Foxcroft Equipment & Service, Co. Inc.

Model FX-300-pH/ORP

Analyzer Instruction Manual

Warning!

Please Read Carefully and Save

The FX-300 Series include an instruction manual that contains important information about its operation. Purchasers who install this product for use by others must leave this instruction manual or a copy with the user.

.Table of Contents

Check all page numbers and subjects

IMPORTANT SAFETY INFORMATION

Please read and observe the following:

All functions of this FX-300 product must be verified on a regular basis.

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may

contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

WARNING: A warning looks like this. It warns you of the potential for personal injury

CAUTION: A caution looks like this. It alerts you to the possibility of instrument malfunction or damage.

NOTE: *A note looks like this. It alerts you to important operating information.*

Introduction

The FX-300 series consists of a family of analyzers for pH, oxidation reduction potential (ORP), conductivity, and ion selective (ISE) and temperature measurement including fluoride, ammonia and nitrate /nitrite. It provides an online continuous measurement for daily monitoring and process control in applications including municipal drinking and waste water, and industrial process water and waste streams.

The modular design allows the user to select only the functions needed for a particular application and add functions at a later date. The basic model provides a measurement, display, and scaled milliamp output of the measurement. Optionally the user can add control and alarm functions, a module to compute total ISE measurement, data logging, Modbus output, or modules to measure other parameters.

The FX-300 family of analyzers consists of:

FX-300-pH/ORP: pH, ORP/mV and Temperature Analyzer with fully scalable 0/4-20mA output and Modbus (optional)
FX-300-CON: Contacting Conductivity Analyzer with fully scalable 0/4-20mA output and Modbus (optional)
FX-300-ISE: Ion Selective Analyzer with fully scalable 0/4-20mA output and Modbus (optional). The ion selective measurement type must be set at the time of purchase at the factory.
FX-300-REL: Alarm & relay controller (On/Off, TPC, PFC) for pH/ORP, ISE & Conductivity measurement modules
FX-300-TOT: Compute pH compensated "Total ISE" from ISE & pH analog inputs, 0/4-20mA analog & Modbus outputs

FX-300pH/ORP Features

- Data Ranges: 0-14pH, ±1000mV, 0-210 °C
- Supports sensors with and without internal preamplifier (max 300 feet with preamp)
- 2-Point Slope calibrations use the same slope in acidic and alkaline ranges
- 3-Point Slope Calibration establishes accurate separate slopes for acidic (0-7 pH) and alkaline ranges (7-14 pH)
- Arbitrary Single (1-Point Offset) Calibration supported for quick calibration with single pH buffer or to allow for agreement between laboratory pH determinations
- Temperature compensation via Platinum 100 or 1000 Ohm element
- Display pH/mV or Temperature
- Fully Scalable Analog Output 0-20 mA or 4-20 mA for pH/mV or Temperature
- Galvanic isolation between sensor input, power & analog output (3000V rating)
- Optional Serial communication via RS-485 Modbus Digital Output

Introduction

FX-300 pH/ORP Features

Operation

Each module has a 3 digit display and 6 LEDs for setup and displaying values. The ‘Mode’ key is used for navigation.

Operation is simple. The module is programmed by the use of 3 keys located on the front panel. The ‘Mode’ key is used for selecting SETUP and the ‘Up’ and ‘Down’ keys are used to scroll through the parameters. The parameter to be altered is selected with the ‘Mode’ key and the value is changed using the ‘Up’ or ‘Down’ keys.

“pH/mV” indicates the run mode.

℃ mode displays the temperature.

“Buffer” is the calibration mode for the offset, or high pH solution.

“Slope” is the calibration mode for the gain, or low pH solution.

“Setup” mode provides access to program the analyzer. To exit SETUP press the "Down" key until parameter "P00" is displayed, then press the "Mode" key.

“Com” LED is illuminates when the Modbus (if included) is active.

Input

The sensor without preamplifier is connected directly to the FX300-pH/ORP module. The mV signal from the sensor is processed by an integrated high impedance amplifier. The FX300-pH/ORP-**X** hardware version can support external preamps (supplied either in the sensor or in an external J-Box) to enable installations that require long cable lengths or to operate in high interference areas. Temperature measurement with a Pt100/Pt1000 allows automatic temperature compensation to be performed.

Introduction

Analog Output

The FX300 analyzers have a single scalable analog output of either 0-20 or 4-20 mA (selectable) in each measurement module. The difference required between the minimum (0/4mA) and maximum (20mA) output is 20% of the selected range (low 0-10, mid 0-100 or high 0-1000 ppm). For example, if the low range (0-10) is selected then the output could be as narrow as 0-2 ppm for the 0/4-20 mA scaling. The output is proportional to ISE ppm or temperature and is galvanically insulated from the input.

Modbus (Optional)

Modbus output is available in two ways.

1. It can be integrated into the pH module at time of order only.

2. It is also available in the FX-300-TOT module, which can be added at any time.

Acquired data is transferred using Modbus standard for multi-drop communication and is connected using RS485. The Modbus-master may be the FX300-DAT module or any SCADA system. When units are ordered with Modbus option, the free of charge Windows data logging and graphing software and be used to monitor and record all process and temperature values from up to 247 transmitter simultaneously at distances up to 6500 feet (2 kilometers).

TECHNICAL SPECIFICATIONS

FX-300-pH/ORP *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 mm^2
	Max torque 0,6 Nm
Temp.:	-15 to +50 °C
Weight:	75 grams (2.64 ounces)
Dimensions:	D 58 x W 36 x H 86 mm (2.3" X 1.4" X
CE mark:	3.4")
	EN61326A

Electrical

Power Supply:	24VDC ±10%
Consumption:	60 mA max
Sensor:	Combination Sensor
pH/mV Range:	0-14 pH, ±1000mV
pH input:	< 1pA, >10GΩ
Accuracy:	±0.2%
Temp Sensor:	Pt100, Pt1000
Temp Range:	0-210°C ± 0.3°C
Temperature	Fixed (Manual) or Automatic using
Compensation:	Temperature (TC) Measurement
Analog Output:	0-20mA or 4-20mA, max. 250Ω

INSTALLATION

Installation Overview

1. Mount the analyzer on the wall.
2. Connect the sensor wires to the analyzer.
3. Make electrical connections for current output, alarm relays, and power to the analyzer.
4. Verify electrical connections and apply power to the analyzer.
5. Program the analyzer operating parameters as needed for your application.
6. Condition and calibrate the pH sensor using the two-point calibration procedure.
7. Install sensor into the process fluid.
8. With the sensor in the process fluid perform the 1-point offset calibration to standardize the sensor with your approved grab sample analysis result. The sensor is ready to use.

General Information

1. The analyzer is designed for wall mounting. Although the analyzer may be mounted outdoors, do not install it in direct sunlight or in areas of extreme temperatures.

2. Install the analyzer in an area where vibration and electromagnetic and radio frequency interference are minimized or absent.

3. Keep the analyzer and sensor wiring at least one foot from high voltage conductors. Ensure there is easy access to the analyzer.

There are five 7/8” conduit openings in the bottom of the enclosure. Conduit openings accept 1/2-inch conduit fittings. To keep the case watertight, block unused openings with NEMA 4X or IP65 conduit plugs.

NOTE: Use watertight fittings and hubs that comply with your requirements. Connect the conduit hub to the conduit before attaching the fitting to the analyzer.

Power

The FX-300 includes a CSA/UL/CE approved universal 115/230 VAC power supply.

INSTALLATION

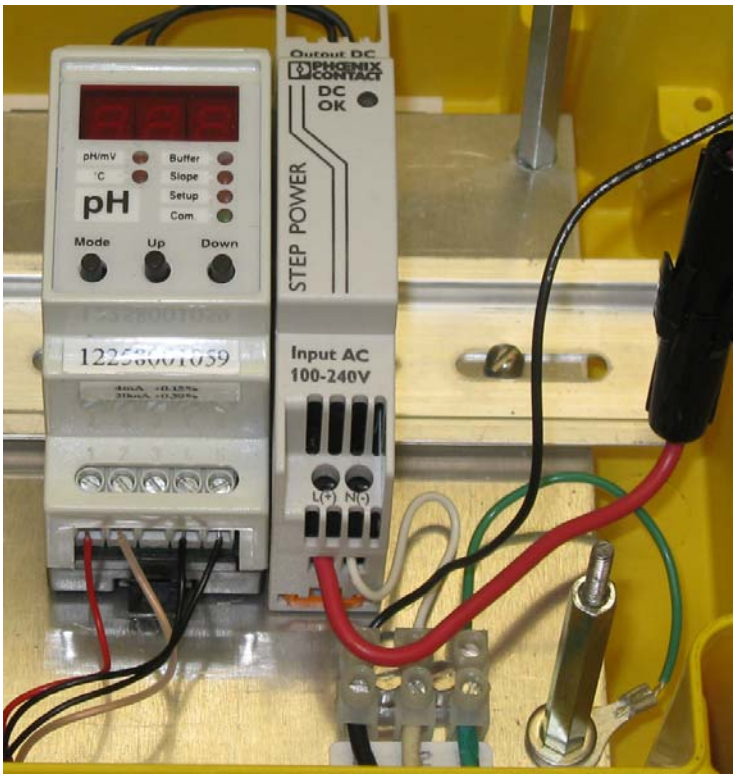
Wiring

The FX-300 analyzer is prewired internally to a terminal strip. The only field wiring required is the incoming power cable, a proper earth ground, output signal cables if required, and the sensor cable directly to the pH module.

If measurement or function modules must be wired or are added at a later date, please refer to the product bulletins with wiring diagrams later in the manual.

Grounding

Grounding of the measurement module itself is not required. In many cases, the pH sensor also does not require grounding. Some applications require the sensor be grounded in the process fluid.

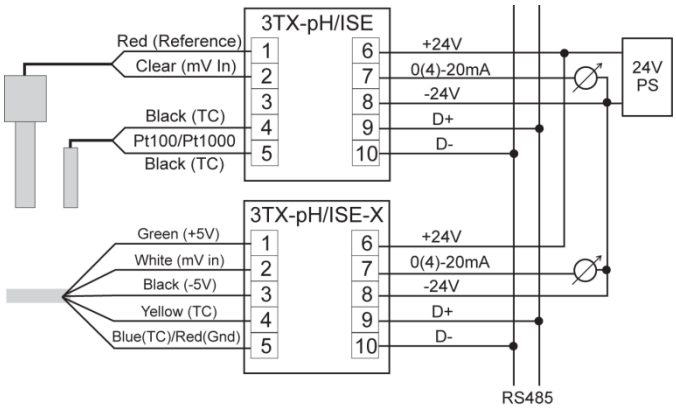


INSTALLATION

WIRING

Wiring the Sensor to the Measurement Module, Output Connections

For reference the wiring for sensors with and without preamplifiers is detailed below. NOTE: These two wiring details represent interface with two different hardware versions which must be selected at time of purchase. The top diagram “3TX-pH/ISE” is for sensors without internal/integrated preamplifiers. The bottom diagram “3TX-pH/ISE-X” is for sensors with internal/integrated preamplifiers. The 4-20mA analog output connects at terminal 7, digital outputs at terminals 9 & 10



Connection Diagram of pH, ORP and Ion Selective (ISE) Sensors WITHOUT Preamplifiers (Tinned Leads Only) to FX-300-pH pH/ORP Transmitters and FX-300-ISE Ion Selective Transmitters

Cable Color Coding	Instrument Terminal Value	FX-300-pH/ISE Terminal Number
Red	pH/ISE Sensor (-) *a.k.a Reference*	1
Clear	pH/ISE Sensor (+) *a.k.a mV Signal*	2
Black	Pt100 or Pt1000	4
Black	Pt100 or Pt1000	5

Note 1: The 3TX-pH transmitter can be used for either pH or ORP measurement and wiring connections are the same for both pH and ORP sensors (only the Parameter No. 03 needs to be changed/toggled to select between the two input types). For ORP sensors select mV as the input type in P03.
Note 2: For 3TX-ISE the ion measurement type (ammonium, fluoride, nitrate, calcium.etc) must be defined at time of purchase and cannot be changed after receipt of transmitter (see label on 3TX-ISE for which ion measurement type is supported for that given unit).
Note 3: Depending upon the Temperature Compensation ordered it may be necessary to change the parameter 04 from PT1000 (default) to PT100 (selectable).

Connection Diagram of pH, ORP and Ion Selective (ISE) Sensors WITH Preamplifiers (Tinned Leads Only) to FX-300-pH pH/ORP Transmitters and FX-300-ISE Ion Selective Transmitters

Cable Color Coding	Instrument Terminal Value	FX-300-pH/ISE Terminal Number
Green	+5V Power (Green)	1
White	pH/ISE Sensor (+) *a.k.a mV Signal*	2
Black	-5V Power (Black)	3
Yellow	TC (Yellow)	4
Blue & Red	TC (Blue) & Common–Ground–Reference (Red)	5

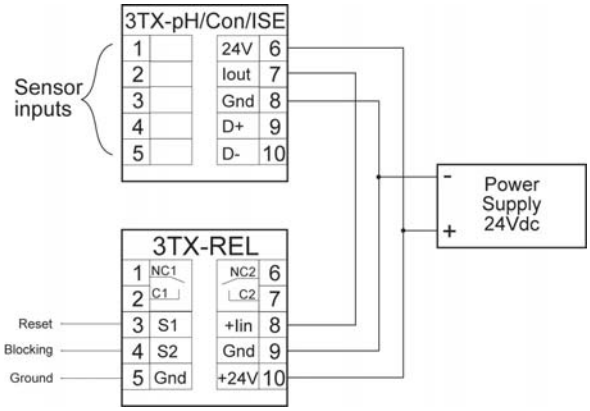
Note 4: Mating pH/ORP/ISE sensor must have the appropriate type of preamplifier integrated inside the sensor or using an external preamplifier in a waterproof J-Box to interface with the FX300-pH-X or FX300-ISE-X transmitter. These FX300-pH-X & FX300-ISE-X are different hardware from the FX300-pH and

INSTALLATION

FX300-ISE transmitter that can directly interface pH/ORP/ISE sensors WITHOUT preamplifiers. The software and functionality is identical for both types of transmitter; the only difference is whether the sensor to interface must or must not have a preamplifier. The maximum recommended cable length for sensors with preamplifiers is 300 feet (in conduit).

Wiring the FX300-REL Alarm /Relay Control Module

Standard Wiring Configuration (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. Please see the following page for this schematic)*

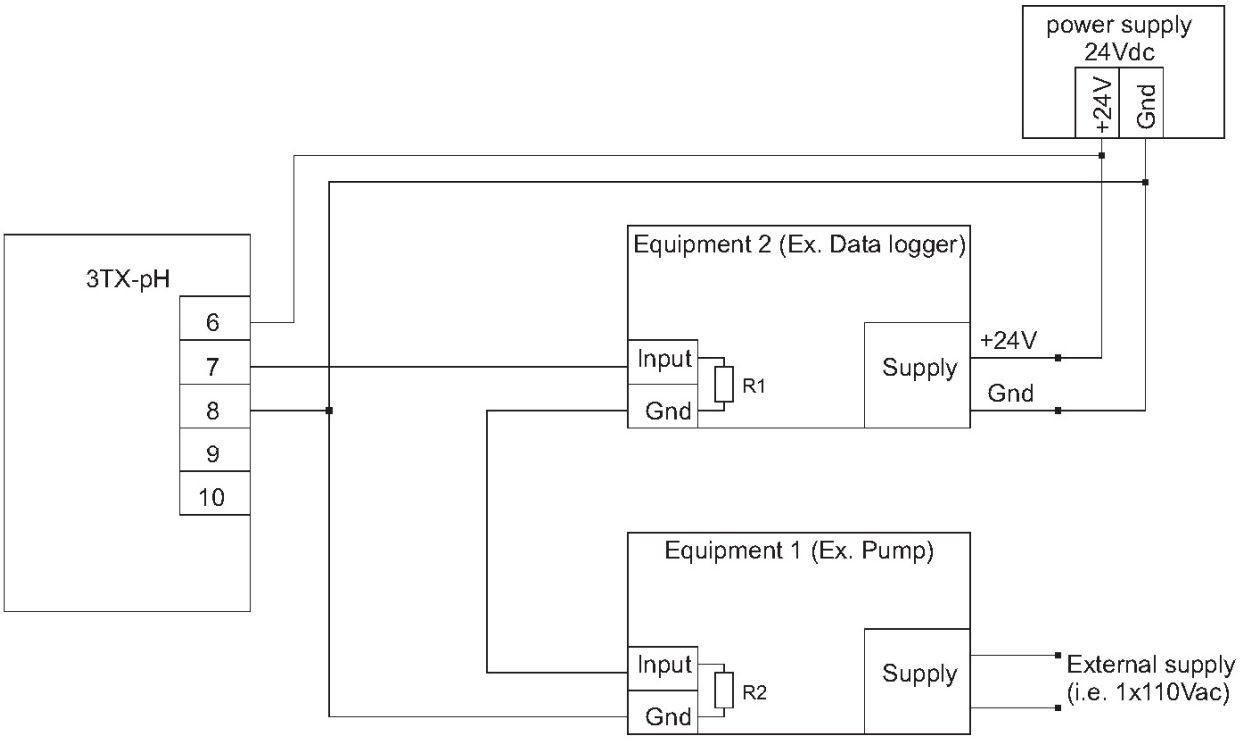


Complete information on the FX-300-REL module is included later in this manual.

INSTALLATION

Wiring the FX300-REL Alarm /Relay Control Module

Alternate wiring schematic for adding other devices to the 0/4-20mA transmitter output loop is to first (also) be sent to another data acquisition or control device. Complete information on the FX-300-REL module is included later in this manual.

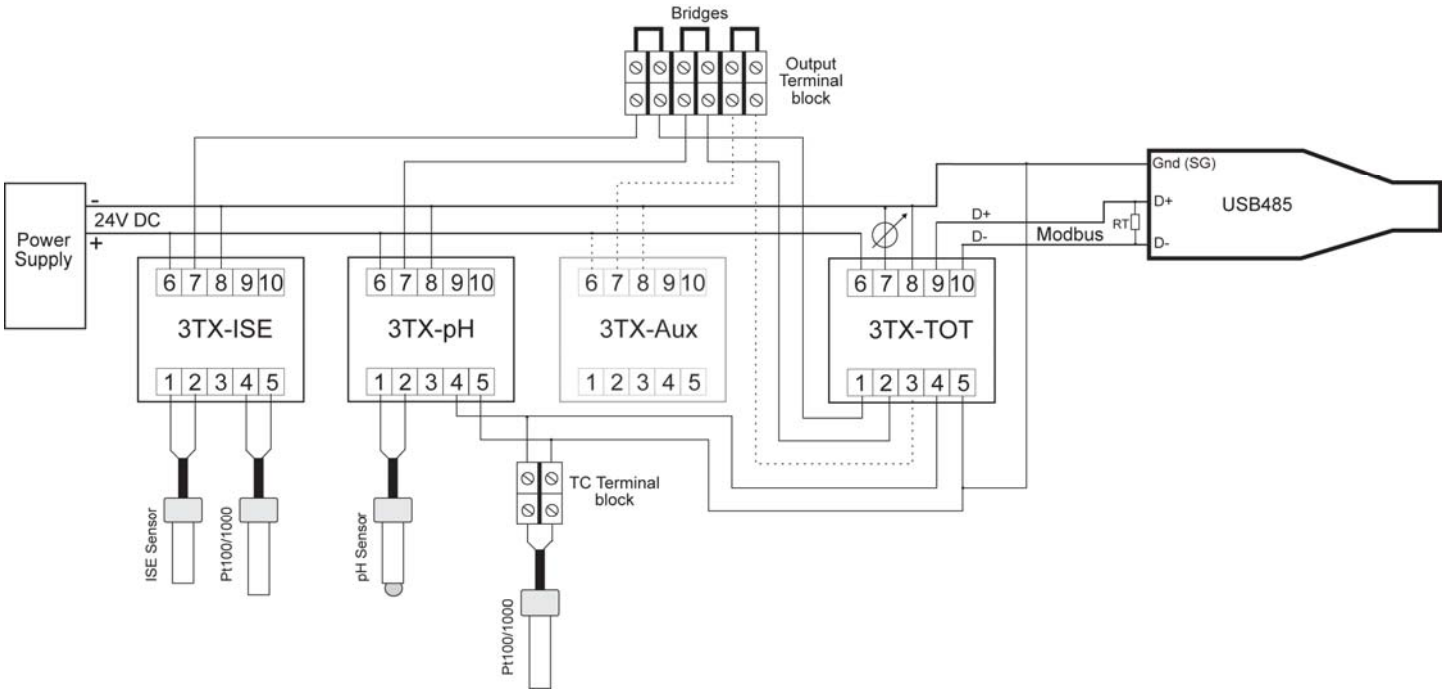


Note:
R1 and R2 are internal resistors.
R1 + R2 < 500Ω

INSTALLATION

Wiring the FX-300-TOT Module

Wiring Approach 1: Spliced Pt100/Pt1000 Temperature Input to 3TX-TOT



Notes about wiring Approach 1:

** The optional 3TX-Aux shown can be any additional measurement transmitter such as 3TX-pH, 3TX-ISE or 3TX-CON*

** The jumpers from the Output Terminal Block can be removed so that the current loop output can be sent to any data acquisition or control system.*

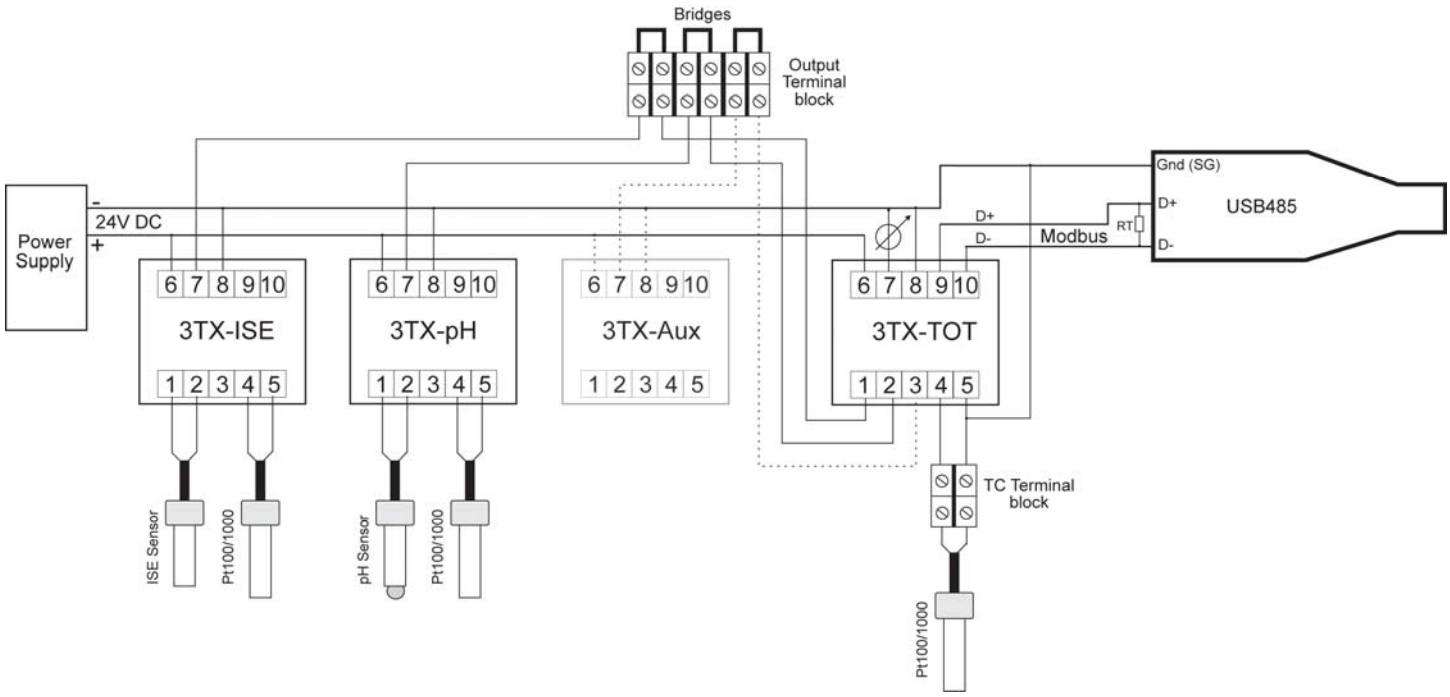
** When purchased as a complete assembly, specify your desired wiring approach and all units will be pre-wired at ASTI factory prior to dispatch.*

Complete information on the FX-300-TOT module is included later in this manual.

INSTALLATION

Wiring the FX-300-TOT Module

Wiring Approach 2: Raw Pt100/Pt1000 Temperature Input to 3TX-TOT



** The optional 3TX-Aux shown can be any additional measurement transmitter such as 3TX-pH, 3TX-ISE or 3TX-CON*

Complete information on the FX-300-TOT module is included later in this manual.

INSTALLATION

Wiring the FX-300-TOT Module

Wiring Approach 3: 4-20mA Temperature Input to 3TX-TOT

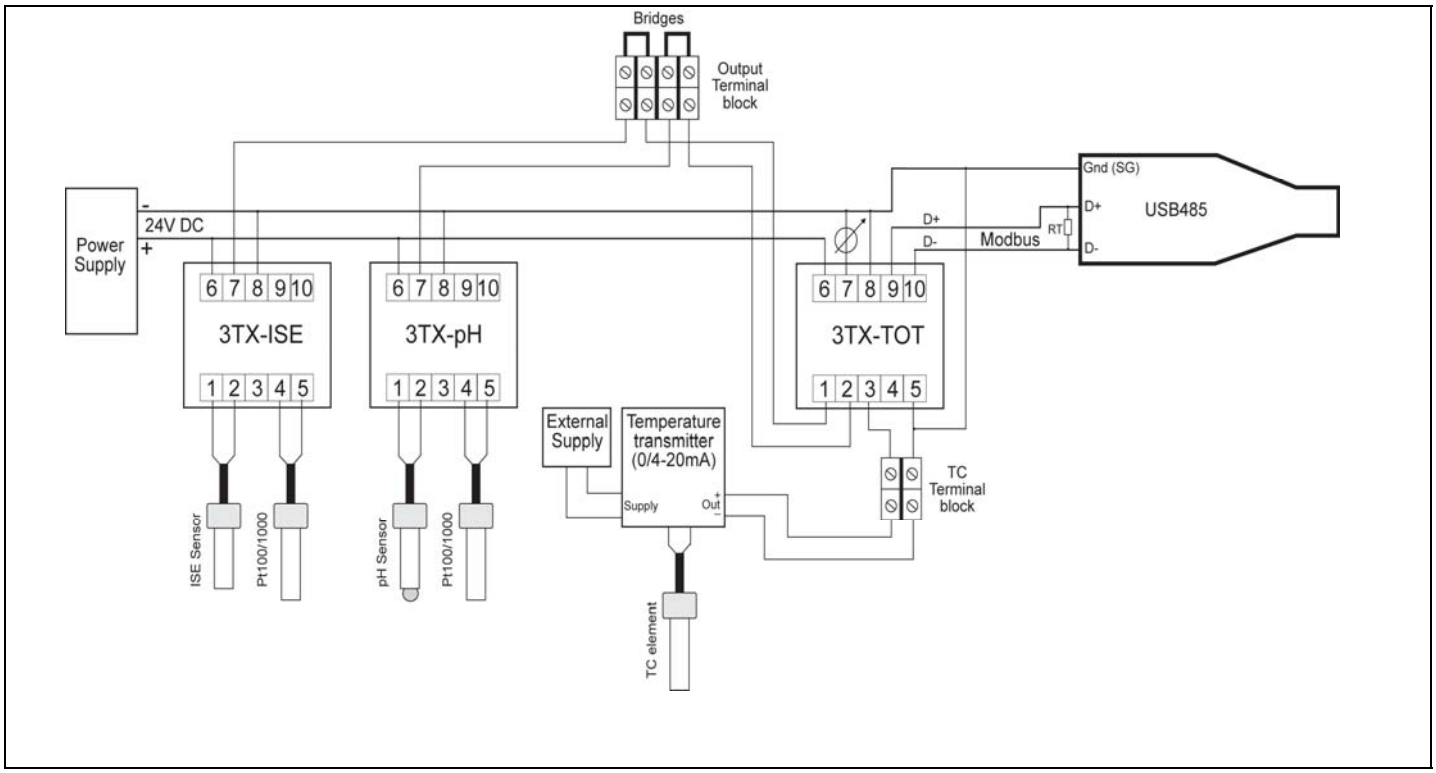
Notes about wiring Approach 3:

** In wiring Approach 3, it is not possible to have a third measurement transmitter (shown on Approach 1 & 2 as 3TX-Aux). The TC terminal block shown is optional.*

** The jumpers from the Output Terminal Block can be removed so that the current loop outputs can be sent to any data acquisition or control system.*

** When purchased as a complete assembly, specify your desired wiring approach and all units will be pre-wired at the factory prior to dispatch.*

Complete information on the FX-300-TOT module is included later in this manual.



CONFIGURATION

After verifying all electrical connections, program the module parameters as required for your application.

Function and Programming

The 20 programmable parameters are shown to the right. The 'Mode' key is used for selecting SETUP and the 'Up' and 'Down' keys are used to scroll through the parameters.

Select the parameter to be altered with the MODE key. Change the value with the UP or DOWN keys. **If the software lock (Par. no. 1) is "On" the parameter can only be read. Set to "Off "to change values.**

To exit SETUP mode, press the down key until P00 is displayed, then press MODE until ppm (run) mode LED lights

Par. no. 2 sets the module's address for Modbus communication.

Par. no. 3 indicates the type of input for the pH/mV input.

Par. no. 4 indicates the type of input for the temperature input. Pt1000 temperature compensation will indicate as "999" due to the 3-digit display.

Par. no. 5 If Par. no. 3 is set to pH, the signal is temperature compensated. Par. no. 5 sets the temperature compensation to either set (manual) or based on the measured temperature.

Par. no. 6 sets the temperature for when temperature compensation of the pH measurement is in set (manual mode).

Par. no. 7 If a long cable is used for the Pt100 sensor the cable impedance should be entered and compensated for this offset. Omit this parameter for Pt1000 sensors.

Par. no. 8 is used to set how the pH sensor slope is calibrated. If 3-Point Slope Option is (On), the sensor is calibrated to have two different slopes for the acidic pH range (i.e. between 6.86/7.00 and 4.01 buffers) and the alkaline pH range (i.e. between 6.86/7.00 and 9.18/10.00). If 3-Point Slope Option is (Off), the slope from a single slope calibration will be used in all pH ranges (0-14).

Par. no. 9 If Par.no. 3 is set to mV, the range is set using this parameter. It is possible to select the whole range (±1000mV), the negative range (-1000-0mV) or the positive range (0-1000mV). This setting impacts the analog output and transferred data.

Par. no. 10 is used to set the analog output proportional to either the pH/mV signal or the temperature signal.

Par. no. 11 sets the analog output to either 0-20 mA or 4-20 mA.

Par. no. 12 allows setting the output to be inverted for control use, output corresponding to 20-0mA or 20-4mA.

Par. no. 13 & 14 are used to set the pH value that corresponds to 0/4mA output set point (**Par no. 13**) and sets the pH value that corresponds to 20mA output set point (**Par no. 14**).

List of Parameters

No	Parameter	Description	Range	Default
01	Lock	**Software Lock**	On / Off	On
02	Address	Modbus	Off, 1…247	Off
03	pH/mV	Type of Input	pH, mV	pH
04	Temperature	Type of Input	**Pt100, Pt1000**	Pt1000
05	Compensation	Temp. Comp.	Auto, Set	Auto
06	Manual Temp	Fixed Temp	0...210	25
07	Cable Impedance	Impedance of Pt100 Cable	0.0 .. 9.9 Ohm	0.0
08	3-Point Slope Option	Calibration of Sensor Slope	Off (2-Point) On (3-Point)	Off
09	Range mV	Range for mV	**±1000, -1000 to 0 0 to +1000**	±1000
10	Input for Iout	Input used for output	pH or Temperature	pH
11	Iout	Type of output	**4-20mA, 0-20mA**	4-20
12	Iout mode	Iout mode	Non-inverted, inverted	n.inv
13	0/4mA Set	Low Setpoint	0.0-13.0 pH	0.0
14	20mA Set	High Setpoint	1.0-14.0 pH	14.0
15	Step Change	mV Increment for Calibration	0=0.2, 1=0.5, 2=1.0, 3=2.0	1 (0.5mV)
16	Offset	mV @ pH 7	±250 mV	0
17	Slope 1	mV per pH	30 to 90	59.2
18	Slope 2	mV per pH	30 to 90	---
19	0/4mA Offset	Trim Low	±9.99%	0.00
20	20mA Gain	Trim High	±9.99%	0.00
21	Energy Save	Energy Save	On / Off	On
22	Baudrate	Modbus	9,600/19,200	19,200
23	**Back to Default**	**Reset to Default**	**Def=Reset, Par=NoReset**	**Par**

The minimum difference between Par no. 13 and 14 must be at least 1.0 pH unit although it is fully scalable without the ranges specified.

Par. no. 15 Variable to define the mV change for each "Up" or "Down" button depression when calibration is performed.

Par. no. 16 View & edit working sensor offset (Abs mV at pH 7)

Par. no. 17 View & edit working sensor slope 1. If P08 is OFF (default) then slope for full 0-14 range. If P08 is ON (3-Point Cal / Dual Slope mode) then this is the slope for 0-7 pH range.

Par. no. 18 View & edit working sensor slope 2 for 7-14 pH range. This is valid only if P08 is ON, or else just blank "---" no value.

Par. no. 19 Offset adjustment for 0/4mA low analog output trim.

Par. no. 20 Gain adjustment for 20mA high analog output trim.

Par. no. 21 If no keys are pressed for 10 minutes the display will show a flashing bar (Energy Save). Pressing any key to return.

Par. no. 22 The Modbus standard requires a baudrate of 9,600 or 19,200 set in accordance with the Modbus-master.

Par no. 23 Feature to reset the analyzer back to factory default.

CONFIGURATION

Buffer / Slope Adjustment

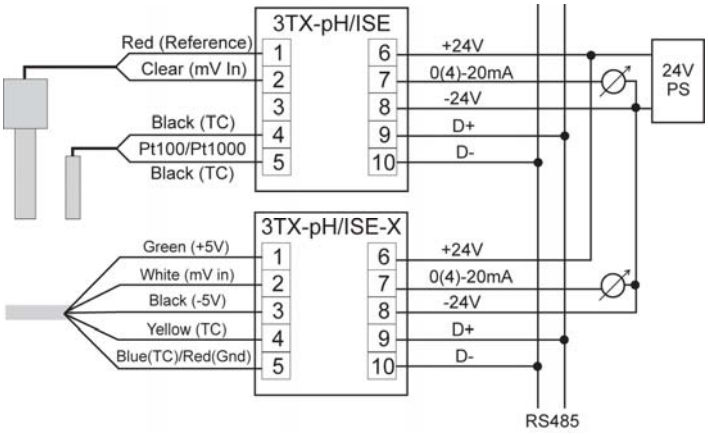
Calibration of the pH electrode is done via the Up/Down keys on the front. Using the 'Mode' key select 'Buffer' and calibrate the electrode to pH7 using the Up/Down keys until the display reads 7.00. Next select 'Slope' and use the Up/Down keys, until the display reads the desired value.

If dual-slope mode is enabled (Parameter 8) the electrode must be calibrated at a total of three points - one at pH 7 (in the 'Buffer' cal mode) then in a pH buffer above pH7 (in the 'Slope' cal mode) and then in a pH buffer below pH7 (in the 'Slope' cal mode). You must exit the 'Slope' mode after completng the acidic slope calibration before entering the alkaline slope calibration.

The 'Buffer' calibration mode can also achieve a process offset calibration where the online reading can be made to agree with any grab sample analysis.

It is possible to manually enter the sensor offset and slope(s) values using **P16**, **P17 & P18** respectively. All settings are stored in EEProm so unit can be powered down without loss of configuration or calibration.

Typical Installation



The wiring for sensors with and without preamplifiers are detailed above. Note that these two wiring details represent interface with two altogether different hardware versions which must be selected at time of purchase.

NOTE: The raw uncompensated (a.k.a. "absolute") mV potential of the pH sensor is displayed by pressing the "Down" key in the main pH/mV display mode. The display now changes from pH to absolute mV units. Negative values will be displayed flashing. The temperature can be calibrated pushing the "Up" or "Down" buttons when in the temperature display (°C) mode.

CONFIGURATION

MODBUS

n order to utilize the Modbus interface the FX-300-pH must be ordered with Modbus. FX-300-pH may be used as a slave for the 'Dat' - unit FX-300-DAT or as a slave in a SCADA system. The setup / communication for each case will be explained in the following.

With FX-300-DAT

If FX-300-pH is used together with the FX-300-DAT, the user must pay attention to two things: The baud rate on the Modbus as well as the address of the FX-300-pH. **The baud rate (P14)** must be set to the baud rate of the FX-300-DAT. Whether a baud rate of 19,200 or 9,600 is used is of no importance, as long as all units on the Modbus are set to the same baud rate.

The address (P02) must be unique in the network; Two units are not allowed to have the same address. In a network with the FX-300-DAT as the master, all addresses must be assigned without leaving any address out; i.e. if 3 units are connected to an FX-300-DAT, the addresses 1, 2 & 3 must be assigned to the three units. The order of the addresses is of no importance. In a network with an FX-300-DAT, up to 14 slaves may be connected, allowing only the addresses 1 through 14.

In a SCADA system

Since different SCADA systems may have different restrictions only the general are mentioned here: **The baud rate (P14)** must be set to the baud rate of the SCADA system. **The address (P02)** must be unique in the network; Two units are not allowed to have the same address.

Modbus Scaling

Note that the scaling for the pH/mV output is always the full scale 0-14 pH range and ±1000mV for ORP and this may differ from the 0/4-20 mA analog output scaling.

The FX-300-pH contains 2 measurements (pH/mV and temperature). Access to these are gained through the function code *Read_Input_Registers (04)*. The FX-300-pH gives access to different diagnostic values via *Diagnostics (08)*, as shown in the following.

Read_Input_Registers

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

Value 1 is pH/mV and value 2 is temperature. The measurements are transmitted in sequence; If 2 values are chosen both pH/mV and temperature are transmitted. For instance, if the value for temperature is wanted, 2 values must be requested. Both values are rated to 0-1000 corresponding to the range, but the temperature has an offset of 1024; i.e. 0-14pH is transmitted as 0-1000 and 0-210°C as 1024- 2024.

Diagnostics

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

INSTALLATION, SENSORS

New pH Sensor Installation Overview

The industrial pH sensor can be installed into service by use of an inline installation (in a pipe tee or flow cell) or by immersion or submersion style installation.

For inline installation, be sure not exceed the flow pressure rating of a given sensor.

Do not allow air bubbles to get trapped near the sensor membrane. This will cause erroneous readings and drift. This potential problem is best alleviated by installing the sensor between just above the horizontal (whether inline or in a tank) to perpendicular to the pipe with sensor tip pointing down. pH sensors should NEVER be installed in a horizontal or inverted configuration as this may lead to erratic and unreliable reading.

In addition, most industrial sensors are liquid or semi-liquid filled and as such may have a small air pocket inside the sensing element. To ensure that there is not an air pocket caught inside the sensing element, simply shake the sensor gently downward. The small capillary force holding the air bubble in place inside the sensing element will be overcome by a gentle downward shake.

Thermal equilibrium between the sensor and process solutions at elevated or depressed temperature (not at 25 degrees Celsius) is generally better achieved via immersion or submersion installation styles. Submersion style sensors do require water proofing.

New pH Sensor Installation Overview:

1. Mount the sensor as required, typically into a 1” to 2” pipe tee. Before inserting the sensor into the fitting, gently shake the sensor downward eliminate the possibility of an air pocket contacting the sensing element.
2. Refer to schematic “Wiring the Sensor to the Measurement Module” and connect the sensor wires to the analyzer.
3. For a new pH sensor, perform a two point calibration using pH standard solutions required for your application to empirically determine the slope (see procedure on following pages).

   NOTE: Care should be taken not to move or touch the cable while a value is being stabilized. Touching the sensor cable can cause a noisy signal that may result in erroneous values and calibrations.
4. Mount the sensor into the process solution and allow it to find electrochemical and thermal equilibrium (assuming the process conditions are stable). The time required for this may vary from 15 minutes up to 24 hours depending upon the particular application.
5. Perform the 1-point offset calibration to bring the sensor into agreement with a grab sample analysis. The sensor is left in service for this procedure. Once complete the sensor is ready to use.

Sensor Calibration

For optimal results all calibration solutions and process grab samples should be calibrated and tested at temperatures identical to the process temperature. The actual temperature of the process solution (and thereby the calibrating solutions as well) is not as critical as the fact that they are calibrated at the same temperature to eliminate all potential sources of uncertainty.

Calibration solutions should be fresh, kept clean, and stored in a cool, dry place out of direct sunlight and/or other high-energy radiation sources to maximize accuracy of their values.

Always rinse the sensor with distilled or deionized water and gently blot dry with a soft lint free cloth before placing the sensor into a different buffer solution during calibration.

Performing the Two Point Slope Calibration

To calibrate you will need:

- A *clean* sensor. Please refer to the cleaning procedure in the previous section.
- A 250 ml glass or plastic beaker that is heavy enough to prevent the sensor from tipping the beaker.
- High pH buffer solution
- Low pH buffer solution
- Distilled or deionized water
- A soft lint free cloth

1. Fill a 250 ml beaker with enough high buffer solution so that the entire tip of the pH sensor will be submersed.

   NOTE: For 2-point calibration always start with the high 7.0 buffer solution first.

2. Allow a minimum of 3 – 5 minutes for the sensor to stabilize in the high buffer solution. The time to reach electrochemical and thermal equilibrium may take several hours in some cases.

   NOTE: Do not to move or touch the cable while a value is being stabilized. Touching the sensor cable can cause a noisy signal that may result in erroneous values and calibrations.

3. With a stable reading displayed, press the “Mode” key until the SETUP indicator lights.
4. Press the Down key to select parameter P01, LOCK. Use the Up/Down key to turn software lock to “OFF”. Select by pressing the Mode key.
5. Press the Down key until P00 is displayed, pres Mode to exit SETUP.
6. Press the Mode key until the BUFFER indicator lights. This is the high buffer calibration mode. Press the Up/Down key as required to enter the calibration solution pH value.
7. Rinse the sensor with distilled or deionized water and blot dry with a soft lint free cloth before placing it into the low buffer solution.
8. Press the Mode key until the SLOPE indicator lights. This is the low buffer calibration mode. Press the Up/Down key as required to enter the calibration solution pH value.
9. Press the Mode key until the pH indicator lights. This is the run mode.

NOTE: There is no need to go back and turn the software lock to ON, it will revert to this mode automatically after a period of time

Sensor Calibration

Performing the 1-Point Offset Calibration

The 1-Point offset calibration is used to bring the online pH or ORP sensor into agreement (or, standardized) with a grab sample analyzed by an alternate method. It can be performed as often as desired without ever having to remove the sensor from process service.

To calibrate you will need:

- The pH value determined by analysis of the grab sample.
- The sensor running normally in the process.

1-Point Offset Calibration Procedure

1. With the sensor installed in service, allow at minimum 3-5 minutes for the sensor to display a stable reading with the process.

   NOTE: Do not to move or touch the cable while a value is being stabilized. Touching the sensor cable can cause a noisy signal that may result in erroneous values and calibrations.
2. With a stable reading displayed, press the “Mode” key until the SETUP indicator lights.
3. Press the Down key to select parameter P01, LOCK. Use the Up/Down key to turn software lock to “OFF”. Select by pressing the Mode key.
4. Press the Down key until P00 is displayed, pres Mode to exit SETUP.
5. Use the ‘Mode’ key to select BUFFER mode, the LED will light.
6. Use the Up/Down keys to adjust until the display shows the correct value in accordance with the pH determined by analysis of the grab sample. Press Mode to select.
7. Press Mode to return to pH (run) mode.

NOTE: There is no need to go back and turn the software lock to ON, it will revert to this mode automatically after 10 minutes.

Sensor Calibration

3-Point Calibration

If the 3-Point Slope Option is (On), the sensor is calibrated to have two different slopes: for the acidic pH range (i.e. between 4.01 and 6.86/7.01) and the alkaline pH range (i.e. between 6.86/7.01 and 9.18/10.00). The three points include the mid-point, typically 6.86-7.01 pH, the low point in the acidic range, typically 3.99-4.01 pH, and the high point in the alkaline range, typically 9.18-10.00 pH.

If the 3-Point Slope Option is set to "Off", the slope from a single slope calibration will be used in all pH ranges (0-14).

3-Point Calibration Procedure

To calibrate you will need:

- A *clean* sensor. Please refer to the cleaning procedure in the previous section.
- A 250 ml glass or plastic beaker that is heavy enough to prevent the sensor from tipping the beaker.
- High pH buffer solution
- 7.0 pH buffer solution
- Low pH buffer solution
- Distilled or deionized water
- A soft lint free cloth

1. Fill a 250 ml beaker with enough 7.0 pH buffer solution so that the entire tip of the pH sensor will be submersed.
    a. **NOTE: For 3-point calibration always start with the 7.0 buffer solution first.**
2. Allow a minimum of 3 – 5 minutes for the sensor to stabilize in the buffer solution. The time to reach electrochemical and thermal equilibrium may take several hours in some cases.

    NOTE: Do not to move or touch the cable while a value is being stabilized. Touching the sensor cable can cause a noisy signal that may result in erroneous values and calibrations.
3. With a stable reading displayed, press the "Mode" key until the SETUP indicator lights.
4. Press the Down key to select parameter P01, LOCK. Use the Up/Down key to turn software lock to "OFF". Select by pressing the Mode key.
5. Press the Down key until P00 is displayed, pres Mode to exit SETUP.
6. Press the Mode key until the BUFFER indicator lights. This is the 7.0 pH buffer calibration mode. Press the Up/Down key as required to enter the offset, or, calibration solution pH value. Press Mode key to accept.
7. Rinse the sensor with distilled or deionized water and blot dry with a soft lint free cloth before placing it into the low buffer solution.
8. Allow the sensor to stabilize, indicated by a stable display reading.
9. Press the Mode key until the SLOPE indicator lights. This is the low (4.0 pH) buffer calibration mode. Press the Up/Down key as required to enter the calibration solution pH value. Press Mode key to accept and exit.

Sensor Calibration

3-Point Calibration Procedure continued

10. Rinse the sensor with distilled or deionized water and blot dry with a soft lint free cloth before placing it into the high (10.0 pH) buffer solution.
11. Allow the sensor to stabilize, indicated by a stable display reading.
12. Press the Mode key until the SLOPE indicator lights. Press the Up/Down key as required to enter the calibration solution pH value. Press Mode key to accept and exit back to pH (run) mode.

NOTE: There is no need to go back and turn the software lock to ON, it will revert to this mode automatically after 10 minutes.

Calibration Notes:

THERE IS A TIME AVERAGING (DAMPEN) FUNCTION THAT IS SET IN THE FX-300-ISE AT THE FACTORY. THIS VALUE IS CONFIGURABLE FOR BOTH THE EXTENT OF TIME AVERAGING FOR THE MEASURE AND CALIBRATE MODES SEPARATELY. IF YOU FIND THAT YOU WISH TO HAVE MORE OR LESS TIME AVERAGING THAN WHAT IS PROVIDED ON YOUR UNIT AT PRESENT, CONTACT THE FACTORY FOR ASSISTANCE WITH THIS. THESE VALUES CANNOT BE MODIFIED IN THE FIELD BUT RATHER NEED TO BE CHANGED AT THE FACTORY. THE PRESET VALUES ARE FINE FOR THE VAST MAJORITY OF USERS AND APPLICATIONS ALTHOUGH THEY CAN BE MODIFIED UPON REQUEST WITHOUT INCURRING ANY COST.

You can view the sensor slope resulting from a 2-point calibration with parameter P15 and the sensor offset resulting from a 2-point calibration with parameter p14. If you perform a 1-point grab sample offset subsequently the offset (P14) will change whereas the sensor slope (P15) will remain from your 2-point slope calibration.

To view the slopes resulting from a 3-point calibration enter the Setup mode and select parameters P16 the working sensor offset (absolute mV at pH 7), P17 the slope for 0-7 pH range, and P18 the slope for 7-14 pH range.

All settings are stored in EEPROM so the unit can be powered down without loss of configuration or calibration.

THE “HOLD” FEATURE IS AUTOMATICALLY ACTIVATED EACH TIME ANY 2-POINT OR 1-POINT CALIBRATION IS PERFORMED. THIS MEANS THAT THE LAST PROCESS VALUE WILL CONTINUE TO BE SENT VIA THE ANALOG 4-20 mA AND MODBUS DIGITAL OUTPUT BEFORE ENTERING THE CALIBRATION MODE. THIS IS THE DEFAULT BEHAVIOR AND CAN ONLY BE MODIFIED AT THE FACTORY IF THIS IS NOT DESIRED.

The decimal place on the display will automatically move as appropriate based upon the ppm value of the sensor reading. Note that the display will always auto-range from 0.00 to 9.99, 00.0 to 99.9 and 000 to 999 ppm.

Your analog and digital Modbus output will, however, be defined as selected in parameter P09. This means that your output may be maxed out and not reflect the exact process reading if you selected too low a range for your output scaling in P09.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

Note: The recommendations given in this document are valid for most of our Industrial pH and ORP sensors. Care and maintenance for your particular sensor may vary from that described here. Contact the factory for specific information regarding proper care and maintenance of your particular pH or ORP sensor for a given installation and application.

No sensor should be used beyond the indicated temperature and pressure limitations for that given sensor. Sensors should only be used for the application(s) that an authorized representative has recommended. If you are unsure that your sensor is recommended for a particular application, please contact the factory.

Storage

The standard shelf life for our pH and ORP sensors is one year from the date of shipment. Sensors stored longer than this period may still be functional but are no longer under warranty. Sensors should be stored in a cool, dry location with the sensor tip (where the pH/ORP element is located) oriented toward the ground. All sensors come standard with a conditioning solution in the cap. This conditioning solution is 50% pH 4 buffer and 50% saturated potassium chloride (mixed by volume). The sensor cap should grip the sensor body tightly and be sealed with common Teflon pipe thread sealing tape when the sensor is not in use.

Sensors that are to be returned for a shelf life warranty claim must have the original sensor cap and conditioning solution intact to be eligible for warranty replacement. Contact the factory before returning any sensor for warranty claim to obtain a valid RMA.

Cleaning

Cleaning methods vary greatly depending upon the application for which the sensor is used. Some common rules for cleaning include:

1. It is best to soak the sensor tip in a cleaning solution and rinse. Never scratch or aggressively scrub the pH or ORP elements. These are delicate glass electrochemical electrodes. They can be broken easily by mechanical force.

2. If necessary you may scrub the tip for 15 seconds with a toothbrush dipped in isopropyl alcohol or one of the approved cleaning solutions below, followed by rinsing well with distilled or deionized water

3. The reference junction is a solid state non-porous cross-linked conductive polymer embedded in a porous Kynar matrix. Since the reference is solid state, it can be cleaned with aggressive chemicals. This solid state reference can also be cleaned effective by using a sharp razor edged tool. GREAT CARE SHOULD BE TAKEN NOT TO SCRATCH THE pH GLASS OR ORP ELEMENT DURING CLEANING OF THE REFERENCE JUNCTION.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

Cleaning continued

Common approved cleaning solutions include:

5-15% Hydrochloric Acid – (For Alkaline deposits)

5-15% Sodium Hydroxide – (For Organic Contaminants)

Surfactant (NON-IONIC SOAPS SUCH AS MICRO-90)

Please inquire to the factory if you plan to use any other cleaning agent.

Conditioning for Calibration

After the sensor has been cleaned, it must be thoroughly rinsed with distilled or deionized water to remove any residual cleaning reagents. The sensor can then be soaked in pH 4 buffer to recondition the pH and reference elements. Some sensors will also require a conditioning in saturated potassium chloride if the reference junction has been depleted of the ions in the solid state conductive polymer (typical for clean water applications). Condition the sensor in saturated potassium chloride and/or pH 4 buffer for whatever period of time is required to achieve optimal calibration results.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

SENSOR WATER PROOFING RECOMMENDATIONS

There are a variety of options available according to sensor mounting style and application to protect the back of the sensor and cable from moisture, exposure to oxidizing or corrosive gases, oxidizing or corrosive liquids, and abrasive process media.

The degree of protection varies from sealing the back of the sensor and the cable where it connects to the sensor; to sealing the back of the sensor and totally isolating the cable back to the analyzer. Note that factory waterproofing options cannot be added once a sensor has been fabricated, they must be installed at the time of manufacture.

Protection can be provided in the field for certain applications as described below.

INLINE MOUNTING STYLE SENSORS

An inline mounted sensor is screwed into a pipe tee or flow cell. Only the sensing element contacts the process fluid.

The sealing on the back of standard, twist lock and immersion sensors is water resistant, but not waterproof. The standard isolation on the back of a sensor is a strain relief grommet. This allows for the sensor to be moved slightly and for some minor water exposure without causing sensor failure.

Standard inline, twist lock and immersion sensors are NOT intended to have rain or continuous contact with water on the back of the cable. In this case, a shorting can result that can result in abnormal performance or failure. ** IF ANOMALOUS PERFORMANCE OR FAILURE RELATED TO THIS OCCURS THIS IS CONSIDERED AN IMPROPER INSTALLATION ISSUE AND THUS IS NOT COVERED UNDER THE STANDARD FACTORY WARRANTY **

For more aggressive water exposure to the back of the sensor, additional precautions must be taken.

INLINE USE INDOORS:

If a standard immersion or twist lock sensor is used for inline installations only (no immersion or submersible use is planned) then no special precautions are required for indoor use. This assumes that the back of the sensor will not be exposed to corrosive gas that may be present and/or the plant will not cause any process media to get onto the back of the sensor, nor give it significant water exposure by washing down the area.

INLINE USE OUTDOORS:

If a standard immersion or twist lock sensor is used outdoors for inline installations only (no immersion or submersible use is planned) there ARE special precautions required.

The most common option is to seal the back end of the sensor in conduit to isolate the back end of the sensor. Use sufficient Teflon tape and a NPT coupling to create a seal for the back of the sensor, and then connect this to either a rigid or flexible conduit back to the analyzer where the lead wires are terminated for cable isolation. This can prevent water from attacking the sensor along the sensor cable and causing internal shorting to solder joins inside the unit itself.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

SENSOR WATER PROOFING RECOMMENDATIONS

Another option for sealing the back of the sensor is to add a factory waterproofing option. In general, for most cases the least expensive “WPIT” option is sufficient. It’s intended to extend sensor life where the sensor can be damaged at the back end, usually by corrosion along the cable. It provides complete isolation of the back end threaded fitting from water and good protection of the cable from corrosion and chemical attack by using a waterproofing fitting, sealant and 3/8"X1/2" long vinyl tubing.

IMMERSION MOUNTING STYLE SENSORS

Immersion mounting is defined as when the sensor is immersed into the process media, but the entire sensor is not submersed. This means that the back of the sensor is NOT completely below the process media level.

Immersion installations *always* require waterproofing at the back of the sensor by attaching it with a mating 1" FNPT coupling, sealing, and running the cable in conduit. Factory waterproofing options can also be added to make the sensor life better even for such immersion installations. It is possible to use the standard immersion or twist lock sensor for immersion use without adding a waterproofing option if VERY GOOD care is taken to seal the back of the sensor with a coupling and properly running the cable in conduit back to the transmitter.

SUBMERSIBLE MOUNTING STYLE SENSORS

Submersible use is defined as when the sensor is COMPLETELY immersed into the process media anywhere from 1 foot below the fluid surface level or deeper. In this case the entire sensor, including the back of the sensor, is completely below the process media level.

Submersible installations always require the back of the sensor/waterproofing to be sealed with a mating NPT coupling and the cable run in conduit. For additional protection factory waterproofing can be added at time of order if desired or required. There is a special surcharge if the sensor has a longer cable length than the standard 10 feet for some waterproofing options.

It is possible to use the standard immersion or twist lock sensor for submersible use without adding a waterproofing option if extreme care is taken to seal the back of the sensor with a coupling and properly running the cable in conduit back to the transmitter. However, the use of factory waterproofing options is VERY STRONGLY recommended (although not strictly required) for submersible installations.

If you have any doubt about whether the exact sensor model that you are using is appropriate for the installation style you are planning to use, please contact the factory for further assistance.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

Regenerating pH & ORP Sensors

This is the procedure to restore pH and ORP sensors that have been stored correctly with their caps on, but beyond the shelf life of 12 months, or for those that have been left dry for an extended period of time.

The following procedure is about 90% successful for most sensor types where the 12 month shelf-life was exceeded during storage with the protective cap in place. This is based on a standard bench test over the buffer range of pH 7.00 (0mV) & pH 4.00 (+177mV).

The procedure has the ability to achieve a "mV response" from a probe for a performance of better than 90% of ideal (59.16mV per pH unit at 25 degrees Celsius).

Example: A pH reading at 7 is -8mV; pH reading at 4 is -159mV. Thus "total measured" is 167mv.

Response = {-8mv - (-159 mV)} / *177x* 100 = *167/177x100* = 94%.

Response is = Total Probe span (mV) / Theoretical Span (mV) x 100 = %.

PROCEDURE:

1. Remove the black caps and store for future re-use after the sensors have been reconditioned.
2. Soak the probes in a bucket of water for a minimum of one week, ensure the water level is covering 90% of the length of the probe; the level should be below the point where the cable enters the backend. This ensures a positive pressure of water on the tip to force the hydration of the reference.
3. Ensure all cables are "cable tied" to avoid tangles and confusion during handling.
4. Remove after 7-8 days and scrub the glass tip for 30 seconds with Bon Ami original formula (recommended to prevent scratching) "abrasive powder" paste using a toothbrush. Rinse the tip with (20%) HCI acid for 30 seconds. Wash and rinse away excess acid with water.
5. Place the probes in saturated KCI solution to a depth 1" for 2 to 3 days.
6. Remove from KCI solution, rinse with distilled or deionized (DI) water, and gently scrub the tips for 15 seconds with a toothbrush dipped in isopropyl alcohol. Rinse well with distilled or deionized water.
7. Replace all the black plastic caps to the probes with a storing solution in the cap consisting of a 50/50 mixture of pH 4 buffer & saturated KCI solution.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

Regenerating pH & ORP Sensors

PROCEDURE:

8. Bench test the probes in pH 7.00 (0mV) and pH 4.00 (+l77mV) to determine the "response" of each probe. The response = "Total Measured" mV Span of the probe, divided by actual range (174mv) x 100 = % Response. We would expect >90% to be returned to classed as a successful "Restore".

9. Ensure the tested & successful probes are correctly tagged & stored "tip down" in a vertical position, caps filled with storing solution" and well sealed or taped with plumbers Teflon sealing tape.

10. Once tagged these probes should be put into service as soon as possible.

pH Sensor Specifications

Specifications FX-300-pH-8052-1000

Part Number & Description	FX-300-pH-8052-1000, 1” MNPT Twist Lock Wide Range Low Impedance pH Sensor
General Specifications:	
pH Range:	0 to 14 pH (2 to 12 pH with low Impedence Option).
Temperature Range:	-5 to 70 ^{o} C
Pressure Range:	1 to 50 psig (6.9 to 345 kPa absolute)
Body Material:	RYTON (Poly-Phenylene-Sulfide)
Junction Material:	HDPE (High-Density-Poly-Ethylene)
Dimensions:	1.31” dia. X 8” overall length
Cable:	RG 174/U Coaxial (without preamplifier)
Connector:	BNC (unless otherwise specified)
pH Sensor Specifications:	
Measuring Glass Type:	Hemispherical, Green Glass (MUGG)
Dimensions:	Hemispherical, 8MM Green Glass (MUGG)
Sodium Ion Error:	Less than 0.15 pH in 1.0 M Na^{+} Concentration at pH 14.00
Acidic Error:	Less than 0.05 pH in 1.0 M HCl @ 0.00 pH
Reference System:	
Type	Double Junction
Reference Half Cell:	Ag/AgCl, Saturated KCl
Primary Junction:	Porous Ceramic, Saturated KCl in crosslinked polymer
Secondary Junction:	Porous HDPE, Saturated with KCl in crosslinked polymer
Surface Area:	366,000 mil^2 (236 mm^2)
Special Features:	Crosslinked polymer is resistant to heat, solvents and to most chemicals. Sensor holds an excess of KCl, assuring saturation at all temperatures and extending in situ sensor life. The reference system holds a generous supply of aqueous saturated KCl, eliminating effects of intruding contaminants and permits the sensor to be left in dry condition for extended periods of time.
Recommended Applications:	Wastewater treatment, chemical processes, pollution control, measurements where long service life or operation at remote locations where (no) low maintenance is required.
Storage and Shelf Life:	At room temperature with closed protector cap, 1 year from date of manufacture.
Standard Hook-Up Options	No Preamp - BNC Connector + TC lead wires
	With Preamp – Multiconductor Lead Wires – See Hook Up Schematics

Additional Measurement or Function Modules

If you wish to install additional measurement modules or modules to provide additional function, please refer to the following guides pertaining to each module for product information and wiring schematics. Please also refer to the documentation included with your particular sensor.

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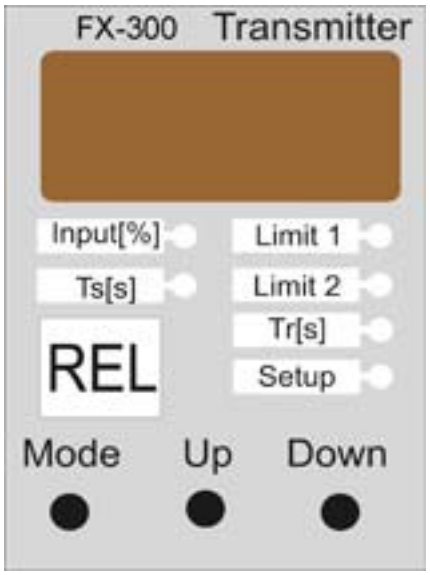
FX-300–REL Alarm Relay and Controller Module

- FX-300-REL is a versatile controller and alarm module with 2 independent limits
- Performs alarm relay and/or controller function for FX-300-pH/ORP, FX-300-ISE or FX-300-CON measurement modules
- Offering Simple On/Off as well as more sophisticated Time Proportional Control (TPC) and Proportional Frequency Control (PFC) a.k.a. Variable Pulse
- One FX-300-REL module is required for control and/or alarm function for each FX-300 measuring module (i.e., 1 each analog input per FX-300-REL module)
- Analog input: 0-20mA or 4-20mA
- Maximum or minimum limits can be configured for each of the 2 relays
- Configurable start timer and reaction timers
- 24VDC power operation, 5A max load/rating for each dry contact relay
- Hold function to disable relays during calibration and maintenance of measurement transmitters and sensors
- Scaling in native measurement units (pH, ppm, µS/mS) for all configurable parameters for ease of use and programming
- DIN rail mountable; small form factor for tight space installations
- Field installations using NEMA 4X enclosures, supporting up to a total of 8 ea FX-300 transmitter modules in a single enclosure



FEATURES

Application

FX-300-REL modules are ideal for supervising mA signals. This unit is fully compatible with the output provided by all of our FX-300 measuring transmitters (FX-300-pH, FX-300-ISE, and FX-300-CON). Simple On/Off as well as programmable control functionality is possible with the FX-300-REL module.

Analog Input

The analog input is a current input, and may be set up to either 0-20mA or 4-20mA. The 3XT-REL can be scaled so as to match exactly the 0-20mA or 4-20mA analog output from the FX-300-pH, FX-300-ISE & FX-300-CON measurement modules.

Digital Input

The FX-300-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, the accepted input voltage range is 5-30VDC. 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 FX-300-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, ppm, µS/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 FX-300-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.

FX-300-REL *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
Temp.: Weight:	Max torque 0.6 Nm -15 to +50 °C
Dimensions:	200 grams (7.04 ounces) 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
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 spec.:	250VAC / 5A
CE mark:	EN61326A

PARAMETERS

Function and Settings

Parameter No. 01 is a "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'** and press 'Mode' key.

Par. no. 2. Hold (Relay condition held – signaled by flashing input LED)

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

Par. no. 4. Indicates the type of limit 1: Min. or Max.

Par. no. 5. Indicates the type of limit 2: Off, Min. or Max.

Par. no. 6. Select if display will show % (4mA=0%, 20mA=100%), pH units, Conductivity Units (either µS or mS), or ISE units (ppm)

Par. no. 7. When P05 is ISE, selects full scale range on FX-300-ISE module's 4-20mA output. 'Lo' is 0-10 ppm, 'Mi' is 0-100 ppm & 'Hi' is 0-999 ppm.

Par. no. 8. When P05 is set to CON, this selects the full scale range on the corresponding FX-300-CON measurement module 4-20mA. Each cell constant will define the full range scale. For K=0.01, Max=0.5mS; K=0.1, Max=5mS; K=1.0, Max=50mS; K=2.0, Max=100mS, K=10.0, Max=500mS

Par. no. 9. * This defines the value of the 4mA input. When P06 is % there are no adjustments possible. When P06 is ISE the value should match P10 on the FX-300-ISE module to which is it connected. When P06 is CON, then this will always be 0mS (no matter what the cell constant). When P06 is pH, the value should match P13 on the FX-300-pH module.

Par. no. 10. * This defines the value of the 20mA input. When in P06 is % there are no adjustments possible. When P06 is ISE the value should be adjusted to match P11 on the FX-300-ISE to which is it connected. The difference between P09 and P10 when P06 is ISE must be at least 20% of the operating range (P09 on the FX-300-ISE). When P06 is CON then this will by default be the maximum full range scale associated with the conductivity cell constant selected. This value should match value of P12 on the FX-300-CON. The minimum value is 10% of full range. When P06 is pH, the value should match P14 on the FX-300-pH module. The minimum difference between P09 & P10 when P06 is pH is 3 pH units.

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 when in PFC mode (P11=3)

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

Par. no. 17. Common parameter - If On/Off mode (P11=1) then hysteresis (dead band) - If TPC or PFC (P11=2/3) then proportional band – For Limit 1

Par. no. 18. Common parameter - If On/Off mode (P12=1) then hysteresis (dead band) - If TPC or PFC (P12=2/3) then proportional band – For Limit 2

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

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	0-20mA, 4-20mA	0-20
04	Limit 1	Type of limit	Min (Lo), Max (Hi)	Hi
05	Limit 2	Type of limit	***Off, Min (Lo), Max (Hi)***	Lo
06	Display Mode	Type of Input Measurement	%, pH, CON, ISE	%
07	ISE Range	ISE Range Input	Lo, Mi, Hi	Lo
08	Con Range	Conductvity Cell Constant	0.01, 0.1, 1.0, 2.0, 10.0	1.0
09	4mA Scale	Reading @ 4mA	*	*
10	20mA Scale	Reading @ 20mA	*	*
11	Mode Lim1	Control mode Lim 1	Off, 1, 2, 3	Off
12	Mode Lim2	Control mode Lim 2	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 1	Polarity for relay 1 ***Non-Inverted, Inverted***	n.inverted, inverted	n.inv
20	Polarity 2	Polarity for relay 2 ***Non-Inverted, Inverted***	n.inverted, inverted	n.inv
21	Logic	Logic for digital inputs	Neg. (Lo), Pos. (Hi)	Lo
22	Trim Low	Calibrate 4mA Input	As Defined	-
23	Trim High	Calibrate 20mA Input	As Defined	-
24	% Trim Low	Display 4mA Offset	± 9.99%	****
25	% Trim High	Display 20mA Gain	± 9.99%	****
26	Back to Default	Reset to Default	Def=Reset, Par=NoReset	Par

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

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

Par. no. 22. Allows calibration offset of 0mA or 4mA current signal input.

Par. no. 23. Allows calibration gain adjustment of 20mA current signal input.

Par. no. 24. Displays result of 0/4mA trim offset calibration (P22) in % units

Par. no. 25. Displays result of 20mA trim gain calibration (P23) in % units

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

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

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

***** Default values will depend upon 4mA and 20mA calibration performed at factory.*

Service

System Repair

Customer Service Department

If you need spare parts, assistance in troubleshooting, or repair service, please contact Foxcroft Customer Service at:

Foxcroft Equipment and Service, Co. Inc.
2101 Creek Road, Glenmoore, PA 19343
Tel: (800) 874-0590
(610) 942-2888
Fax: (610) 942-2769
Email: service@foxcroft.com
www.foxcroft.com

Customer Repair / Returns Policy

All systems returned for repair or replacement must be freight prepaid and include the following information:

1. A clearly written description of the malfunction.
2. Name of person to contact and the phone number where they can be reached.
3. Proper return address for shipping system back. Include preferred shipping method.
4. A purchase order if the system is out of warranty to cover costs of repair.
5. A Return Material Authorization Number (RMA) is required before shipping any products for service. Call telephone number above to receive a RMA number.

NOTE: *Returns will only be held at Foxcroft for 90 days. If a decision is not made regarding the repair, the product will be returned.*

Product Warranty

Foxcroft Equipment & Service warrants all products obtained hereunder to be free from defects in material and workmanship for a period of one year from the date of shipment. In the event of a product failure or defect requiring warranty repair, the customer must obtain an RMA number by calling 1-800-874-0590, before returning the product, at the customer's expense to Foxcroft for repair. Warrantor (Foxcroft Equipment and Service) will repair the unit, without charges for parts, labor and return freight

Foxcroft Equipment & Service is not responsible for damage to its products through improper installation, maintenance, act of God, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or for any unauthorized repair.

Buyer agrees to hold Foxcroft Equipment & Service harmless from all claims for damages arising out of injury or death to any person or damage to any facility, or any other property, or loss of use of any such property, whether such person or property is on or off the installation or activity site for which the equipment or material furnished hereunder is destined and whether such damage, loss destruction or loss of use, injury or death results directly or indirectly from a nuclear incident or for any other cause.

Statements and instructions set forth herein are based upon the best information and practices known to Foxcroft Equipment & Service but it should be assumed that every acceptable safety procedure is contained herein. Of necessity this company cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

Serial Number Label of FX-300 Series Analyzer:

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