Foxcroft Equipment & Service, Co. Inc.
Model FX-300-DpH/ORP
Smart Digital pH 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.

Document FX-300-DpHOM1.

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HELPFUL IDENTIFIERS

CAUTION: alerts you to the possibility of instrument malfunction or damage.

NOTE: A note alerts you to important operating information.

Introduction

The FX-300-DpH/ORP analyzers for pH or oxidation reduction potential (ORP) consists of an intelligent digital transmitter paired with an industrial duty smart digital sensor. This provides efficient installation and maintenance as well as advanced management of sensors without the high cost and complexity of other fieldbus alternatives such as HART®, Profibus or FOUNDATION™.

FX-300-DpH/ORP Feature Highlights

- Data Input Ranges: -2 to +16pH, ±1000mV for ORP, -40 to 210 °C
- Automatic pH calibration mode recognizes 4.00, 6.86, 7.00, 9.18 & 10.00 pH buffers for all calibration types & corrects for temperature induced changes to pH buffer, ensuring a systematic result no matter which operator calibrates the sensor.
- Plug and play smart sensors can be calibrated in the shop or in the field. Smart sensors automatically upload calibration data to the transmitter, or you can download configuration from the transmitter to the sensor.
- Smart digital sensors store all calibration data, dispatch date, installation date, time used in the field, last used date & the complete transmitter configuration in onboard non-volatile EEPROM memory for installation portability.
- Calibration data is stored on smart digital sensor. Calibrate in the lab or instrument shop & put the precalibrated sensor into process use. Plug & play sensors can be swapped in and out at will.
- The software checks for correct sensor type to prevent accidental connection of incompatible sensors. The sensor item, serial & invoice numbers are all stored on sensor.
- The live working calibrations and last five sets of historical calibrations stored on sensor can be displayed & downloaded to file including date associated for each.
- 100% pure digital communications have no signal degradation in noisy environments with cable lengths up to 2,000 feet with NEMA 6P & IP67 rated quick disconnect waterproof & corrosion-resistant snap connectors.
- Perform 1-point offset, 2-point or 3-point calibrations. 3-Point calibration establishes accurate separate slopes for both the acidic (-2 to +7 pH) and alkaline ranges (7-16 pH).
- 1-Point offset calibration for pH, ORP and temperature measurements.
- Auto temperature compensation via Platinum 100 or 1000 Ohm element
- Display pH/mV or Temperature
- Fully Scalable and Invertible Analog Output 0-20 mA or 4-20 mA for pH/mV or Temperature
- Galvanic isolation between sensor input, power & analog output (3000V rating)
- Digital Output via RS-485 Modbus RTU in standard or high resolution mode is standard
- Transmitter configuration on transmitter can be downloaded to the smart digital sensor as a backup or else to be uploaded directly onto other transmitters to clone configurations
- Configuration on the smart digital sensor can be saved as a file when used with the supplied Windows software for backup, archiving or tracking the configurations at each installation site
- Configurations saved to file can be directly loaded to smart digital sensor. Configurations loaded to sensor can in turn be loaded onto any FX-300-DpH transmitter to which it is connected.
- The transmitter can create a restore point backup of the exact current working configuration and can be reverted back to this restore point configuration at any time.
- The transmitter configuration can be hard reset back to the factory defaults

Introduction

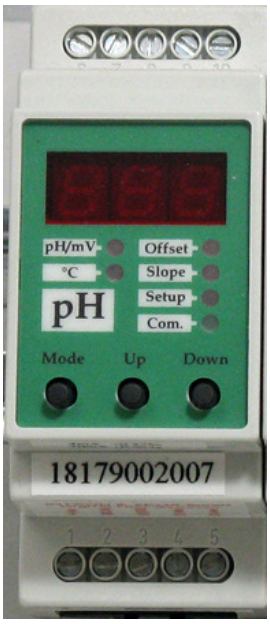
FX-300-DpH/ORP Features

Operation

Each module has a 3 digit display and 6 LEDs to indicate the active operating mode.

3 keys located on the front panel are used to view and change settings in the module. The ‘Mode’ key is used to select a particular operating mode including SETUP, where transmitter settings can be viewed and modified. Once in Setup mode, the ‘Up’ and ‘Down’ keys are used to scroll through the parameters. The parameter to be viewed or altered is selected with the ‘Mode’ key and the value is changed using the ‘Up’ or ‘Down’ keys.

To change any of the parameter settings you must first turn off the software lock, parameter #P01, by pressing the up or down key. The software will automatically re-lock if no key is pressed for 60 seconds.



“pH/mV” indicates the run mode and displays pH or mV for ORP measurements.

- To view the absolute mV value of a pH sensor press the ‘Down’ key while in pH/mV LED mode.
- The current mA output from the programmed scaling can be displayed by pressing the ‘Up’ key in pH/mV LED display mode.

℃ mode displays the temperature.

- The temperature is calibrated by pushing the ‘Up’ or ‘Down’ buttons when in the temperature display (°C) mode after the software lock is turned off.
- Min and max temperatures are digitally stamped on sensor for process condition tracking. This feature allows tracking of process excursions even if just a single 4-20mA output for pH/ORP is used & no second analog temp output exists. MODBUS output always sends BOTH the pH/ORP value and the temperature.

“Buffer” is the calibration mode for the offset, or high pH solution. Use the Up or Down keys to adjust after the software is unlocked.

“Slope” is the calibration mode for the gain, or low pH solution. Use the Up or Down keys to adjust after the software is unlocked.

“Setup” mode provides access to view and program settings in the analyzer. To make setting changes press Mode key until SETUP is illuminated, select parameter “P01” with the Up key, and change to “OFF” to unlock the software. To exit SETUP press the "Down" key until parameter "P00" is displayed, then press the "Mode" key.

“Com” LED is illuminated when Modbus is active.

Introduction

Outputs

Analog 0/4-20mA Output

The FX300 analyzers have a single scalable analog output of either 0-20 or 4-20 mA (selectable) in each measurement module.

Analog 0-20mA or 4-20mA output can be scaled to 1pH to get an effective output resolution of 0.001pH units or down to 100mV to get a net output resolution of 0.1mV for any part of the ORP range

You may set the analog output to be non-inverted (proportional & linear, 0-20mA or 4-20mA) or inverted (20-0mA or 20-4mA) using parameter “P12”.

The analog output is galvanically isolated from the input with a 3KV rated opto-coupler.

Modbus

Digital MODBUS RS-485 RTU multidrop communications is a standard feature in addition to the analog output.

The MODBUS RS-485 RTU has a standard resolution 0.01pH units or 1mV for ORP (this is compatible with the FX-300-DAT module). The RS-485 MODbus RTU output mode can also be set to achieve a 0.001pH or 0.1mV resolution for the highest precision.

The Modbus-master may be the FX300-DAT module or any SCADA system. A 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).

Output Hold During Calibration

Analog and digital outputs are placed on hold automatically when in calibration mode.
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.

WINDOWS SOFTWARE FOR CALIBRATION & CONFIGURATION

Windows software is provided with a free of charge perpetual software zero cost license. Only a suitable RS-485 to USB converter assembly is required to use the Windows software. Foxcoft offers a field ready NEMA4X Windows Interface Bridge Box for Smart Digital Sensors to enable turn-key out of the box use of this Windows software.

Windows software provides convenient testing and calibration of plug and play smart digital sensor and creating complete transmitter configuration which can be saved to file as well as to additional smart digital sensors. This can be done at field installation points throughout the plant from anywhere that a laptop, desktop or tablet with a USB connection is available.

Using the Windows software to create the configuration allows for it to be saved on the PC with a logical filename should it need to be loaded onto a new sensor in the future or else to keep track of changes to the transmitter configuration over time for the given installation point. If multiple installations will use exactly the same transmitter configuration this same file can be loaded onto multiple sensors. This task of loading the same configuration onto multiple smart digital sensors can also be accomplished via the intelligent transmitter using the appropriate parameter call.

Introduction

FX-300-DpH/ORP *TECHNICAL SPECIFICATIONS*

Mechanical

Housing:	Lexan UL94V-0 (Upper part) Noryl UL94V-0 (Lower part)
Mounting:	M36 for 35 mm DIN rail
IP Class:	Housing IP40. Connector IP20
Connector:	Max 16A. Max 2.5 mm^2 Max torque 0,6 Nm
Temp.:	-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 3.4")
CE mark:	EN61326A

Electrical

Power Supply:	24VDC ±10%
Consumption:	60 mA max
Sensor:	Combination Sensor
pH/mV Range:	-2 to +16 pH, ±1000mV ORP
Sensor Input:	Foxcroft Smart Digital Sensors Only ±0.2% Excluding sensor (ideal)
Accuracy:	Integral platinum Pt100, Pt1000
Temp Sensor:	-40 to +210°C ± 0.3°C
Temp Range:	
Temperature	Fixed (Manual) or Automatic using
Compensation:	Temperature (TC) Measurement 0-20mA or 4-20mA, max. 500Ω
Analog Output:	MODBUS 485-RTU
Digital Output:	Automatic in calibration mode
Output Hold:	

WIRING

The FX-300 analyzer is prewired at the factory. The only field wiring required is the mA output signal cable, digital output (Modbus) cables if used and the sensor cable(s) to the measurement module(s).

The 24VDC power supply is prewired to the power entry module located on the underside of the enclosure. The measurement modules are prewired to each other and to the power supply. Applying power is simply a matter of plugging in the supplied power cord.

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

Power

The FX-300 includes a CSA/UL/CE approved universal input 115/230 VAC 50-60Hz, 24VDC power supply. This power supply is pre-wired at the factory to a 6 Amp fused power entry module that accepts a power cord with IEC #C13 connector on one end and NEMA 5-15P connector on the other end. No power wiring is required. Bypassing the factory default power wiring will void the warranty.

WARNING: Because the FX-300 transmitter is a 3-wire device, it is ABSOLUTELY critical that the 24VDC power supply is COMPLETELY separate from all other equipment. This includes all other instrumentation as well other equipment such as pumps and motors. The FX-300 cannot share plant wide 24VDC power.

Grounding

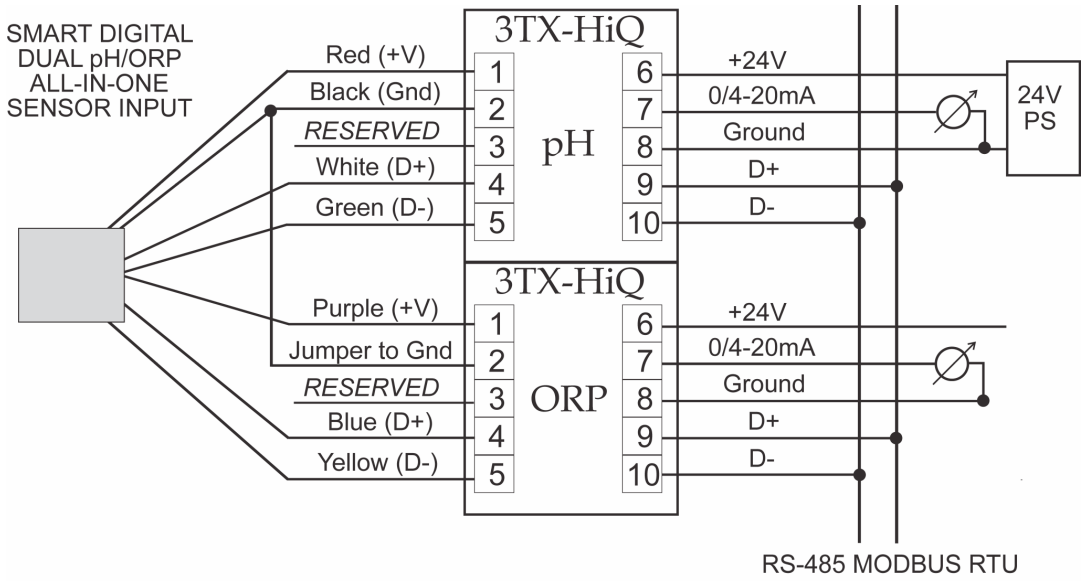
Grounding of the instrument is provided by the supplied power cord. Some applications require the sensor be grounded in the process fluid, contact the factory for assistance with solution grounding.

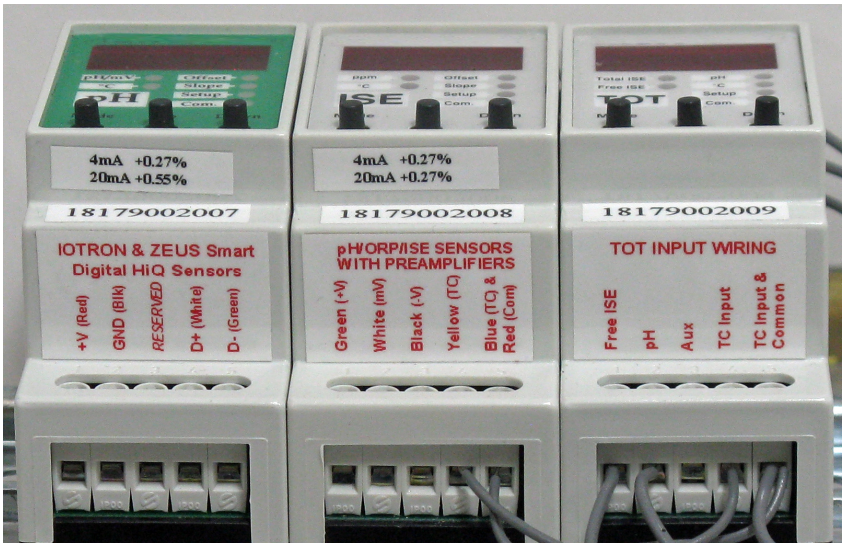
WIRING

Direct Wiring the Sensor to the Measurement Module, Input & Output Connections

Care should be taken when making these connections to follow the terminal assignments exactly to avoid damaging the sensor or transmitter. No connection of any kind should be made to the factory-reserved input terminal #3 on any of the digital pH modules.
Each terminal on the pH transmitter inputs is clearly labeled with the input type and sensor cable conductor color. Likewise, the output and power terminals are clearly labeled with the designations shown in the diagram below.

The top diagram “3TX-HiQ pH” is for pH sensors; the bottom diagram 3TX-HiQ ORP” is for ORP sensors. The 4-20mA analog output (+) connects at terminal 7 and the (-) to ground terminal 8. Digital Modbus outputs connect to terminals 9 & 10.





WIRING

OUTPUT WIRING

4-20 mA Output

The 4-20 mA output MUST ALWAYS be connected to an isolated analog input. If your SCADA / PLC does not have isolated analog inputs, then you must add an isolator for each current loop to be used. The ground cannot be shared on both the analog current output from the transmitter (since it is a 3-wire device) and on the analog input on the PLC.

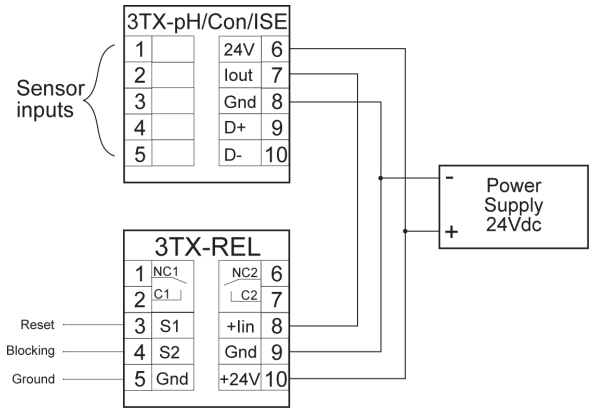
Prior to dispatch the transmitter has the 4mA trim offset and 20mA trim gain calibrated for optimal analog precision, these values are shown on a label. These values may change slightly over time or due to environmental conditions. In such cases the analog trim can be further adjusted by modifying the appropriate parameter on the transmitter. If the transmitter is reset to factory default settings the calibration values shown on this label will be restored and any field adjustment will be lost.

Connect Digital MODBUS 485-RTU output to terminals D- and D+ as shown.

WIRING

Wiring the Optional 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)*

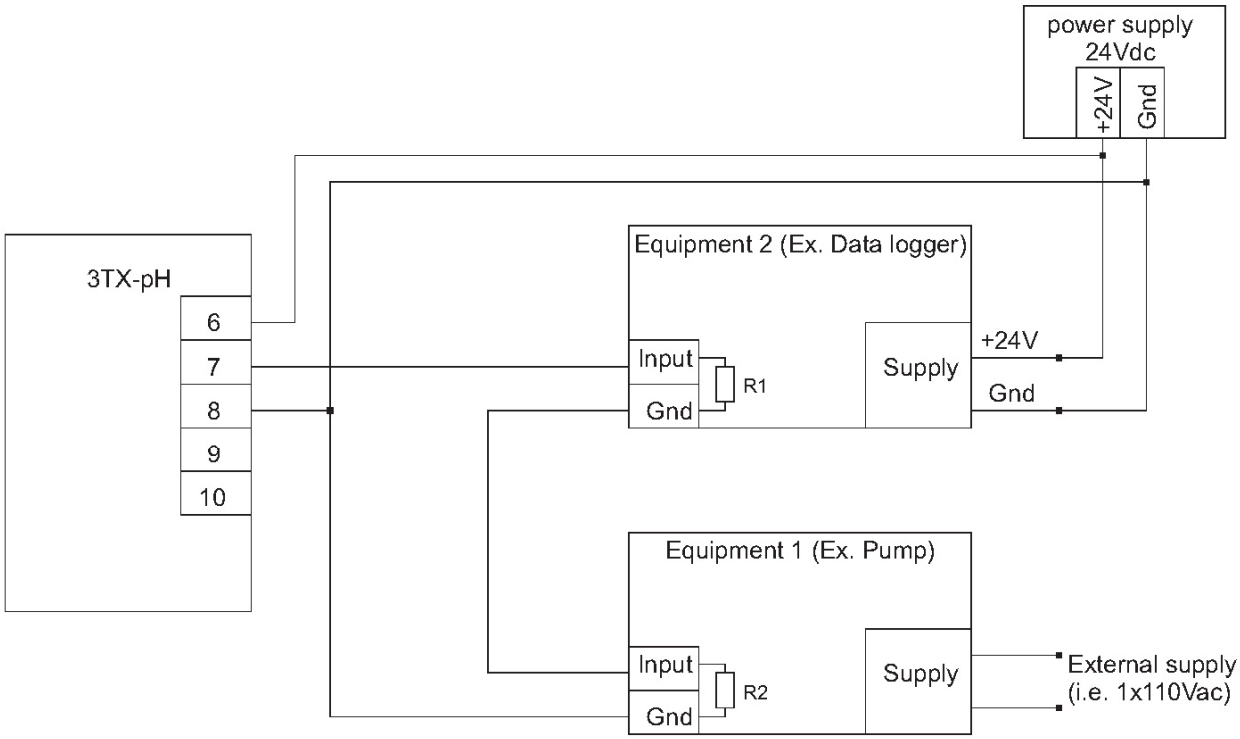


Complete information on the FX-300-REL module is included later in this manual.

WIRING

Adding other devices to the 0/4-20mA transmitter output loop

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

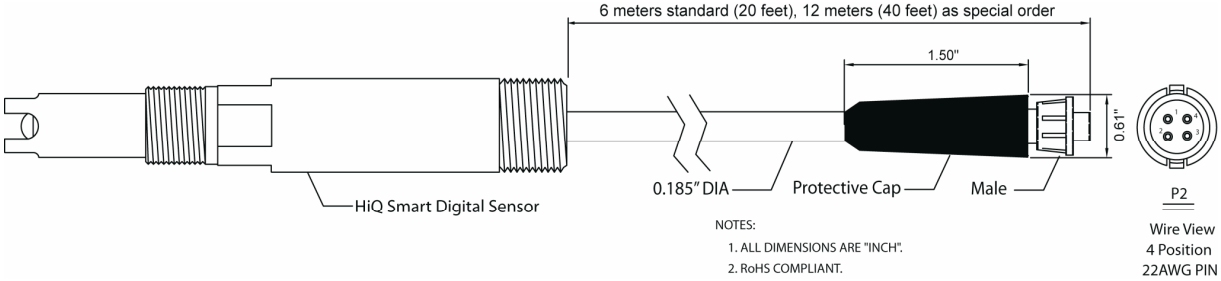
pH/ORP Sensor Wiring With Extension Cable

Digital pH/ORP sensors may be connected to the transmitter in three ways:

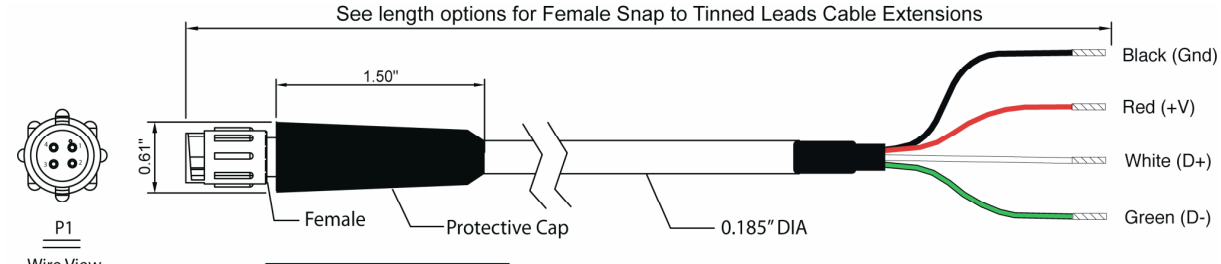
1. Directly to the transmitter using tinned leads.
2. To a cable extension with female connector on one end that is permanently wired to the transmitter using tinned leads.
3. Using cable extensions which connects to a female connector mounted on the analyzer enclosure that is pre-wired to the transmitter at the factory

Total cable length up to 610 meters (2,000 feet) using extension cables is possible.

Detail drawing for standard smart digital sensor with male snap connector cable termination



Detail drawing for female snap to tinned leads cable extensions:



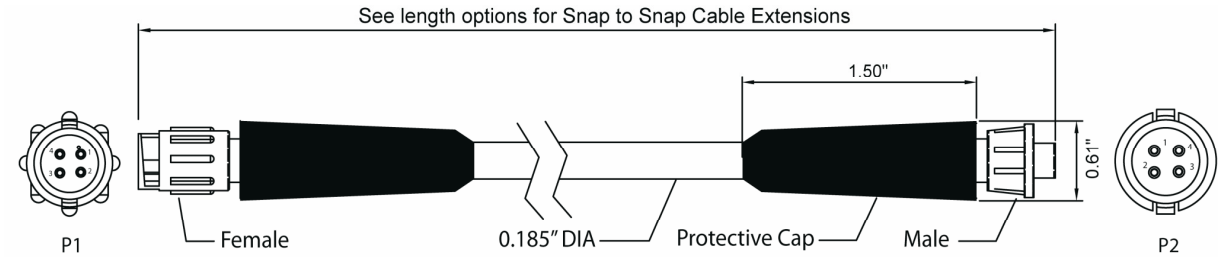
Cable Extension	Length
HiQ4F-1.5m-TL	5 feet
HiQ4F-3m-TL	10 feet
HiQ4F-6m-TL	20 feet
HiQ4F-12m-TL	40 feet

PIN OUT

P1	
1	Black
2	Red
3	White
4	Green

NOTES:
1. ALL DIMENSIONS ARE "INCH".
2. RoHS COMPLIANT.

Detail drawing for female snap to male snap cable extensions:



Cable Extension	Length
HiQ4F-3m-HiQ4M	10 feet
HiQ4F-6m-HiQ4M	20 feet
HiQ4F-12m-HiQ4M	40 feet
HiQ4F-24m-HiQ4M	80 feet

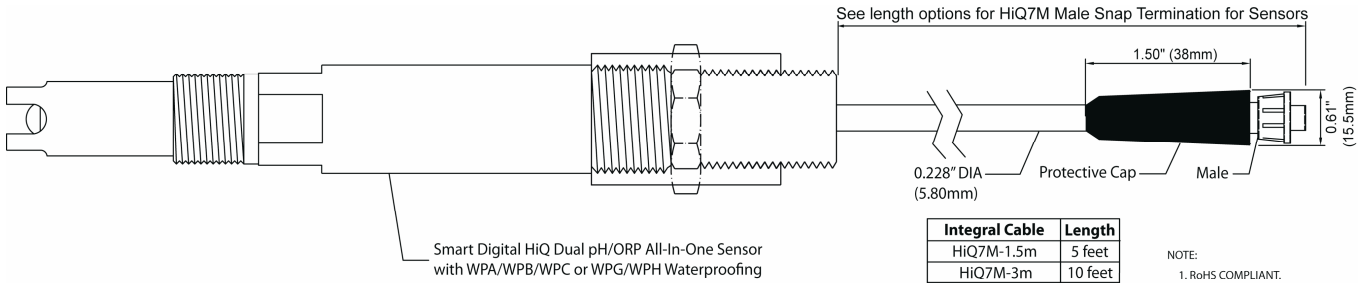
PIN OUT

P1		P2
1	Black	1
2	Red	2
3	White	3
4	Green	4

NOTES:
1. ALL DIMENSIONS ARE "INCH".
2. RoHS COMPLIANT.

All-In-One Dual pH/ORP Sensor Wiring With Extension Cable

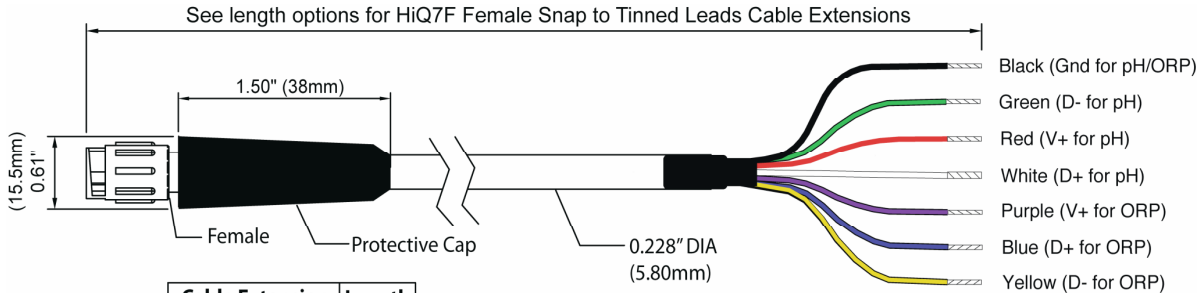
Drawing for smart digital Dual pH/ORP All-In-One sensor that measures both pH and ORP with standard male snap connector cable termination:



Integral Cable	Length
HiQ7M-1.5m	5 feet
HiQ7M-3m	10 feet
HiQ7M-6m	20 feet
HiQ7M-12m	40 feet
HiQ7M-23m	75 feet

NOTE:
1. RoHS COMPLIANT.

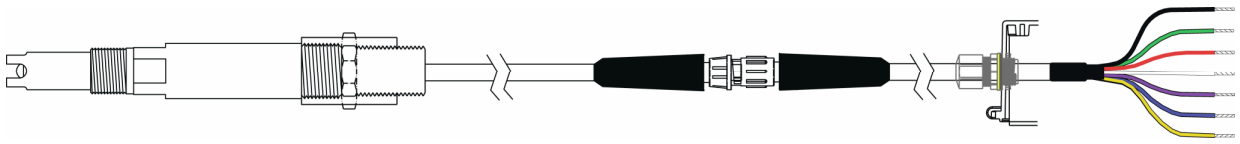
Detail drawing for standard female snap to tinned leads cable extensions <u>Dual</u> pH/ORP sensors:



Cable Extension	Length
HiQ7F-1.5m-TL	5 feet
HiQ7F-3m-TL	10 feet
HiQ7F-6m-TL	20 feet
HiQ7F-12m-TL	40 feet
HiQ7F-23m-TL	75 feet

NOTE:
1. RoHS COMPLIANT.

Installation Assembly Drawing for Smart Digital <u>Dual</u> pH/ORP sensors with Snap Connector Extension:



CONFIGURATION

Function and Programming Parameters

The 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 displays item number from connected sensor.

Par. no. 4 displays serial number from connected sensor.

Par. no. 5 sets the temperature compensation mode to either 'Set' (manual) or 'Aut' (ATC) automatic for digital pH sensors.
Par. no. 6 sets the temperature when temperature compensation of the pH measurement is in "Set" (manual mode).

Par. no. 7 Offsets the time zone from GMT. Check P41-P45 to ensure that your P07 adjustment resulted in desired local time.
Par. no. 8 If 3-Point Slope is "Off:, one slope (P17) will be used in all pH ranges (-2 to +16). If 3-Point Slope is "On", the sensor will have two slopes; one slope (P17) for the acidic -2 to +7 pH range and another slope (P18) for the alkaline +7 to +16 pH range.
Par. no. 9 Range mode for ORP sensor; "fuL" range is ±1000mV, the "nEg" range -1000 to 0mV or the "PoS" range is 0 to +1000mV. P24 & P25 set analog output scaling for these range mode limits.
Par. no. 10 is used to set the MODBUS output mode to either the maximum resolution 'pHE' mode or the 'DAT' compatible mode (1000 Steps only).
Par. no. 11 sets analog output to either 0-20 or 4-20 mA.
Par. no. 12 Set analog output to be non-inverted (proportional & linear, 0-20mA or 4-20mA) or inverted (20-0mA or 20-4mA).
Par. no. 13 & 14 defines pH for 0/4mA setpoint (**P13**) & for 20mA setpoint (**P14**). P13 & P14 must be at least one (1.0) pH unit apart.
Par. no. 15 Variable to define the mV change for each "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(pH only). If P08 is "OFF" slope 1 used for -2 to +16 pH. If P08 is "ON" (3-Point/Dual Slope) then slope1 is for -2 to +7 pH only & P18 is used for alkaline slope.
Par. no. 18 View & edit working sensor slope2 for 7-16 pH range. This is valid only if P08 is ON, or else just blank "---" no value.
Par. no. 19 Offset adjustment for 0/4mA low analog output trim.

No	Parameter	Description	Range	Default
01	Lock	**Software Lock**	On / Off	On
02•	Address	Modbus	Off, 1…247	Off
03†	Sensor Item Number	Defines all sensor options	1-9,999 (>999 displayed with flashing)	Per Sensor
04†	Sensor Serial Number			Per Sensor
05•	Temp. Compensation	Correct slope as function of Temp.	Auto, Set	Auto
06•	Manual Temp Comp.	Fixed Temp. Comp. *	-40 to +210°C	25
07•	Offset from GMT	Hours offset from GMT RTC	-12 (hours) to +12 (hours) *	Per Sensor
08•	3-Point Slope Option	Enable Dual slope option	Off (2-Point) On (3-Point)	On
09•	mV Range Selector for ORP mode	Available mV Range Modes	Ful (±1000), Neg (-1000 to 0) or Pos (0 to +1000)	Ful ±1000
10•	MODbus output mode	Set mode for compatibility with DAT datalogger or for max resolution	Maximum Resolution in *pHE* mode or *DAT* compatible mode	DAT
11•	Output Mode	Type of output	4-20mA, 0-20mA	4-20
12•	Output Style	Standard or Inverted Modes	Non-inverted, inverted	n.inv
13•	0/4mA Set	Low Setpoint for pH analog output	-2.0 to +15.0 pH *	0.0
14•	20mA Set	High Setpoint for pH analog output	-1.0 to +16.0 pH *	14.0
15•	Step Change	mV Increment for Calibration	0=0.2, 1=0.5, 2=1.0, 3=2.0	1 (0.5mV)
16‡	mV Offset Calibration	mV@pH7 for pH / mV Offset for ORP	±250 mV *	0
17‡	Slope 1	mV per pH (for pH sensors only)	30 to 90	59.2
18‡	Slope 2	mV per pH (only if P08 is "On")	30 to 90	59.2
19#	0/4mA Offset	Trim Low	±9.99%*	0.00
20#	20mA Gain	Trim High	±9.99%*	0.00
21•	Energy Save	Energy Save	On / Off	Off
22•	Baudrate	Modbus	9,600/19,200	19,200
23•	Show two significant figures above 9.99 pH	Substitutes integer part of pH scale with letter when greater than 9.99	Off or On; If set to "On" then 10=A, 11=b, 12=C, 13=d, 14=E, 15=F, 16=g	Off
24•	0/4mA ORP Set	Low Setpoint for ORP mA output	-999 to +900 * (limits set per P09)	P09
25•	20mA ORP Set	High Setpoint for ORP analog output	-900 to +999 * (limits set per P09)	P09

CONFIGURATION

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 to normal display.

Par. no. 22 Sets MOdbus baudrate to 9,600 or 19,200

Par no. 23 Show two significant figures when pH is 10 or greater

Par. no. 24 & 25 Defines mV for 0/4mA setpoint (**P24**) & 20mA setpoint (**P25**) for analog output with ORP sensor. The P24 & P25 setpoints must be at least 100mV apart. Defaults/limits set by P09.

Par. no. 26 display the date of manufacture at factory. ***
Par. no. 27 display date first connected to transmitter. **Windows software calibrates sensor without setting first install date.** ***
Par. no. 28 display date sensor last used with transmitter. ***
Par. no. 29 display total number of equivalent days (24hr periods) the sensor has been installed into field service; with ±2% accuracy.
Par. no. 30 display invoice number associated with sensor.
Par. no. 31 Sets sampling frequency of sensor in Hz. If timeout error is reported from transmitter, reduce the sampling rate.
Par. no. 32 Sets the coefficient for temperature compensation of pH values. **Contact factory before changing this value.**
Par. no. 33 Display software version of connected sensor.
Par. no. 34 Defines set of historical calibrations to be viewed with P35-P38 in read only mode. P34 defines the position in the FIFO circular ring buffer that is used to store the calibrations. Note that each calibration stack is completely separate. The P34 parameter only sets the calibration reference number in the stack. The dates corresponding with each of the calibrations (mV offset, slope1, slope 2, temperature) may differ for each calibration even when the P34 setting is identical. Date of the historical calibration provided as a display feature (see *** note for details). P34 is the only parameter that can be changed without setting P01 lock to 'Off'.
Par. no. 35 View historical mV offsets as defined by P34. ****
Par. no. 36 View historical slope 1 values (pH mode only). ****
Par. no. 37 View historical slope 2 values (When P08="On") ****
Par. no. 38 View historical temp offset calibrations in °C ****
Par. no. 39 Display lowest temp experienced by sensor in use
Par. no. 40 Display highest temp experienced by sensor in use
Par. no. 41 Shows year, **Par. no. 42** shows month, **Par. no. 43** shows date, **Par. no. 44** shows hours & **Par. no. 45** shows minutes.

No	Parameter	Description	Range	Default
26†	Manufacture Date ***	Date dispatched	See date display scheme	Per Sensor
27†	Initial Installation Date ***	Date first connected to transmitter	See date display scheme	Per Sensor
28†	Last used date in field ***	Last date connected to transmitter	See date display scheme	Per Sensor
29†	Days in field service	Days in use after installation date	0-65,535 (>999 display as flashing)	Per Sensor
30†	Invoice for sensor	Invoice no. for sensor connected	0-65,535 (>999 display as flashing)	Per Sensor
31†	Sampling Frequency	Set sampling frequency in Hz units	0.5, 1.0, 2.0 and 4.0	4.0
32†	Temp Comp Coefficient	Set temp compensation coefficient	(000-999) Units are µV per °C	198
33†	Sensor Board Software	Revision of sensor board connected	From sensor (READ ONLY)	Per Sensor
34†	Calibration Number	Set of historical calibrations	From 1 to 5 per position in FIFO ring buffer	1
35†	mV Offset ****	mV@pH7 for pH & mV Offset for ORP	±250 mV * (READ ONLY)	Per Cal
36†	Slope 1 ****	mV per pH (when P03=pH)	30 to 90 (READ ONLY)	Per Cal
37†	Slope 2 ****	mV per pH (when P08=On)	30 to 90 (READ ONLY)	Per Cal
38†	Temperature Cal ****	Shows temp offset cal in °C units	±25.0°C * (READ ONLY)	Per Cal
39†	Min Temp in Use	Shows lowest temp in field use	Min -40°C * (READ ONLY)	Per Sensor
40†	Max Temp in Use	Shows highest temp in field use	Max 210°C (READ ONLY)	Per Sensor
41#	RTC, Year	Display Only - Year	00-255= 2000–2255 (READ ONLY)	
42#	RTC, Month	Display Month	01-12 (READ ONLY)	
43#	RTC, Day	Display Day	01-31 (READ ONLY)	
44#	RTC, Hour	Display Hour	00-23 (READ ONLY)	
45#	RTC, Minute	Display Minute	00-59 (READ ONLY)	
46	Reset All Sensor Cals **	All sensor cals reset to defaults	'Cur'= No Action, 'Rst/Cal'=Reset sensor cals	Cur

CONFIGURATION

Par. no. 46 Reset all live working calibrations on sensor, as shown in P16, P17, P18 & °C LED, back to factory default values. **
Par. no. 47 Parameters marked "•" are downloaded to sensor as configuration parameters when P47 call is invoked.
Par. no. 48 Parameters marked "•" are loaded into a shadow copy, which can be used to revert to this configuration with P49 **
Par. no. 49 Restores configuration to version from P48 shadow copy **
Par. no. 50 Uploads configuration from sensor to transmitter. The current configuration values will be overwritten! Use P48 to make a backup shadow copy of configuration before using P50. **
Par. no. 51 Reset **ALL** parameters to factory default values **

47	Load config onto sensor	Load settings for "•"param **to** sensor	'Cur'= No Action, 'Cfg/Sen'=Cfg to sensor	Cur
48	Make shadow copy **	Backup settings for "•"params	**'**Cur'= No Action, 'Cpy/Cfg'=Back up config	Cur
49	Restore to Shadow Copy **	Restores settings to P48 shadow copy	'Cur'= No Action, 'Rst/Cfg'=Reset to Backup	Cur
50	Load config from sensor **	Load "•" param settings **from** sensor	'Cur'= No Action, 'Lod/Sen'=Cfg from sensor	Cur
51	Reset All **	Resets all param back to defaults	'Cur'= No Action, 'Def/Rst'=Reset All values	Cur

Notes:

** Negative numbers shown as flashing*

*** The configuration stored on smart digital sensor are unchanged by invoking these parameters.*

**** Date format: "H"+last two digits of year, then "m.dd" where "m" is month shown as 1-9 for Jan-Sept, then A=Oct, b=Nov, C=Dec & "dd" is day of month (October 8th 2015 shown as "H15" followed by "b.08")*

***** Date associated with calibration is accessed by pushing the **'Up'** button while value is shown. Date format is same as per note *** above.*

***** Calibration reference number (P34) associated with P35-P38 calibrations accessed by pushing **'Down'** button while value is shown.*

• = *Parameters are downloaded to sensor as configuration parameters when P47 is invoked on transmitter or else uploaded from sensor to transmitter when P50 is invoked*

† = *Parameters are ONLY stored on Smart pH & ORP sensors & these parameters are read only*

‡ = *Parameters stored on Digital pH & ORP sensors & parameters can be viewed **& modified***

= *Parameters are ONLY stored on the transmitter & these parameters are display/read only*

CONFIGURATION

MODBUS

The FX-300-DpH comes standard with RS-485 MODBUS RTU output implemented as follows: 8-bit, even parity with 1 stop bit. A special order version is available with no parity. FX-300-DpHmay be used as a slave for the FX-300-DAT field datalogger (when P10=DAT compatible mode) or as a slave in any MODBUS type SCADA data acquisition system in any P10 mode. All possible P10 configurations are compatible with the free Windows Datalogger Software for FX-300 transmitters with MODBUS.

In a SCADA system

The baud rate (P22) must match the baud rate of the SCADA system. **The node address (P02)** must be unique in the network; Up to 247 each FX-300 transmitters can be connected on a single network.

Modbus Scaling

The FX-300-DpH operates in two MODBUS output modes. The first mode is P10='DAT' yielding the same pH/ORP & temp outputs as the FX-300-pH transmitters.

The second P10='pHE' high resolution mode yields the same outputs for pH/ORP as analog FX-300-pH but the temp output range is different.

MODbus scaling may differ from 0/4-20 mA analog scaling. Low & high scaling, number of steps & resolution is detailed in the tables below.

The DAT is a compatibility mode that restricts the pH and temperature resolution and range that can be transmitted via MODBUS.

To transmit all possible ranges for pH, ORP & temperature at the maximum resolution, set P10='pHE' mode. This mode sends the highest resolution possible for all values but will make the output incompatible with the FX-300-DAT field data logger. Please see the tables below for details on scaling and resolution for all configurations.

When P10 is set to 'DAT' compatible mode both the measurement & temperature sent as 0-1,000 steps (1024 offset for 2nd temp value):

Smart Sensor Connected to FX-300-DpH	**If P09 reads this: (Valid for ORP Sensors Only)**	**Input for DAT / FX-300 Windows Data logger**	**Scale (low) will be fixed at:**	**Scale (high) will be fixed at:**	**Effective Resolution:**
pH	N/A	**FX-300-pH (pH)**	0.00 pH	14.00 pH	0.014pH
ORP	Neg	**FX-300-pH (-1000 mV)**	-1000 mV	0 mV	1 mV
ORP	Pos	**FX-300-pH (+1000 mV)**	0 mV	+1000 mV	1mV
ORP	Ful	**FX-300-pH (±1000 mV)**	-1000 mV	+1000 mV	2mV

When P10 is set to 'pHE' high resolution mode then pH is sent as 0-18,000 steps and ORP/mV is sent as 0-20,000 steps:

Smart Sensor Connected to FX-300-DpH	**If P09 reads this: (Valid for ORP Sensors Only)**	**Input for DAT / FX-300 Windows Data logger**	**Scale (low) will be fixed at:**	**Scale (high) will be fixed at:**	**Effective Resolution:**
pH	N/A	**FX-300-DpH (pH)**	-2.000 pH	+16.000 pH	0.001pH
ORP	N/A	**FX-300-DpH (mV)**	-1000.0 mV	+1000 mV	0.1mV

The second MODbus value sent is always temperature. When P10='DAT' the temperature range is 0-210°C with 1,000 steps sent as 1024-2024 yielding a resolution of 0.2□C with an uncertainty is ± 0.3°C.

When P10='pHE' the temperature range is -40 to +210 °C with 2,500 steps sent as 0-2,500 yielding a resolution of 0.1°C with an uncertainty is ± 0.3°C.

To interface the P10='pHE' style configuration with the free Windows Datalogger Software for FX-300 transmitters with MODBUS output the version must be 2.5 or higher.

CONFIGURATION

MODBUS

With FX-300-DAT

If FX-300-DpH is used with FX-300-DAT, baud rate on the MODbus and address of the FX-300-DpH should be noted. **The baud rate (P22)** must be set to the baud rate of the FX-300-DAT. Whether a baud rate of 19,200 or 9,600 is not important, as long as all units on the MODbus network are set to use the same baud rate.

The node address (P02) must be unique in the network; Two units cannot have the same address. In a network with FX-300-DAT as the master, all addresses must be assigned in series; i.e. if 3 units are connected to FX-300-DAT, the addresses 1, 2 & 3 must be assigned to three units. The order of addresses is not important.
FX-300-DAT MODbus fieldlogger supports up to 63 each FX-300 nodes.

To record the values obtained from your measurements use the MODBUS output from the transmitter with the free of charge Windows datalogging and graphing software for FX-300 transmitters with MODBUS output.

The FX-300-DpH contains 2 values; pH/mV and temperature. Access is gained through function code 04 *Read_Input_Registers*.

Read_Input_Registers

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

Value 1 is pH/mV and value 2 is temperature. The measurements are always transmitted in sequence; If 2 values are chosen both pH/mV and temperature are transmitted. If the value for temperature is wanted, 2 values must be requested. When P10 is set to 'DAT' mode both values are rated 0-1000 corresponding to the range, but the temperature has an offset of 1024; i.e. 0-14pH is transmitted as 0-1000 and 0-210□C as 1024- 2024.

Diagnostics
The FX-300-DpH gives access to different diagnostic values via function code 08 *Diagnostics*, as shown in the following.

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

Installation Overview

1. Mount the analyzer on the wall.
2. Connect the sensor wires to the analyzer.
3. Make electrical connections for 4-20 mA current output, digital output and alarm relays if supplied.
4. Verify electrical connections and apply power to the analyzer by plugging the power cord into the power input module on the underside of the analyzer, and then plugging into a standard NEMA 5-15 type B grounded socket.
5. Program the analyzer operating parameters as needed for your application.
6. Remove the protective cap from the sensor tip and install as required.
7. The digital sensor is ready to use with the original factory calibration.

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.
4. There is one 7/8” conduit opening for 1/2-inch conduit fittings in the bottom of the enclosure for signal wiring. Use watertight fittings and hubs that comply with your requirements. There is one watertight cable grip for each sensor supplied to connect to its mating measurement module.
5. 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.

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.

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

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, sharply swing the sensor downward as you would a thermometer before inserting it into the process.

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

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.

INSTALLATION

New pH Sensor Installation Overview:

1. Refer to schematic “Wiring the Sensor to the Measurement Module” and connect the sensor wires to the analyzer inputs if not done at the factory. Snap cable extensions are typically factory wired.
2. Program the transmitter to the desired settings. Most of the factory default settings will be used. At minimum you must set the date using P07 (check P41-P45 to ensure that your P07 adjustment resulted in desired local time) and the mA output scaling (P13 & P14) if you do not wish to use the default scaling of 4mA=0, 20mA=14.
3. **For a new digital pH sensor you do not need to perform a calibration using pH standard solutions.** The factory calibration is suitable for most applications.
4. Remove the protective cap from the sensor tip and retain for future use.
5. Mount the sensor as required, if inline, typically into a 1-1/2” to 2” pipe tee. Before inserting the sensor into the fitting, forcefully shake the sensor downward to eliminate the possibility of an air pocket contacting the sensing element. The sensor should be oriented as stated above with the tip pointed down.
6. Allow the sensor to reach electrochemical and thermal equilibrium. Sufficient time must be allowed for the pH sensor to come to equilibrium with the ambient condition before valid readings will be produced. Typically when the temperature stops changing this indicates that equilibrium with ambient has been reached. If the process temperature is quite warm or quite cold this can be a rather slow process. Consider that nearly every material of construction in the pH sensor is a very good insulator (plastic and glass). Insulators do not change temperature quickly and so if the process temperature differs from the ambient condition significantly you will need to be patient.
7. Once stabilized the sensor is ready to use. Offset or multipoint calibration is not required unless dictated by the facility standard operating procedures.

Sensor Calibration

One of the core advantages of the smart digital platform is the availability to calibrate in one location and to install the sensor into another location. The calibration values saved on the sensor are automatically loaded to the intelligent transmitter after the sensor is connected with the NEMA 6P rated field snap connector without any user action of any kind; providing a true plug and play hot-swap ability between any sensor and transmitter.

The choice of where to perform the calibration is a matter of what is best for your particular facility and operational setup. In order to avoid downtime while the calibrations are performed, at least one spare digital sensor is required.

There are three options to perform the calibration of the digital sensor and modify the transmitter configuration after the initial field commissioning. All are functionally equivalent the choice of which approach is employed is based upon what best suits your needs. The three possibilities are:

1. Use a spare transmitter assembly. The unit employed can be identical to the field commissioned package so that this spare transmitter assembly can be used for calibration as well as a backup in case the field unit(s) are damaged due to some unforeseen incident.
2. Use a portable assembly with a transmitter installed. The primary advantage here is that such a portable unit is battery powered (either from a 9V or a 5V USB rechargeable cell) and so the calibration can be done in any location whether line power is available or not. This portable assembly can also serve to spot check process

measurement values as well as performing recalibration for the field installed sensors.

3. Use the Windows software. This can be done in the lab with a desktop PC and also in the field if the transmitter to Windows bridge box is purchased with the portability package and a laptop computer is employed.
    - Note that when calibrating a sensor new out of box only the Windows software will not stamp the sensor with the initial installation field activation date nor the last date in service.
    - If you simply wish to spot-check any sensor in stock then the Windows approach is the best choice as it will not stamp/update either the field activation (first date in use) nor the last date field in field service dates.
    - While calibration values from any of the three choices detailed above will automatically be loaded onto the field installed inline transmitter, the transmitter configuration requires an affirmative user action prevent accidental crossing of transmitter configuration for different installation points.
    - Since transmitter configurations are NOT automatically loaded from the sensors, this allows for the sensors to be seamlessly hotswapped between installations that may have different transmitter configuration but use the same type of smart digital sensor model.
    - It is best practice to save any modifications to the transmitter configuration for a given installation point as a new filename from the Windows software for archival tracking of transmitter configurations as well as to allowing to revert to a previous setup if desired.

Calibration Buffer Solutions & Best Practices

It is always recommended that the user does not touch the sensor or cable during calibration. Doing so can induce a temporary static charge into the sensor that will skew the readings. You should use 250 ml glass or plastic beakers that are heavy enough to support and prevent the sensor from tipping the beaker over.

Always make sure the sensor is clean before calibrating. Then rinse the sensor with distilled or deionized (DI) water and gently blot dry with a soft lint free cloth before placing the sensor into a buffer solution.

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.

The alkaline pH buffers are much more temperature sensitive and generally unstable as compared to the neutral or acidic pH buffers. In increasing order of sensitivity to aging (decomposition), air (intrusion of carbon dioxide), light, contamination and temperature induced changes are the pH9.18, pH10 and pH 12.45 buffers.

Misconceptions on Calibration with pH4 and pH10 Buffer Solutions
The slope derived from a two-point pH4 & pH10 calibration is actually incorrect through the entire range because it averages the acidic and alkaline slopes to produce a slope that is not accurate for the acidic measurement or the alkaline measurement. Accordingly, you get poor results anywhere in the measurement range.

Furthermore, if one of the buffers used is not pH7 or pH6.86 there is no true asymmetric potential (A.P.) calibration. As a result, you will not really know what the pH sensor reads at pH7. In pH measurement the isopotential point (the zero point in effect, where an ideal electrode at 25°C will produce 0.0 mV when placed in a solution with a pH of 7.00) is pH7 for the purposes of automatic temperature calibration. You will induce errors in the temperature compensation by having an incorrect A.P. with the two-point pH4 & pH10 calibration, it essentially forces the A.P. to be an erroneous value. The larger the deviation of the actual A.P. from this erroneous value the larger the error introduced into the temperature compensation and therefore the pH measurement.

Sensor Calibration

The automatic calibration mode corrects for the temperature induced change to find the exact value of the pH buffers

If your facility's procedures require the use of pH4 buffer and pH10 buffer for calibration, the only way to do this properly is by enabling the three-point calibration mode. Using the intelligent digital pH transmitter, this is quite easy to do with the automatic calibration mode. Follow the instructions on how to perform a 3-point calibration.

TEMPERATURE CALIBRATION INSTRUCTIONS

The temperature is calibrated by pushing the 'Up' or 'Down' buttons when in the temperature display (°C) mode.

Calibration Hold: Analog and digital outputs are placed on hold automatically when in calibration mode. When calibration mode is entered, the last value from measurement mode will be held for both the 4-20mA analog output as well as the MODbus output.

AUTOMATIC pH CALIBRATION

Automatic pH calibration recognizes 4.00, 6.86, 7.00, 9.18 & 10.00 pH buffers for 1-point, 2-point and 3-point calibrations with built-in correction for temperature induced changes to pH buffers. Note that this is an altogether different correction than the Nernstian temperature compensation for the pH sensor potential itself. This correction for the value of the pH buffer is a temperature induce equilibrium shift of the measured solution.

The transmitter computes the exact pH buffer value based upon the temperature value obtained from the connected smart sensor.

To calibrate to any pH buffer or grab sample value not available in the autocal mode use the manual pH calibration mode.

AUTOMATIC 3-POINT CALIBRATION INSTRUCTIONS

If P08 three-point calibration (dual-slope) mode is enabled, the calibration will need to be performed twice in the Slope LED mode. Once for a pH buffer below 7 (only 4.00 in autocal) and once above 7 (9.18 or 10.00 in autocal). Intelligent calibration features on the pH transmitter automatically assign acidic slope (P17) and alkaline slope (P18) based upon the buffers used in autocal.

- For offset LED mode the 6.86 and 7.00 pH buffers are the available choices in the automatic calibration mode
- For slope LED mode the 4.00, 9.18 and 10.00 pH buffer are the available choices in the automatic calibration mode

If the software lock (P01) is "On" then no changes can be made. Set P01 to "Off " to allow calibrations & configuration modifications. The P01 software lock will automatically reset back to "On" if no key is pressed for 60 seconds.

- Set P01 lock to "Off" and then set P08 to "On"
- Clean the sensor and rinse with DI water and blot dry.
- Place in pH7 or pH6.86 buffer and allow the reading to stabilize. Set the P01 lock to "Off"

Using the 'Mode' button toggle to the 'Offset' LED mode. Hold 'Up' & 'Down' keys simultaneously to begin an 'Offset' autocalibration session. The display then toggles between dashes on the left & right LED until auto-read algorithm is complete. If all criterion of auto-read algorithm were met the auto-buffer recognition

- feature then displays the suggested pH buffer. If all auto-read criteria were not meet then an ‘Err’ message is returned.

- To accept the suggested pH buffer value from the auto buffer recognition feature press the ‘Mode’ key. Alternatively you can use the ‘Up’ or ‘Down’ keys to pick a different pH buffer followed by pressing ‘Mode’ key. If the user selected pH buffer exceeds the calibration limits for the given offset or slope mode then an ‘Err’ message will also be shown and the calibration aborted. After completion the A.P. (P16) will be properly calibrated.

- Rinse the sensor with DI water and blot dry. Place into pH4 buffer.

- Using the ‘Mode’ button toggle to the 'Slope' LED mode. Hold ‘Up’ & ‘Down’ keys simultaneously to begin a 'Slope' autocalibration session. To accept the suggested pH buffer value from the auto buffer recognition feature press the ‘Mode’ key. After completion the current working acidic slope (P17) will be properly calibrated.

- Rinse the sensor with DI water and blot dry. Place into pH10 or pH9.18 buffer.

- Hold ‘Up’ & ‘Down’ keys simultaneously to begin a second 'Slope' autocalibration session. Press the ‘Mode’ key to accept the suggested pH buffer value. After completion the current working alkaline slope (P18) will be properly calibrated.

- When finished press the Mode key to toggle to the pH operating mode.

If the Autocal procedure was successful then ‘YES’ is displayed. An ‘Err’ message is displayed if the autocal failed at any stage.
The user needs to try the calibration again if an Err is reported. It is most likely that the sensor was placed into one pH buffer but improperly selected another pH buffer in the autocal. Another possibility is to reset the calibrations back to default and them perform them again.

The pH buffer value shown on the display is nominal at 25°C rather than the actual exact value of the pH buffer at the current temperature. The pH buffer solution bottle shows the exact value of pH value of the buffer at various temperatures. The exact values of these pH buffers are programmed in the transmitter for intelligent, automatic & accurate pH calibration. Intelligent calibration on the pH transmitter includes automatic retrieval of the exact value for the pH buffer at any temperature from 0 to 60°C as sensed by the integral platinum temperature element for the 4.00, 6.86, 7.00, 9.18 & 10.00 buffers.

- Free Windows software performs all auto calibration features detailed above without setting/changing the initial install or last used date.

There is a (2) second averaging in ALL calibrate modes and a (10) second averaging for the pH/ORP measure mode.

HISTORICAL CALIBRATION VALUES (DISPLAY / READ ONLY PARAMETERS)
• The working mV offset * (P16), slope1 (P17) & slope2 (P18) can be viewed whether you perform automatic or manual calibrations.
If P01 lock is ‘Off’, the live P16-P18 values can also be manually adjusted but this is only recommend for experienced users.
• The historical calibration values can only be viewed and downloaded to file via the free Windows software
• Use P34 to define which calibration in the stack will be shown for mV offset (P35), slope1 (P36), slope2 (P37) and temp (P38)
• The historical mV offset * calibrations shown with P35 (Valid for pH sensors & ORP sensors)
• The historical slope1 calibrations shown with P36 (Only valid for pH sensors)
• The historical slope2 calibrations shown with P37 (Only valid for pH sensors when P08 three-point / dual slope mode is enabled)
• The historical temperature offset calibrations shown with P38 (Valid for all measurement and modes)

Sensor Calibration

• The date associated with each calibration can be viewed as a display feature (see note **** in Configuration section)

DISPLAY FEATURES IN MAIN pH/MV LED MODE:
• The absolute mV value * of sensor is displayed with ‘Down’ key in pH/mV LED mode.
• The current mA output selected scaling displayed by pressing the ‘Up’ key in pH/mV LED display mode.

DISPLAY FEATURES REQUIRING P01 SOFTWARE LOCK ‘ON’ TO BE ENABLED
• If 'Down' is pushed in °C LED mode offset in °C units * for current temperature offset calibration is shown.
• If 'Down' is pushed in 'Offset' LED mode, the current offset calibration in units of mV * (P16) is shown
• If 'Down' button in 'Slope' LED mode is pushed, the current slope for the live pH value is shown in units of mV per decade. The Slope1 (P17) is shown unless both P18 (dual slope mode) is enabled & the current pH value is above 7, in which case P18 is shown.

** Negative values are shown as flashing.*

AUTOMATIC 2-POINT CALIBRATION INSTRUCTIONS

Automatic pH calibration recognizes 4.00, 6.86, 7.00, 9.18 & 10.00 pH buffers. You will always use either 6.86 or 7.00 pH buffer in this calibration. If the process operates in the alkaline range the second buffer must be either 9.18 or 10 pH. If the process operates in the acidic range the second buffer will be 4.00 pH. To calibrate to any other pH buffers use the manual pH calibration mode.

- Set P01 lock to "Off" and then set P08 to "Off", which disables 3-point calibration.
- Clean the sensor and rinse with DI water and blot dry.
- Place in pH7 or pH6.86 buffer and allow the reading to stabilize. Set the P01 lock to "Off"
- Using the ‘Mode’ button toggle to the ‘Offset’ LED mode. Hold ‘Up’ & ‘Down’ keys simultaneously to begin an 'Offset' autocalibration session. The display then toggles between dashes on the left & right LED until auto-read algorithm is complete. If all criterion of auto-read algorithm were met the auto-buffer recognition feature then displays the suggested pH buffer. If all auto-read criteria were not meet then an ‘Err’ message is returned.
- To accept the suggested pH buffer value from the auto buffer recognition feature press the ‘Mode’ key. Alternatively you can use the ‘Up’ or ‘Down’ keys to pick a different pH buffer followed by pressing ‘Mode’ key. If the user selected pH buffer exceeds the calibration limits for the given offset or slope mode then an ‘Err’ message will also be shown and the calibration aborted. After completion the A.P. (P16) will be properly calibrated.
- Rinse the sensor with DI water and blot dry. Place into either the low or high pH buffer.
- Using the ‘Mode’ button toggle to the 'Slope' LED mode. Hold ‘Up’ & ‘Down’ keys simultaneously to begin a 'Slope' autocalibration session. To accept the suggested pH buffer value from the auto buffer recognition feature press the ‘Mode’ key. After completion the current working slope (either P17 for acidic slope or P18 for alkaline slope) will be properly calibrated.
- When finished press the Mode key to toggle to the pH operating mode.

Sensor Calibration

Manual 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 after calibration is complete.

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.

MANUAL pH CALIBRATION INSTRUCTIONS

Manual pH calibration allows offset & slope adjustment to any pH buffer or grab sample reference value.

To calibrate you will need:

- A *clean* sensor. Please refer to the cleaning procedure in the previous section.
- (3) 250 ml glass or plastic beakers that are heavy enough to prevent the sensor from tipping the beaker over.
- High pH buffer solution
- Low pH buffer solution
  1. One of these buffer solutions should be either pH 7.0 or pH 6.86 for the most accurate measurements, see note above in the previous section.
- Distilled or deionized water
- A soft lint free cloth

Fill a 250 ml beaker with enough high buffer solution (typically pH7) so that the entire tip of the pH sensor will be submersed.

NOTE: For 2-point calibration a**lways start with the high buffer solution first.**

Sensor Calibration

1. 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.

    a. Temperature can be displayed by pressing the mode button until the °C LED lights. Temperature can be adjusted by pressing the up and down arrows while in this mode (if software lock is off).

    NOTE: Smart digital sensors are substantially less sensitive than analog sensors to induced electrical charges caused by touching the sensor and cable (which distorts readings) and therefore have full electro-static discharge protection.

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.

- Use the 'Mode' button to toggle to the 'Offset' LED and calibrate to first desired value using 'Up' and 'Down' keys. In manual calibration mode you must take into consideration the exact value of the pH buffer at the current temperature. This information is always available on the pH buffer bottle.
- For this Offset calibration the typical pH buffer employed are 6.86 or 7.00 although in manual mode it is not necessary to use any specific pH buffer or value for the offset calibration. In manual mode the offset calibration can be performed anywhere from -2 to +16 pH.
- Use the 'Mode' button to toggle to the 'Slope' LED and use 'Up' and 'Down' keys until the display reads the second desired value on the pH buffer bottle at the current temperature. This is most typically pH buffer 4.00 for applications that are typically acidic to neutral and pH buffer 9.18 or 10.00 for applications that are typically neutral to alkaline.
- Press Mode to return to pH (run) mode after calibration is complete.

Manual Three-point Calibration

Three-point calibration is used when the process measurement frequently crosses the pH7 condition; it allows for a dual slope operation and calibration. The pH sensor is calibrated at three points to create the dual slope operating scheme. The calibrations must be performed in the order stated below.

- One calibration typically near pH 7 in 'Offset' LED mode, this becomes the mV offset.
- Second calibration in pH buffer below pH7 in 'Slope' mode, this becomes Slope 1 for Acidic Conditions
- Third calibration in pH buffer above pH7 in 'Slope' mode, this becomes Slope 2 for Alkaline Conditions

Procedure:

- Unlock the software by navigating to parameter P01, LOCK. Toggle to "Off" using the up or down keys.
- Select parameter P08 and Set 'On' using the up or down key. This enables the three-point calibration mode.
- Rinse the sensor with distilled water and blot dry. Insert the sensor into a heavy beaker containing a buffer solution near pH 7 and allow it to reach temperature equilibrium and stabilize.
- The software lock will have been automatically locked during stabilization time, use parameter P01 to unlock.
- Use the 'Mode' button to toggle to the 'Offset' LED mode.
- Check exact value of pH buffer on bottle at the current temperature displayed on the transmitter and ensure that both the pH sensor and the pH buffer are at a stable equilibrium temperature.
- Calibrate to first desired value using 'Up' and 'Down' keys.
- Perform the second calibration in pH buffer below pH7. Use the 'Mode' button to toggle to the 'Slope' LED and use 'Up' and 'Down' keys until the display reads the second desired value.
- Exit 'Slope' mode after completing acidic slope calibration (below pH7) by pressing the 'Mode' button. Toggle through the modes to re-enter 'Slope' mode to perform the second 'Slope' calibration for the alkaline (above pH7) calibration.

Sensor Calibration

- Use the ‘Up’ and ‘Down’ keys until the display reads the third desired value for the alkaline value.
- Press Mode to return to pH (run) mode after calibration is complete.

ORP CALIBRATION INSTRUCTIONS

The ORP sensors can only undergo an ‘Offset’ type calibration performed in manual mode. Automatic calibration mode is disabled for ORP sensors. Toggle to ‘Offset’ LED mode with ‘Mode’ and use the ‘Up’ and ‘Down’ buttons to adjust mV reading to match desired value of ORP standard solutions or else to agree with an offline determined ORP reference value of the inline process media. Negative values will be shown as flashing. The live working mV offset calibration for ORP sensor can be viewed and adjusted in P16. *

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.

GENERAL pH & ORP CARE AND MAINTENANCE RECOMMENDATIONS

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.

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

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 **

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.

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.

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%) HCl acid for 30 seconds. Wash and rinse away excess acid with water.
5. Place the probes in saturated KCl solution to a depth 1" for 2 to 3 days.
6. Remove from KCl 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 KCl 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.

FX-300-DpH Digital Measurement System
Troubleshooting Guide & FAQ

!!! WARNING !!!
The FX-300-DpH digital transmitters are ONLY for use with genuine Foxcroft supplied smart digital sensors. Connecting any other sensor (analog or digital) may permanently damage the transmitter and/or the improper sensor. If there should be any doubt as to whether you are connecting a genuine digital sensor to the digital transmitter, please inquire to the Foxcroft factory for verification.

The smart digital pH/ORP sensors are designed for a seamless and simple plug and play type operation with the intelligent digital FX-300-DpH transmitters. In the case that any exception occurs a variety of diagnostic information may be displayed in the form of error codes reported on the FX-300-DpH LED display. Instructions about what should be done if any of these error codes or diagnostic messages are displayed is provided below to assist with troubleshooting initial commissioning as well as ongoing maintenance of your installation.

Error codes are shown flashing on the display in the format “X.Y” where “X” is from 1 to 10 and “Y” can vary from 0 to 9. The exact coding designations are generally only relevant for internal uses by the factory. In particular the “Y” portion of the error code can be safely ignored unless specifically requested for remote diagnostic troubleshooting assistance purposes.

NO SENSOR CONNECTED OR IMPROPER WIRING ERRORS
If no genuine smart digital sensor is connected, it is expected that one or more error codes will be reported including the 2.Y type error code.

If there is a digital sensor connected but it is not interfaced to the correct type of mating transmitter you will get a 3.Y measurement type mismatch error. It is very important to make sure that the four leads from the smart digital sensor are properly wired to the terminals on the transmitter to prevent damage to the electronics. Please see page one (1) for the color coding and terminal designations of the four leads. Since the digital measurement system employs a NEMA 6P rated quick disconnect termination, the tinned lead connections need only be made correctly once to the transmitter.

COMMUNICATION ERRORS
If a digital sensor is properly connected and an error code of the type 1.Y, 4.Y, 5.Y , 6.Y, 9.Y or 10.Y is received then these indicate that some form of a communication exception has occurred. Such errors are quite rare. If observed at all they are typically quite brief in duration signifying a very brief transient temporary communication issue. If these error codes starting with 1, 4, 5, 6 or 9 persist this indicates that there was some damage to the electronics inside the digital sensor and it must be replaced. Typically some ground loop or electrical/installation issue is responsible for this damage.

DATE STAMPING ERRORS
If an error code of the type 7.Y or 8.Y is received then these indicate that some form of an error has occurred related to setting the field activation or the last date of field use. These errors are also extraordinarily rare and indicate either an improper configuration or else a corruption to that portion of the EEPROM (very unlikely). If the issue is simply an improper configuration this can be resolved at the factory. The sensor item number, serial number, invoice number and dispatch date will be requested for approval of any such return. All of this information can be obtained from the transmitter to which the digital sensor is connected by looking at the appropriate parameters.

GENERAL TROUBLESHOOTING TIPS
• Ensure that all snap connections with the extension cables are secure and that none of the pins are damaged.
• Ensure that there is good integrity of PVC insulation on leads & cable jacket for both sensor and/or extension cables.
• Disconnect and reconnect the digital sensor via the snap connection. Allow ~5 to 10 seconds before reconnecting.
• Cycle the power to the transmitter and swap out the extension cable for a unit that is known to be working.
• Connect a genuine Foxcroft digital sensor known to be working to ensure transmitter is functioning normally.

- Being able to view the mV offset (A.P.) and the slope from the main LED mode is very useful to see if the current working calibration is reasonable.

OFL and UFL Error Codes

The flashing “OFL” means that an overflow issue exists on the input while a flashing “UFL” means that an underflow issue exists on the input. When this error exists you will not be able to perform any programming or configuration of the transmitter until the issue is resolved. The “OFL” or “UFL” condition can be due to a variety of possible causes which are summarized below:

POTENTIAL TEMPERATURE INPUT RELATED PROBLEMS

- A temperature element is not properly connected to the transmitter input board. Most electrochemical transmitters require a valid temperature input in order to operate properly.
    - Check that each of leads are firmly connected to the proper terminals per the wiring schematic
    - If no sensor is available or the sensor employed does not have a temperature compensation
    - element, please use a 110 Ohm axial resistor to simulate a P100 TC input @ 25°C or a 1100 Ohm axial resistor to simulate a Pt1000TC input @ 25°C.
    - Check that the transmitter setting for the Pt100 or Pt1000 TC type matches the temperature element in the sensor.

POTENTIAL SIGNAL INPUT RELATED PROBLEMS

- The input signal value obtained from the connected sensor exceeds the lower or upper boundary limits possible for the input circuit. There are a variety of potential causes itemized below:

- Confirm that the proper type of sensor is being connected to the correct type of mating transmitter. For example: transmitters come in separate versions that are for use with sensors without integral preamplifiers and sensors that have integral preamplifiers.

- Leads are not secure or the color coding is not correct. Please refer to the documentation supplied in documentation with your shipment or contact the factory for assistance.

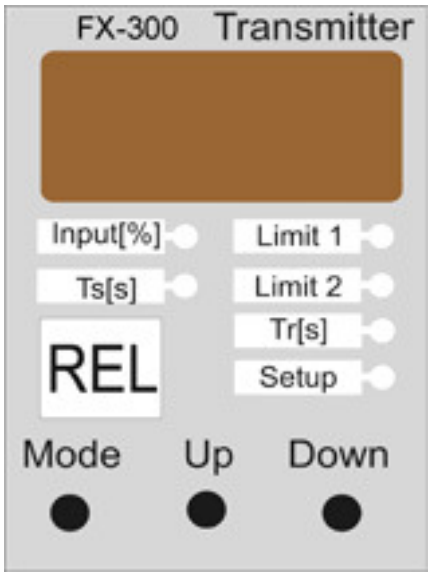
- The connected sensor is either damaged or expired. Connect a different known working sensor on the

same transmitter to determine if the issue is with the input board or to the connected sensor.

- If you have gone through all of the troubleshooting steps and are still receiving the “OFL” or “UFL” error then most likely your input board has stopped working properly. Contact the factory.

Optional 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 (a.k.a. Variable Pulse).

Reset

In simple supervision an alarm may be reset by activating the external reset input (S1 – terminal 3) or by pressing the ‘Mode’ key in the “input” display mode. The alarm condition must be cleared to reset.

FX-300-REL *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
Temp.: Weight:	Max torque 0.6 Nm
Dimensions:	-15 to +50 °C 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

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

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. 19. Polarity of relay 1: Non inverted/ Inverted ***

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.

FOXCROFT

EQUIPMENT & SERVICE COMPANY, INCORPORATED

Serial Number Label of FX-300 Series Analyzer:

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