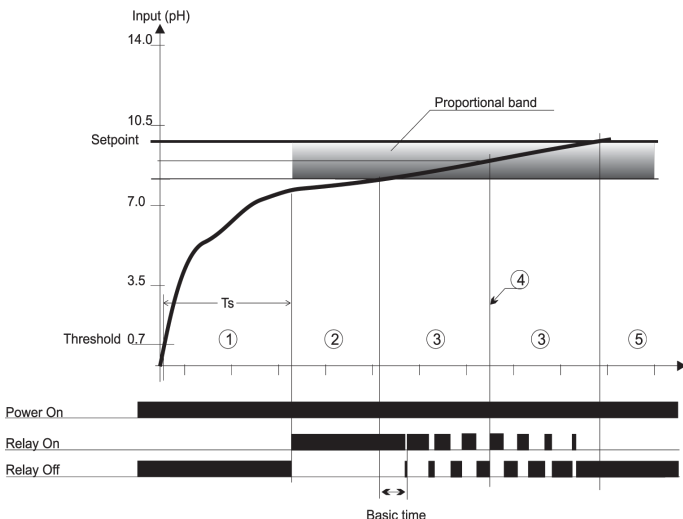
Control examples

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.

Parameters Accessible from LED Menu

In addition to the parameters in the setup menu, the 3TX-REL also features parameters directly accessible from the main LED menu (see next column top). The parameters are accessible by pressing the 'Mode' key until the LED for the parameter to be altered is lit. Use the 'Up' and 'Down' keys to alter the parameter. These parameters and their functions are shown in the table below. **Par No. 01 "lock" which must be 'Off' to change ANY parameter at all.**

The figure below shows in principle how the TPC algorithm works. The 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.



Programming for LED Parameters

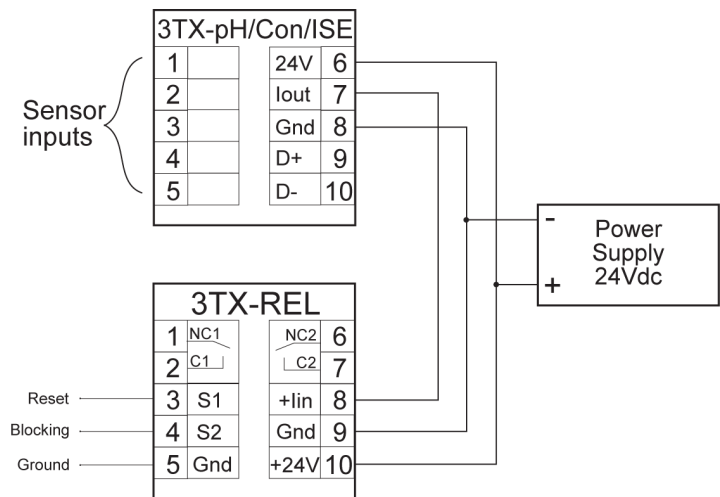
Parameter	Description	Range	Default
Ts [s]	Start up – timer	0.0 to 999s	10.0
Limit 1	Setpoint for limit 1	5.0– 99.9 %	80.0
Limit 2	Setpoint for limit 2	5.0– 99.9 %	20.0
Tr [s] (Limit 1)	Reaction time limit 1 ^	00.0 to 99.9s	10.0
Tr [s] (Limit 2)	Reaction time limit 2 ^	00.0 to 99.9s	10.0

Note 1: Negative limit setpoints for ORP/mV mode are shown as flashing

Note 2: Limits are shown in engineered units based upon the input type, range and scaling defined by P06, P07 & P08. Both limit 1 & 2 must be somewhere within 5-99.9% of the scaling defined for the pH, ORP, ISE, DO, Conductivity or TOT analog input.

^ During this time period, no relay action will be undertaken when P06 is set to Off (supervision / alarm function only) or On/Off Relay control mode

Typical Installation



Note: An alternate wiring configuration is required if the 0/4-20mA transmitter output is to first (also) be sent to another data acquisition or control device. See website for alternate wiring.

Example of pH Control Application using TPC Mode

- 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 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)



ORDERING INFORMATION FOR 3TX FAMILY OF TRANSMITTERS

<i>ENCLOSURE TYPE</i>	
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) with IP65 WeatherProof Enclosure; Up to 2 Total Modules (Wall Installations Only)
3TX-2M	3TX Transmitter(s) with IP65 WeatherProof Enclosure; Up to 2 Total Modules (Wall or Pipe Installations)
3TX-3MP	3TX Transmitter(s) with NEMA 4X Enclosure for ½-DIN Panel Only ; Up to 3 Modules (with Panel Bracket Assembly)
3TX-3MF	3TX Transmitter(s) with NEMA 4X Enclosure; Up to 3 Total Modules (Wall or Pipe Installations)
3TX-4MW	3TX Transmitter(s) with IP65 WeatherProof Enclosure; Up to 4 Total Modules (Wall Installations Only)
3TX-4M	3TX Transmitter(s) with IP65 WeatherProof Enclosure; Up to 4 Total Modules (Wall or Pipe Installations)
3TX-6M ***	3TX Transmitter(s) with IP65 WeatherProof Enclosure; Up to 6 Total Modules (Wall or Pipe Installations)
3TX-7MF ***	3TX Transmitter(s) with NEMA 4X Enclosure; Up to 7 Total Modules (Wall or Pipe Installations)
3TX-9MF ***	3TX Transmitter(s) with NEMA 4X Enclosure; Up to 9 Total Modules (Wall or Pipe Installations)
<i>MEASUREMENT MODULES ONE (1) THROUGH SEVEN (7)</i>	
CODE	DESCRIPTION
-pH **	pH/ORP/mV/Temp Measurement Module / Transmitter
-HiQ-pH	Intelligent pH & ORP Transmitter for Smart Digital pH & ORP Sensors; Both 4-20mA & MODBUS outputs standard
-CON-CELL/RANGE	Contacting Conductivity Measurement Module / Transmitter (CELL Constant & RANGE in mS Defined at Time of Order)
-ISE-ION **	Ion Selective (ISE) Measurement Module / Transmitter (Ion Measurement Type ION Must be Defined at Time of Order) *
-DO **	Dissolved Oxygen Measurement Module / Transmitter For Galvanic Type DO sensors
<i>OUTPUT OPTIONS FOR ANALOG MEASUREMENT MODULES (ONE OPTION MUST BE SELECTED FOR EACH MODULE)</i>	
CODE	DESCRIPTION
-A	Single Fully Scalable Analog 0-20 or 4-20 mA Output Only
-D	Single Fully Scalable Analog 0-20 or 4-20 mA Output Only AND RS-485 MODbus Digital Output
<i>ADD-ON MODULES FOR MEASUREMENT MODULE ENCLOSURE ASSEMBLIES</i>	
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
-TEM	Scalable Analog 0-20 or 4-20mA Temperature Transmitter for Raw or Spliced Pt100/Pt1000 temperature element
-SW	On/Off Power Switch (½ Width of power supply module and ¼ width of standard 3TX transmitter)
-REL	Alarm and Relay Controller Module for 3TX-pH, 3TX-ISE, 3TX-CON and 3TX-DO measurement modules
-TOT	Compute pH compensated "Total ISE" from analog inputs for ISE & pH, 0/4-20mA analog & MODbus digital outputs
-DAT	Datalogger & MODbusmaster for 3TX Transmitters with RS485 MODbus; Download & Setup via RS232/USB on Windows

Contact the factory for specific recommendations & ALL ISE inquiries. Pipe mounting bracket kits supplied separately. For 3MP, 3MF, 6M & 7MF enclosures power supply is not counted as a module for space purposes.

Model: 3TX-2M-pH-A-CON-1.0/50-D

Description: Dual Channel Transmitter Assy w/ Weatherproof Enclosure (2 Total Modules); 1 each pH Measurement w/ Analog Output; 1 each Contacting Conductivity Measurement w/ Cell Constant 1.0/cm & Full Range 0-50mS/cm (Min Scaling 0-5.0mS/cm); with Analog and Digital MODbus RS-485 Outputs (No AC Power Supply)

Model: 3TX-3MP-ISE-F-A-pH-A-TOT-PS

Description: Dual Channel Total Fluoride Measurement Transmitter Assembly with NEMA 4X (UL) Enclosure for ½-DIN Panel Mounting Installations (for 3 Total Modules); 1 each ISE Fluoride Ion and 1 each pH Measurement Module with Analog Output Only; 1 each TOT module to compute total fluoride (HF + F-) with Analog & MODbus Outputs for all free fluoride, total fluoride, pH and temperature; With Universal 11 Power Supply Module

Model: 3TX-3MF-DO-D-TEM-SW-PS

Description: Dissolve Oxygen Transmitter Assembly with NEMA 4X CSA/UL rated Enclosure; Field or Wall Mounting Installations (3 Module Max); 1 each DO transmitter for galvanic type dissolved oxygen sensors; Scalable Analog & MODbus Output for DO ppm, saturation & Temperature; 115/230 Power Supply with On/Off Switch

Model: 3TX-4MW-ISE-NH4-A-pH-A-TOT-PS

Description: Dual Channel Total Ammonia Measurement Transmitter Assembly; Weatherproof Wall Mount Only Enclosure (4 Modules Max); 1 each ISE Ammonium Ion and 1 each pH Measurement Module with Analog Output Only; 1 each TOT to compute total ammonia (NH₃) with Analog & MODbus Outputs; With 115/230 Power Supply

Model: 3TX-6M-ISE-NH4-A-pH-A-TOT-ISE-NO2-A-pH-D-DO-D-PS

Description: Five Channel Transmitter Assembly with Weatherproof Enclosure (for 6 Total Modules); 1 each ISE Ammonium Ion and 1 each pH Measurement Module with Analog Output Only; 1 each TOT module to compute total ammonia (NH₃) with Analog & MODbus Outputs; 1 each ISE Nitrite Ion with Analog Output Only; 1 each ORP Measurement Module and 1 each DO transmitter for galvanic active self-polarizing type sensors both with Scalable Analog & MODbus Outputs; With 115/230 Power Supply

Model: 3TX-6M-ISE-X-F-D-REL-pH-X-D-REL-CON-10.0/500-D-DAT-PS

Description: Triple Channel Transmitter Assembly with Weatherproof Enclosure (for 6 Total Modules Max); 1 each Preamp Style Fluoride ISE Measurement Module & 1 each Preamp Style pH Measurement Module with Alarm/Relay Controller for both Fluoride ISE & pH; 1 each Contacting Conductivity Measurement with K=10.0/cm & Full Range 0-500mS; Analog & MODbus Outputs for All Measurements; DAT Datalogger/MODbusmaster Module to record all parameters; Universal 115/230 Power Supply

Model: 3TX-7MF-ISE-NH4-D-ISE-NO3-D-ISE-NO2-D-pH-D-CON-1.0/50-D-DO-D-DAT

Description: Six Channel Measuring Transmitter Assembly Optimized for Low-Power Battery Operation; with NEMA 4X CSA/UL rated Enclosure (7 Module Max); 1 each ISE Ammonium Ion, 1 each ISE Nitrate Ion and 1 each ISE Nitrite Ion Module; 1 each pH module; 1 each Contacting Conductivity K= 1.0/cm & Full Range 0-50mS; 1 each Dissolved Oxygen module; Analog & MODbus Outputs for all Measurements & Temp; DAT Datalogger/MODbusmaster for continuous datalogging of all parameters

** For sensors with integral preamplifiers, order the pH/ORP transmitters as -pH-X and the ion selective (ISE) transmitters as -ISE-X and dissolved oxygen (DO) transmitters as -DO-X

*** For 2" NPT pipe mounting installations, an additional adapter plate must also be ordered for the 6M, 7MF & 9MF enclosures (inquire to factory for details).