INSTRUCTION MANUAL

MODEL T80 UNIVERSAL TRANSMITTER

ELECTRO-CHEMICAL DEVICES

T80 IMC13

SCREEN MAP

CAL (Calibration)	Auto	Cal 1 (Offset) using Calibration Solution				
		Cal 2 (Slope) using Calibration Solution				
	Standardize	Enter Grab Sample Determined Value				
	Manual	Enter Offset, enter PV value and associated mV				
		Enter Slope, mV/pH, mV/decade, mV/ppm…				
	Temp	Enter measured Temperature				
CONFIG (Configuration)	XMTR	LCD	Set Up	Temp. °C or °F		
				Contrast	Adj. 0-100%	
				Back Light	Enter ON time	
			Legend	Icon buttons		
				Text buttons		
			Graph	Line	Screen Duration	
				Gauge		
				Bar		
			Label	TAG ID	Enter Name	
				TAG ON/OFF		
				POP UP ON/OFF		
		Output	4-20	Range	4 mA =	
					20 mA =	
				Cal	Trim 4.00 mA	
					Trim 20.00 mA	
				Fault	3.5 mA	
					22 mA	
					NONE	
			RELAY	Relay 1	Alarm	Set Point
					Timed	Period, Duration
					Fault	
				Relay 2	Alarm	Set Point
					Timed	Period, Duration
					Fault	
				Relay 3	Alarm	Set Point
					Timed	Period, Duration
					Fault	
			HOLD	Time out		
		Serial	Address			
			Baud rate			
			Format			
		Password	Menu			
			CAL			
			CNFG			
			SIM			
	Sensor	Type	Choose Sensor: pH, ORP, DO ppm, mg/L, % Sat, NH_4^+, Br^-, Ca^{++}, Cl^-, Cu^{++}, CN^-, F^-, NO_3^-, K^+, Ag^+, Na^+, S^{--}, Resistivity, Conductivity			
		T COMP	Enter % Comp			
		ISO PT	Enter mV value			
	Load Default					
INFO (Information)	XMTR	Configuration				
	Sensor	Calibration logs				
SIM (Simulate)	System	Fixed value				
		Ramp				
	Relays	#1 ON/OFF				
		#2 ON/OFF				
		#3 ON/OFF				
	4-20 mA	Enter Value				

PREFACE

Purchasing products from Electro-Chemical Devices, Inc. provides you with the finest liquid analytical instrumentation available. If this is your first purchase from ECD, please read the entire manual before installing and commissioning your new equipment.

Manuals are accessible on the ECD website at http://www.ecdi.com/literature/manuals.html .

If there are any questions concerning this equipment, please contact your local ECD representative, or the factory directly at:

Electro-Chemical Devices, Inc.
1681 Kettering
Irvine, CA 92614 USA
Telephone: +1-949-336-6060
FAX: +1-949-336-6064
Website: www.ecdi.com
Email: sales@ecdi.com

SYMBOLS USED IN MANUAL

	This symbol is used to designate important information, warnings and cautions. Failure to follow this information could lead to harm to the instrument or user.
	This symbol is used to designate a WARNING “Risk of Electrical Shock”
	Equipment protected throughout by double insulation.

	Read the complete manual before installing or using the equipment.

Contents of this manual are believed to be correct at the time of printing and are subject to change without notice. ECD is not responsible for damage to the instrument, poor performance of the instrument or losses resulting from such, if the problems are caused by:

- Incorrect operation by the user.
- Use of the instrument in incorrect applications.
- Use of the instrument in an inappropriate environment or incorrect utility program (power supply).
- Repair or modification of the related instrument by anyone not authorized by ECD.

Table of Contents

WARRANTY

Electro-Chemical Devices, Inc. (ECD) warrants this product to be free from material defects and factory workmanship, and agrees to repair or replace any product that fails to perform, as specified, within two (2) years after the date of shipment. This warranty shall not apply to any product that has been:

1. Subjected to misuse, negligence or accident;
2. Connected, installed, adjusted or otherwise used not in accordance with the instructions furnished by ECD;
3. Repaired, modified or altered by persons not authorized by ECD, resulting in injury to the performance, stability or reliability of the product.

This warranty is in lieu of any other warranty, expressed or implied. ECD reserves the right to make changes in the design or construction of its products at any time, without prior notification, and without incurring any obligation to make any changes in previously delivered products.

Seller's sole liabilities and the buyer's sole remedies under this agreement shall be limited to a refund in the purchase price, or at ECD's discretion, to the repair or replacement of any product that proves, upon ECD's examination, to be defective, when returned to the factory, transportation prepaid by the buyer, within one (1) year of the product's original shipment date. Seller shall not be liable for damages consequential or incidental to defects in any product, for failure of delivery in whole or in part, for injuries resulting from its use, or for any other cause.

This warranty and the writing attached constitute the full understanding of seller and the buyer, and no terms, conditions, understanding, or agreement purporting to modify or vary the terms hereof shall be binding unless hereafter made in writing and signed by an authorized official of Electro-Chemical Devices, Inc.

This warranty does not cover pH, ORP, Dissolved Oxygen or Specific Ion electrodes or any electrode cartridges that have been commissioned in service.

IMPORTANT SERVICE INFORMATION

Use only factory authorized components for repair. Tampering or unauthorized substitution of components may adversely affect the operation of this product and may void the warranty.

If service or repair is required, please obtain the serial number(s) or sales order number of the product(s) in question and contact ECD's Service Department at:

+1-800-729-1333 (USA/Canada) or +1-949-336-6060
or email Service@ecdi.com

A Return Material Authorization (RMA) number must be obtained from the service department before returning any material to ECD. All material returned to ECD shall be shipped prepaid to the factory.

UNPACKING THE INSTRUMENT

Your Electro-Chemical Devices instrument has been carefully packaged to protect it from damage during shipment and dry storage. Upon receipt please follow the procedure outlined below.

1. Before unpacking, inspect the condition of the shipping container to verify proper handling by the carrier. If damage is noted, save the shipping container as proof of mishandling for the carrier.
2. Check the contents of the shipping container with the items and quantities shown on the packing list. Immediately report any discrepancies to ECD.
3. Save the original packing material until you are satisfied with the contents. In the event the product(s) must be returned to ECD, the packing material will allow you to properly ship it to ECD.
4. Familiarize yourself with the instrument before installation, and follow proper installation and wiring procedures.

WARNING Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other applicable national or local codes.

Installation and wiring

Failure to follow the proper instructions may cause damage to this instrument and warranty invalidation.

Use only qualified personnel to install, operate and maintain the product.

The Model T80 transmitter should only be used with equipment that meets the relevant IEC, American or Canadian standards. ECD accepts no responsibility for the misuse of this unit.

Basic Parts List

1. Model T80 Transmitter
2. Mounting Hardware
3. Instruction Manual

INSTRUCTION MANUAL REVISION

Revision	Date	Remarks
A	07/12	Initial release
B	03/13	Added Sensors and Conductivity Data
C	03/13	Updated Symbols

1.0 GENERAL DESCRIPTION

The ECD Model T80 transmitter is a single channel, intelligent, multi-parameter transmitter designed for the online continuous measurement of pH, ORP, pION or dissolved oxygen in a general purpose industrial environment. The Model T80 transmitter digitally communicates with any ECD S80 digital sensor, automatically configuring the transmitter's menus and display screens to the measured parameter.

The Model T80 transmitter can be loop powered, 24 VDC powered or 100-240 VAC line powered. The standard configuration has a 4-20 mA output and a RS485 serial communication port with MODBUS®RTU output. A HART® communication version is also available. Alarm relays are optionally available on either line powered transmitter.

1.1 FEATURES

- Multi-Parameter, pH, ORP, Specific Ion, Dissolved Oxygen, Conductivity, Resistivity
- Simple, user friendly menu structure
- Noise free digital communication with sensors
- Reads and writes calibration data to sensor
- Isolated 4-20 mA output and MODBUS® RTU standard, optional HART®

1.2 SPECIFICATIONS

1.2.1 INPUT SPECIFICATION

Digital protocol, all ECD S80 sensors
Optional analog to digital converter, 5 inputs [mV+, mV-, temp +, temp-, solution ground]

1.2.2 INPUT RANGES

pH	-1.00 - 15.00 pH
ORP	-1500 - +1500 mV
pION	000.1 - 999.9, Auto Ranging: ppb ↔ ppm ↔ ppt (thousand)
Dissolved Oxygen	000.1 - 999.9, Auto Ranging: ppb ↔ 20.00 ppm, % SAT, mg/L
Conductivity	0.000 – 2.000, Auto Ranging: µS ↔ mS ↔ S
Resistivity	0.000 – 20.00 MΩ
Temperature	100K-ohm TC, -30°C - 140°C

1.2.3 ACCURACY

pH	0.02 pH
ORP	± 1 mV
pION	Specific for electrode type
Dissolved Oxygen	2% of range
Conductivity	2% of range
Resistivity	2% of range
Temperature	± 0.3°C

1.2.4 Output Signals

4-20 mA output (standard), Fault Condition: 3.5 mA, 22 mA or none
Modbus RTU (standard)
HART® (optional)

1.2.5 Contact Relays

(Optional) Three (3) SPDT, 1 form C, 250 VAC, 10 Amp resistive maximum, relays, user configurable as Hi/Lo alarms with expiration timer or Fault alarms

1.2.6 Display

128 x 64 pixels (2.75" x 1.5") LCD, Black/Grey background on loop powered instruments, Blue/White background LED backlight on 100-250 VAC and 24 VDC powered instruments, English or icon based menus, numeric and graphical displays

1.2.7 Enclosure

Beige Polycarbonate, NEMA 4X, weatherproof, ½ DIN, (L x W x D) 5.7" X 5.7" X 3.5" (14.4cm X 14.4cm X 9.0cm)

1.2.8 Power

Code -0	Loop powered, 24 VDC 600 Ω maximum load (18-36VDC @ 35 mW minimum)
Code -1	24 VDC (18-36 VDC @ 250 mW minimum)
Code -2	100-240 VAC, 50/60 Hz, 4W, with 250V, 1A, Slow Blow fuse

1.2.9 Environmental Conditions

Ambient Temperature	-20°C - 70°C
Storage Temperature	-30°C - 85°C
Relative Humidity	0 – 90%, non condensing

1.2.10 Shipping

Size	8" x 8" x 5" (20.5 cm x 20.5 cm x 12.7 cm)
Weight	1.6 lbs. (0.75 kg)

1.3 Model Codes

Model T80-					
	10 (S80) S80 Digital Sensor, pH, ORP, pION, DO, Conductivity, Resistivity				
	20 Triton® DO80 Optical DO, Triton® DO9 ppb DO				
	30 Internal Preamp, Digital to S10/S17 pH, ORP, pION (+mV, -mV, 100K TC, SG)				
	40 Internal Preamp, Digital to SGTC Conductivity/Resistivity (CSX2 or 2 electrode contacting)				
	50 Internal Preamp, Digital to SGTC Dissolved Oxygen, (Steam Sterilizable Products)				
	60 Triton® TR6 Turbidity				
		-0 Loop Powered Transmitter			
		-1 24 VDC Powered Transmitter			
		-2 100-240 VAC powered Transmitter			
			0 No Relays		
			1 (3) form 1C 250 V 3A relays		
				0-0 4-20 mA output and MODBUS RTU	
				1-0 HART®	

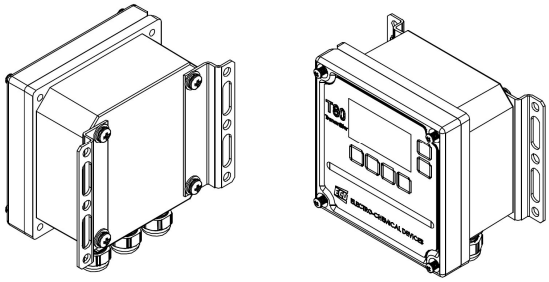
				2-0 2 x 4-20 mA & MODBUS	
					0 No Mounting Hardware
					1 Universal Mount
					2 Panel Mount
					3 Handrail Mount
					4 Sunshield Vertical Rail Mount
					5 Sunshield Horizontal Rail Mount
Model T80-	**10**	**-0**	**0**	**1-0**	**1**

Example above shows part# T80-10-001-01, a T80 transmitter for use with an S80 sensor, loop powered with HART® communication and a universal mounting bracket.

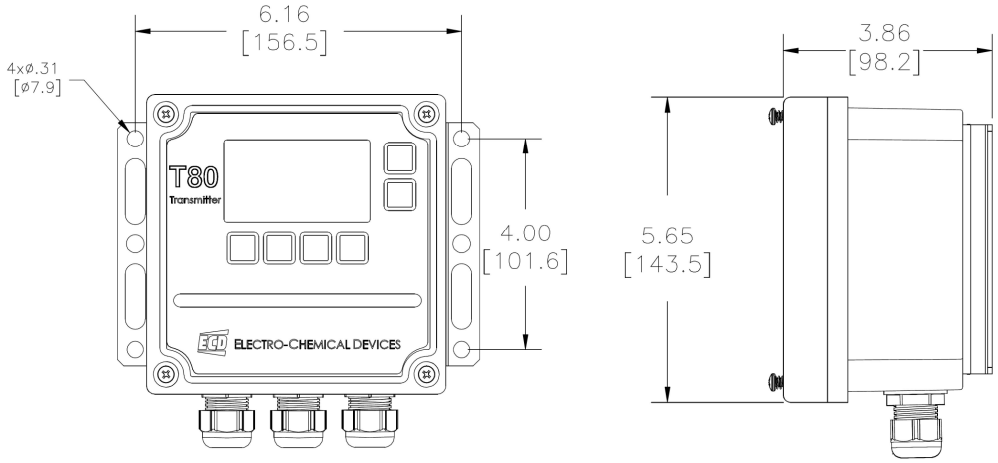
2.0 INSTALLATION

2.1 MOUNTING

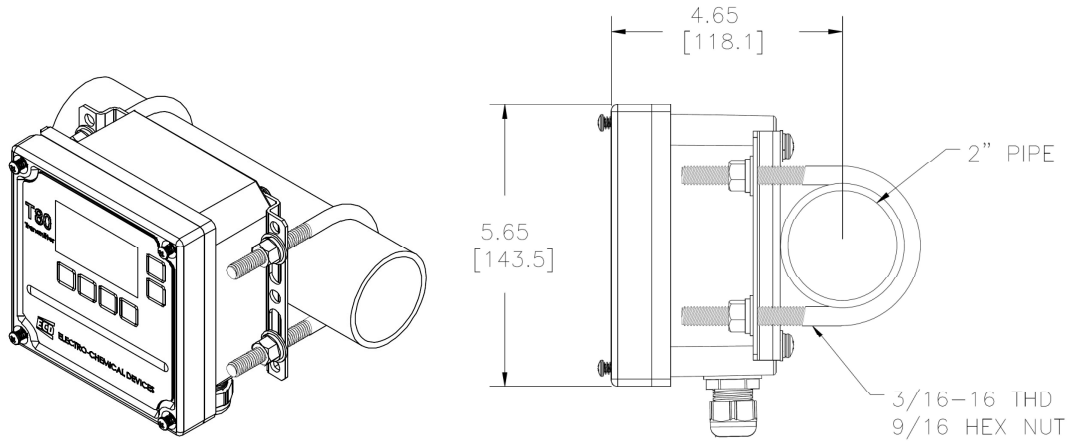
Mount the T80 in a location where there is easy access to the analyzer and sensors. Install the system in an area where vibrations, electromagnetic and radio frequency interference are minimized or absent. Do not mount in direct sunlight or areas of extreme heat (temperature > 120°F). The NEMA 4X T80 is suitable for outdoor use but it is best to mount it with a protective cover or sunshield to prevent discoloring over the years.



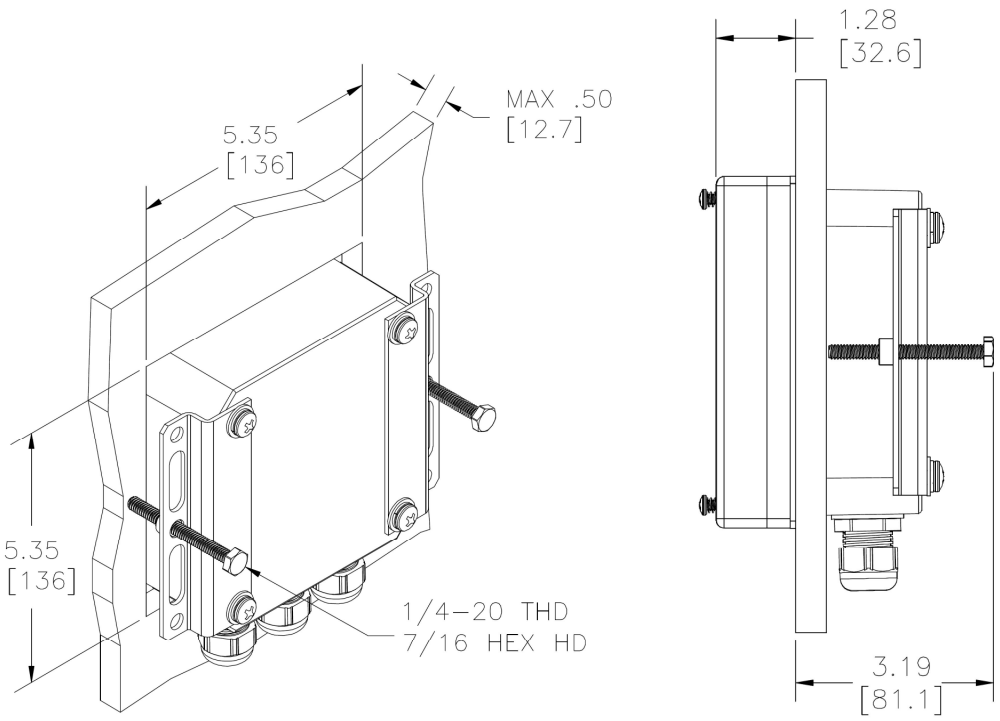
Universal Mounting Brackets



Rail Mounting



Panel Mounting



Cut Out: 5.35” x 5.35” (13.6 cm x 13.6cm)

2.2 WIRING

Electrical wiring should only be conducted by qualified personnel. See the T80 wiring diagram in Figure 2.2.X

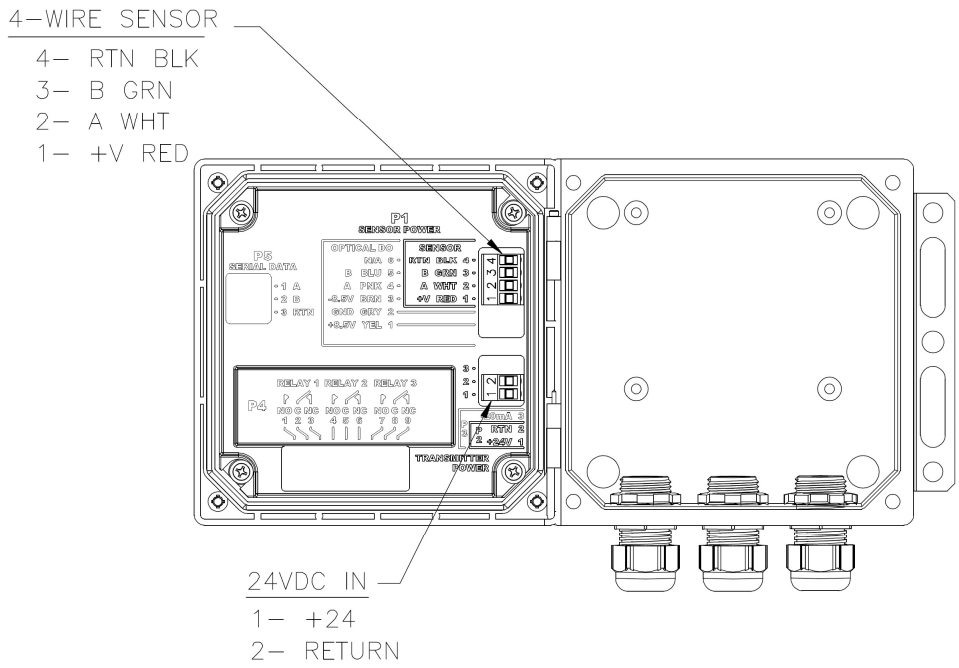


Figure 2.2.1 Loop Powered Transmitter

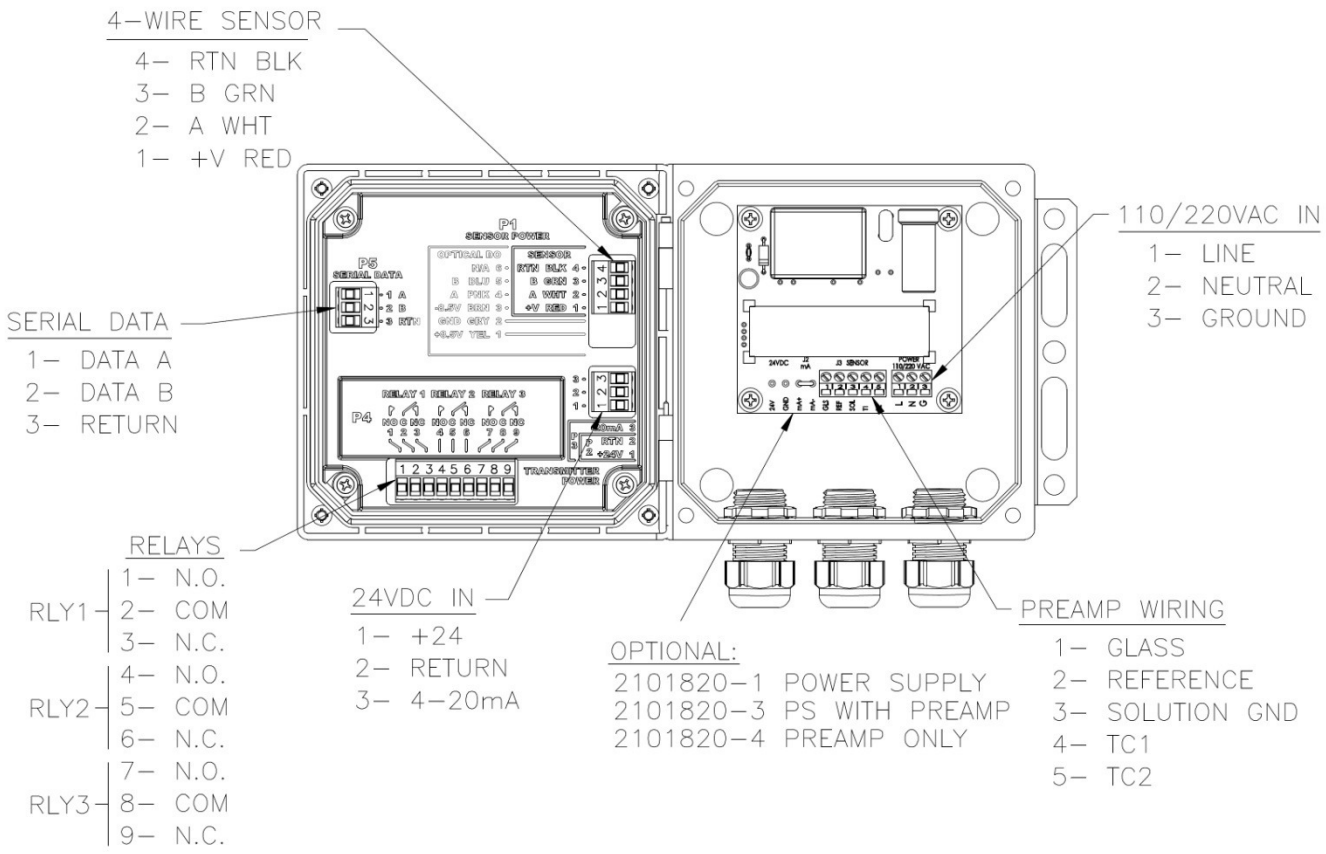


Figure 2.2.2 4-Wire Transmitter, 24VDC or /110/22 VAC, MODBUS, Relays/Optional Digital Preamp

	Warning: RISK OF ELECTRICAL SHOCK
	Disconnect Power before opening instrument.
	WARNING Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other applicable national or local codes.

2.2.1 WIRING, POWER

ECD recommends using a two prong power cord, type SJTW (service grade, hard service, thermoplastic, outdoor sunlight resistant jacket and wet location rated inside of a ½" flexible conduit. If a two prong plug is not used and the power is hard wired then provide a switch or breaker to disconnect the analyzer from the main power supply. Install the switch or breaker near the analyzer and label it as the Power Switch for the analyzer.

Loop Powered (2 wire configuration)
Attach the 24VDC signal cable to terminals #1 and #2 as shown in Figure 2.2.1 and on the diagram inside of the T80 cover. Feed the cable through the gland fitting on the right hand side of the T80. Tighten the cable gland to provide a good seal to the cable. The instrument can be powered up at this point with no harm to the analyzer but it is best to wait until the sensor is installed.

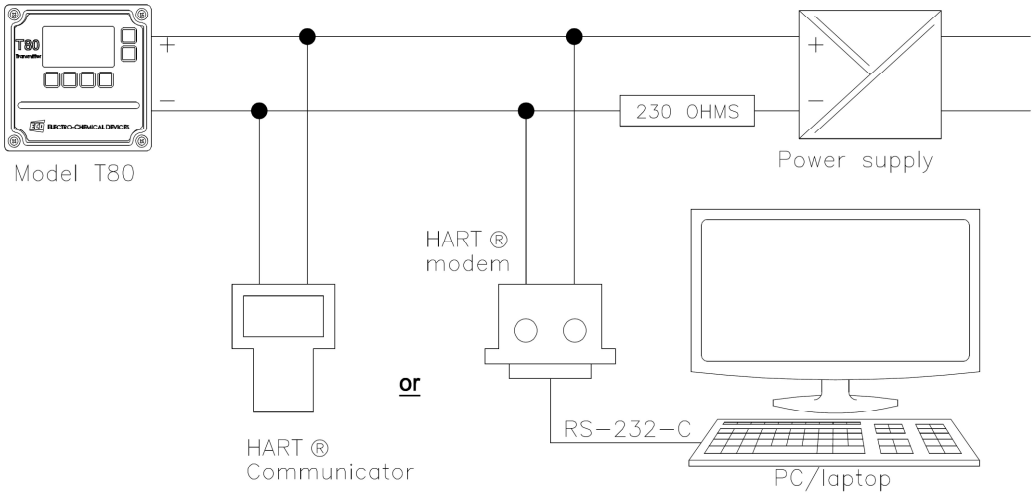
24VDC (4 wire configuration)
Attach the 24VDC power cable to terminals #1 and #2 as shown in Figure 2.2.2 and on the diagram inside of the T80 cover. Attach the 4-20 mA cable to terminals #3 (out) and #2 (return). Feed the cables through the gland fitting on the right hand side of the T80. Tighten the cable gland to provide a good seal to the cable. The instrument can be powered up at this point with no harm to the analyzer but it is best to wait until the sensor is installed.

110/220 VAC (4 wire configuration)
Attach power cable as shown in Figure 2.2.2 or as on the diagram inside of the T80 cover. Feed the cable through the gland fitting on the right hand side of the T80. Tighten the cable gland to provide a good seal to the cable. The instrument can be powered up at this point with no harm to the analyzer but it is best to wait until the sensor is installed.

2.2.2 Wiring, Sensor
Attach the sensor wires as described on the diagram inside the T80 cover. Feed the sensor cable through the gland fitting on the left hand side of the T80. Do not use the same gland fitting for the AC power or Alarm/Relays. The green terminal strip connectors are detachable from the circuit boards. Remove the connector by pulling straight back from the circuit board.

2.2.3 Wiring, 4-20 mA Outputs
Loop Powered Instruments:
Connect the 4-20 mA cable to terminals #1 (+24V) and #2 (-24V) for loop powered instruments, Model T80-XX-0 X-XX.
24 VDC or 110/220 VAC powered instruments:
Connect the 4-20 mA cable to terminals #3 (out) and #2 (return) for instruments powered from the internal power supply, either Model T80-XX-1X-XX (24VDC) and T80-XX-2X-XX (110/220 VAC).

Transmitters with HART® Communication can be wired as shown below. See HART® Communication menu in Appendix 9.2:



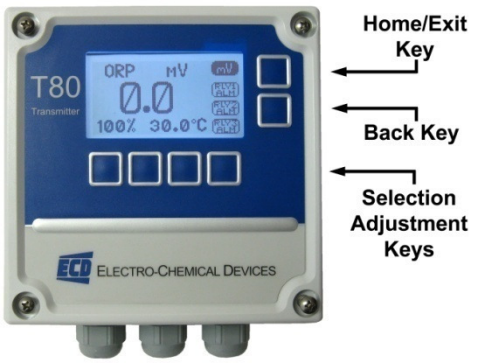
2.2.4 Wiring, Contact Relay Outputs

The standard configuration has three SPDT 230V 5 A relays that can be wired either **normally open (NO)** or **normally closed (NC)**. The default configuration is set to use the relays as normally open.

2.2.5 Wiring, Serial Output MODBUS RTU

Attach the sensor wires as shown in Figure 2.2.2 or as described on the diagram inside the T80 cover. Feed the sensor cable through the gland fitting on the left hand side of the T80. Do not use the same gland fitting for the AC power or Alarm/Relays. See MODBUS command register in Appendix D.

3.0 OPERATION



The ECD Model T80 transmitter is an intelligent, single channel, multi-parameter transmitter designed for the online continuous measurement of pH, ORP, pION or Dissolved Oxygen in a general purpose industrial environment. The Model T80 transmitter digitally communicates with any ECD S80 digital sensor. The measurement identity is contained in the sensor's memory. When an S80 sensor is connected to the transmitter it automatically configures the transmitter's menus and display screens to the measured parameter.

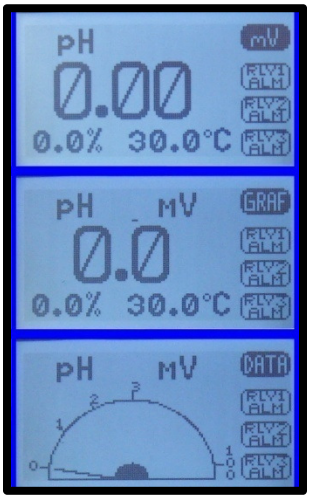
3.1 KEYS

The functions associated with each key are displayed above the key for the Selection Adjustment Keys and to the left of the key for the HOME and BACK keys. **Press any Selection Adjustment key twice within one second to enter the HOME Menu Screen.**

3.1.1 HOME/EXIT KEY

The **HOME key** performs two functions, it selects which screen is displayed and it returns the active screen to the HOME Menu Screen from anywhere inside the menu structure.

Three Display screens are available:



1. **DATA SCREEN**: Displays the measurement type, numerical value, engineering Units, % Output of the 4-20 mA channel and temperature.
2. **mV SCREEN**: Displays the measurement type, the sensor's raw millivolt Value, % Output of the 4-20 mA channel and temperature.
3. **GRAF SCREEN**: Displays a Graphical representation of the 4-20 mA channel % Output, the measurement type, the engineering units, and temperature. Only one of the three graphical display styles is available through the HOME key, either the Bar, Gauge or Line display. Choose which style will be displayed in the Graph Menu. (pathway to Graph Menu: CONFIG → XMTR → LCD → Graph menu)

Each of the above screens also displays the condition of the optional Alarm Relays, black if energized and white if de-energized.

The HOME key changes to the **EXIT key** in the HOME Menu Screen, pressing EXIT prompts the user to "Save Changes" YES/NO when exiting the HOME Menu. YES applies any changes made in the menus, NO exits the HOME Menu without applying any changes made in the menus.

3.1.2 HOLD/BACK KEY

The **BACK key** changes the screen to the previously displayed screen when inside a MENU, it moves BACK one screen. It can also be used to enter the HOME Menu screen from the HOME screen by pressing it twice within one second. The **HOLD key** toggles the output HOLD function ON/OFF.

3.1.3 Selection Adjustment Keys

The (4) Selection/Adjustment keys allow navigation and numerical adjustments to be made in the MENUs. **To enter the HOME Menu screen press any of the Selection/Adjustment keys twice within one second.** The various Menu choices and adjustment tools are displayed above the buttons once inside the MENU.

3.1.4 Alpha Numeric Entry

The **LABEL** and **PASSWORD** Menus allow alphanumeric entry. Entry is accomplished by scrolling through the alphanumeric list with the ▲ (forward) and ▼ (backwards) arrows to the character of choice and then moving to the NEXT digit. Pressing and holding the ▲ or ▼ keys will initiate two speed auto scrolling. The character set is sequentially listed below. The first character in the set is an empty space.

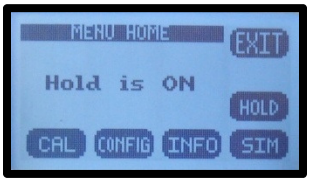
! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [¥] ^ _ ' a b c d e f g h I j k l m n o p q r s t u v w x y z { | } → ←

3.2 MENU STRUCTURE

Double tap any Selection/Adjustment key to enter the HOME Menu Screen. Five menu choices will appear, **CAL, CONFIG, INFO, SIM and HOLD**. Each of the Menus is detailed below.

3.2.1 HOLD (Output Hold)

Pressing the **HOLD Key** activates the HOLD function, HOLD is ON, displayed.

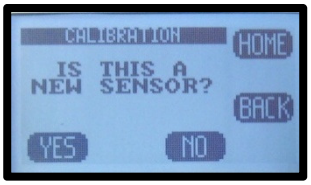


- Freezes the 4-20 mA output at the last value prior to activation
- Freezes optional Alarm Relays in the inactivated state
- While in the HOLD mode the % Output display toggles between the last value and HOLD

Pressing HOLD again turns the hold function off, Hold is OFF, displayed. The HOLD function remains ON until it is turned OFF. (see Time Out in CONFIG>XMTR>OUTPUT>HOLD)

3.2.2 CAL (Calibration Menu)

Four options are available, **AUTO, STAND, MANUAL and TEMP.**

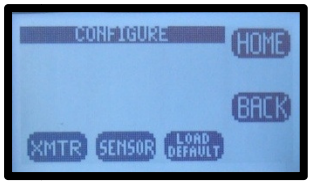


The first screen asks, "**Is this a New Sensor, YES / NO**". If YES the calibration history from the previous sensor is cleared from memory and a new register is started, if NO then the calibration is written to the memory stack (3) sets of data are stored.

- **AUTO** is a two point calibration. The calibration proceeds in two steps, AutoCal 1 is an offset calibration and AutoCal 2 is a slope calibration. Auto Cal provides automatic solution recognition of the calibration solutions used for each measurement in accordance with the following list:
  1. pH Calibration Buffers (US Standard), pH 4.01, pH 7.00 and pH 10.00 (see Appendix 9.1)
  2. ORP Calibration Solutions: Quinhydrone saturated: pH 4.01= +89 mV, pH 7.00= +266 mV
  3. pIon Calibration Solutions: 1.00, 10.00, 100.0 ppb, ppm, ppt (thousand)
  4. Dissolved Oxygen: Zero ppm (Sodium sulfite, Na_2SO_3 in water), Air saturated water, 8.25 ppm

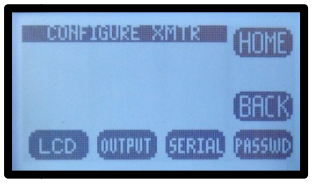
Any two solutions can be used for AUTO calibration however if solutions other than those listed above are used for calibration then the calibration values must be entered manually.

- **STAND** is standardization, a single point calibration. Standardizations are typically used to adjust the process reading to agree with a laboratory determined "grab sample" reading.
- **MANUAL** is a data entry screen. Manual calibration allows the user to enter a concentration with the corresponding mV value and a slope for an electrode. Laboratory generated calibration data for an electrode can be input to a remote analyzer where calibration is difficult or impractical.
- **TEMP** allows the displayed temperature to be trimmed to agree with actual process temperature.

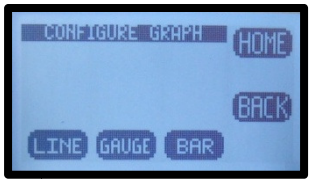


3.2.3 CONFIG (CONFIGURATION MENU)

Three options are available in the Configure Menu, **XMTR, SENSOR and LOAD DEFAULT**.

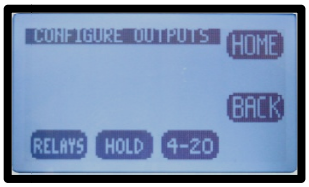


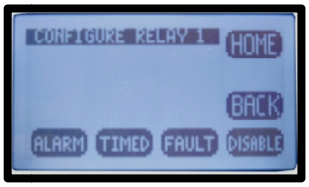
- **XMTR** enters the Transmitter Configuration menu.
  - **LCD** access the Display Configuration Menu
    - **SETUP** adjust screen lighting characteristics
      - **Temp.** Choose °C or °F
      - **CONT** adjust Contrast
      - **BACK LIGHT** adjust Backlight Timeout**,** from always ON to OFF after 10 minutes
    - **LEGEND** provides the choice of **Text** Menus or **Icon** based Menus
    - **GRAPH** provides the choice of which Graph style is displayed on the Home screen.
      - **LINE ,** Moving average, vertical scale set to 0-100% of the 4-20 mA output and user defined time scale
      - **GAUGE,** Live reading 0-100% of 4-20 mA range
      - **BAR,** Live reading 0-100% of 4-20 mA range



    - **LABELS**
      - **TAG,** Enter up to 2 lines x 16 characters, Name, tag #... Displayed in INFO
      - **TAG ON,** Turn TAG ON/OFF, adds TAG to Main Display Sequence
      - **POP UP**, Turns ON/OFF, the double tap HOME Screen pop up memo

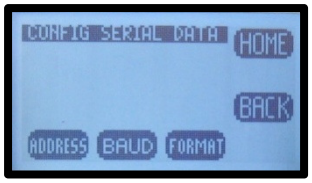
  - **OUTPUT** access the Output Configuration Menu
    - **4-20 mA** configure 4-20 mA output
      - **RANGE** Enter 4 mA value and 20 mA value
      - **CAL** Trim 4.00 mA output and 20.00 mA output
      - **FAULT** Choose fault condition 3.5 mA, 22 mA, None
    - **Optional 2nd 4-20 mA** for Temperature Output only
    - **RELAY**
      - **RLY1** Choose relay type:
        - **Alarm**, enter the Set point ON, Set Point OFF, Expiration time, Delay ON and Delay OFF times and the state of relay changes from de-energized to energized (energizes on





alarm).
- **Timed,** Enter Period and Duration times
- **Fault**, No input required, relay condition changes from energize to de-energize.
- **Disable**, Inactivates relay and removes the relay 1 button from the HOME Screen display.

- **RLY2** Same features as Relay 1
- **RLY3** Same features as Relay 1



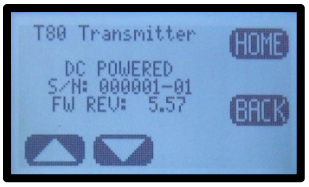
- **HOLD,** Freezes outputs at current value and locks relays in de-energized state.
  - **Hold Timeout,** Removes HOLD after a certain period of time, default setting: No Timeout, selections include 15 minutes, ½ hour, 1 hour

- **SERIAL** MODBUS configure serial output,
  - **ADDRESS,** enter address: 001 to 247
  - **BAUD,** Choose baud rate, default 9600
  - **FORMAT,** set serial data format, default value: 8N1, 8 bit, no parity bit, 1 stop bit

- **SERIAL** HART configure output,
  - **ADDRESS,** enter address: 01-63
  - **BAUD,** default 1200, no adjustment available
  - **FORMAT,** default value: 8O1, 8 bit, Odd parity bit, 1 stop bit, no adjustment available
- **PASSWD** Enter 4 character password to protect access to MENU Level, CAL Menu, CONFIG Menu and SIM Menu (simulate). Each level can be turned ON or OFF and can have a unique password.
  - **MENU** ON/OFF _ _ _ _ Locks Main Menu
  - **CAL** ON/OFF _ _ _ _ Locks CAL and CONFIG
  - **CONFIG** ON/OFF _ _ _ _ Locks CONFIG
  - **SIM** ON/OFF _ _ _ _ Locks SIM and CONFIG

❖ **SENSOR** enters the sensor configuration menu.
- **TYPE,** Allows T80 transmitter to configure the S80 sensor. For use only when switching the measurement electrode type in an S80 sensor, i.e. for a pH electrode to a pION electrode. Select Sensor Type: pH, ORP, DO_2, NH_3, NH_4^+, Br^-, Ca^{++}, Cl^-, Conductivity, Resistivity, Cu^{++}, CN^-, F^-, NO_3^-, K^+, Ag^+, Na^+, S^{--}
- **T COMP,** Enter % temperature compensation per degree: pH, pION 0.33%, ORP 0.00%, DO_2 4%
- **ISO PT,** Enter Iso Potential value in mV. The Iso Potential is the point where changes in the temperature do not cause changes to the signal.

❖ **Load Default** resets all Menus to factory default configuration.



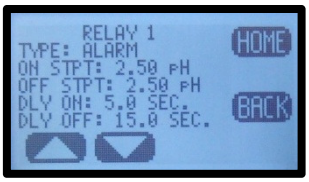
3.2.4 INFO (INFORMATION MENU)

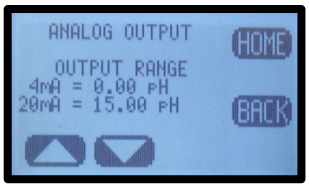
The Information Menu provides two choices,

❖ **Transmitter Screen**, details the Name, Power type, Serial #, Firmware

version and the output configuration(s).

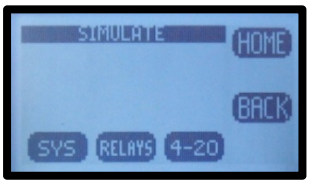
- **Sensor Screen**, details the Name, Part #, Serial # and three sets of Calibration data.





3.2.5 SIM (SIMULATION MENU)

The Simulation menu allows the Input or Output signals to be simulated.



- **SYSTEM** allows the Input to be simulated. Two choices are available, FIXED is a fixed value, RAMP varies the signal across the 4-20 mA range, from the highest value to the lowest value and back, activating and deactivating relays if present. The RAMP has two adjustments the Ramp period, 30 seconds to 2 minutes and Duration; 1 cycle, 5, 10, 20, 30 minutes.
- **RELAYS** allows individual relays, #1, #2, and #3 to be activated and deactivated
- **4-20 mA** allows the output to be simulated from 4.00 mA to 20.00 mA.

3.2.6 FAULT SCREENS

Fault	Definition	Recommendation
Memory Error	AN ERROR WAS FOUND WITH THE MEMORY OF THE MICROCONTROLLER	RETURN TO FACTORY FOR SERVICE
Input Voltage OOT	POWER IS OUT OF TOLERANCE	CHECK WIRING TO THE TRANSMITTER
+12V OOT	ONBOARD 12V IS OUT OF TOLERANCE	RETURN TO FACTORY FOR SERVICE
+3.3V OOT	ONBOARD 3.3V IS OUT OF TOLERANCE	RETURN TO FACTORY FOR SERVICE
Loss of Comm	COMMUNICATION WITH THE SENSOR WAS LOST	CHECK WIRING TO THE SENSOR
No Sensor	NO SENSOR WAS FOUND AT START-UP	CHECK WIRING TO THE SENSOR
Cal Failed	SENSOR CALIBRATION FAILED	1) CLEAN SENSING TIP 2) VERIFY SOLUTIONS 3) DO NOT LEAVE UNATTENDED 4) RE-CALIBRATE
Relay 1 Expired	RELAY 1 TIME ON EXPIRED	1) CHECK SENSOR OP 2) CHECK AUX EQUIP SUCH AS: A) PUMPS B) TANKS
Relay 2 Expired	RELAY 2 TIME ON EXPIRED	1) CHECK SENSOR OP 2) CHECK AUX EQUIP SUCH AS: A) PUMPS B) TANKS
Relay 3 Expired	RELAY 3 TIME ON EXPIRED	1) CHECK SENSOR OP 2) CHECK AUX EQUIP SUCH AS: A) PUMPS B) TANKS

3.3 START UP GUIDE

Install and wire the T80 Transmitter as described in Sections 2.1 and 2.2 above.

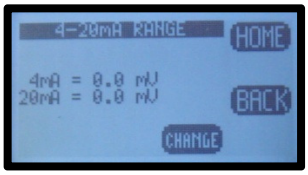
Connect the sensor to the transmitter as described in Section 2.2 above.

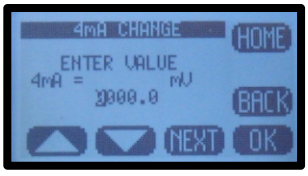
Supply power to the Model T80 transmitter.

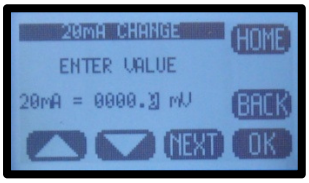
Verify the proper measurement type is displayed, pH, ORP or Ion. The sensor automatically uploads the measured parameter, the calibration data and the range of measurement to the transmitter. The default configuration of the 4-20 mA output is the range of the sensor, 0-14 pH for pH sensors, -2000 - +2000 for ORP or 0-XXX X ppm for a pIon Sensor. To change the 4-20 mA range, follow the instructions in Section 3.3.1 below.

3.3.1 CONFIGURE 4-20 MA OUTPUT RANGE

- Double press any key except the HOME key to enter the HOME Menu. Follow the path below to set the 4-20 mA range.
- HOME Menu → Press CONFIG → XMTR → OUTPUT → 4-20 → Range
- Press CHANGE to enter New Values, Press BACK to leave values as displayed.
- Choose 4 mA value, press OK,
- Enter value using ▲ or ▼and NEXT to move to the next digit, press OK
- Choose 20 mA value, press OK,
- Enter value using ▲ or ▼and NEXT to move to the next digit, press OK
- Press BACK to return to the CONFIGURE 4-20 mA screen or HOME to return to the HOME Menu screen.





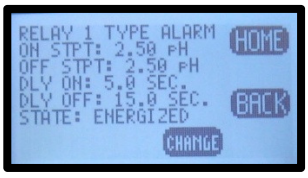


3.3.2 CONFIGURE 4-20 MA FAULT CONDITION

- In the CONFIGURE 4-20 mA screen, Press **FAULT**
- Choose **Low Fault 3.5 mA** or **Hi Fault 22 mA** or **NONE**, (default setting **NONE**), Press OK
- Press BACK to return to the Configure Outputs screen or HOME to return to the HOME Menu screen.

3.3.3 CONFIGURE ALARM RELAYS (RELAYS OPTIONAL)

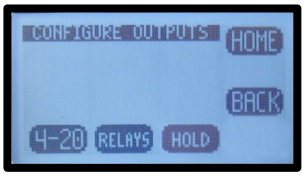
- HOME Menu → Press CONFIG → XMTR → OUTPUT → RELAYS→RLY1
- Choose the ALARM, FAULT or DISABLE mode for Relay 1
- **DISABLE** turns off the relay and removes it's icon from the HOME screen
- **FAULT** sets the relay condition to de-energize (open) in response to a Fault condition.
- **ALARM** Displays the current Set Point, Hysteresis, Delay ON and Delay OFF times,
    - **SET POINT ON**: The Value of the process variable that activates the relay.
    - **Expiration**: Enter time that should not be exceeded before the PV should have changed enough to activate the OFF set point. No change in the PV after the activation of the set point relay indicates a process control problem, the relay is deactivated and a Fault condition is initiated.
    - **SET POINT OFF**: The Value of the process variable that deactivates the relay.
        - SET POINT OFF > Set Point → Low Set Point
        - SET POINT OFF < Set Point → Hi Set Point
    - **Delay ON**: The amount of time the PV must remain above/below the



set point before the relay activates.

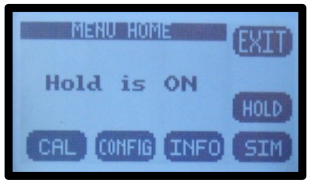
- **Delay OFF**: The amount of time the PV must remain above/below the hysteresis point before the relay deactivates.
- **STATE**: Energized/De-energized

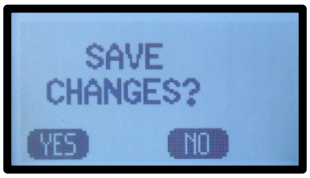
- Press **CHANGE** to enter new values
- Choose ON Set Point, Press OK
- Enter value using ▲ or ▼and NEXT to move to the next digit, press OK, press BACK (Min –Max values indicate the range of acceptable values)
- Choose Expiration, Press OK
- Choose time from drop down menu using ▲ or ▼
- Choose OFF Set Point, Press OK
- Enter value using ▲ or ▼and NEXT to move to the next digit, press OK, press BACK
- Choose Delay ON, Press OK
- Enter value using ▲ or ▼and NEXT to move to the next digit, press OK, press BACK
- Choose Delay OFF, Press OK
- Enter value using ▲ or ▼and NEXT to move to the next digit, press OK, and press BACK when done to exit Relay 1.
- Repeat for Relay 2 and Relay 3.



3.3.4 Exit Menus and Return to Main Display

- Press HOME Key to return to the Home Menu Screen
- Press Hold to turn OFF Hold
- Press EXIT Key to exit the menu
- "Save Changes?" press YES
- Choose Display Mode, **DATA**, **mV** or **GRAF** by pressing selection Key. The selection key displays which screen will be displayed next.
  - The type of graphical display used, Line, Bar or Gauge is selected in CONFIG → XMTR → LCD → GRAPH → LINE, GAUGE, BAR





3.3.5 Sensor Start Up

All sensors are supplied with protective caps over the sensing end. Remove the cap(s) from the sensor before installing in the process.

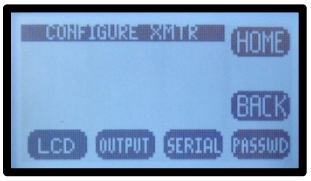
All sensors were calibrated at the factory before shipment, no calibration should be necessary before use. Allow the sensor to equilibrate to the process solution conditions for ½ hour before verifying the reading against a grab sample. If calibration is required follow the instruction in Section 4.0 below.

3.4 USER SELECTABLE OPTIONS

3.4.1 Screen Lighting

LED back lighting is available on AC and DC powered instruments only, this feature is inactive on loop powered instruments.

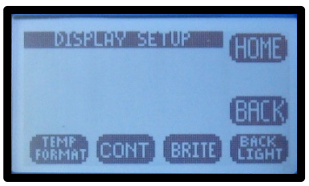
The lighting characteristics of the Model T80 transmitter, Brightness and Contrast can be adjusted to match other displays on the control panel or for optimal viewing as a stand alone instrument. The Backlight can be adjusted to timeout after a set period of time or remain on.



Location: CONFIG → XMTR → LCD → Set Up → CONT, BACK LIGHT

3.4.2 SCREEN LEGEND

The keys can be displayed as English Text or Icons. See Appendix 9.3 for Button/Icon legend.



Location: CONFIG → XMTR → LCD → LEGEND → ICON, TEXT

3.4.3 GRAPHICAL DISPLAY

There are three graphical display choices:

- **LINE,** The Line graph is a moving average of the process variable with the 4-20 mA range as the maximum/minimum values and a choice of time scales.
  The Time scale is the amount of time displayed across the full screen. Choices include:

Full Screen Period	15 minutes	1 hour	12 hours	1 day	2 days
Sample Rate (1 point every)	10 seconds	40 seconds	8 minutes	15 minutes	30 minutes

- **GAUGE,** Live reading displaying 0-100% of 4-20 mA range. The Alarm Relay number(s), #1, #2 and#3 mark the respective set points on graph.
- **BAR,** Live reading displaying 0-100% of 4-20 mA range. The Alarm Relay number(s), #1, #2 and#3 mark the respective set points on graph.

Pressing **OK** after selecting a Graphical Display will exit the menu structure and return to the Main Display.

Location: CONFIG → XMTR → LCD → GRAPH

3.4.4 TAG TRANSMITTER NAME

Two 16 character lines are available for naming the transmitter, Upper and Lower case characters, Numbers and Punctuation are available. The information entered will be displayed in the INFO screen and optionally in the Main display sequence if activated in the TAG ON menu. The character set is listed below sequentially; the first character in the set is an empty space.

! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [¥] ^ _ ' a b c d e f g h I j k l m n o p q r s t u v w x y z { | } → ←

Entry is accomplished by scrolling through the alphanumeric list with the ▲ (forward →) and ▼ (backwards ←) arrows to the character of choice and then pressing **NEXT** to advance the cursor to the next digit. Pressing and holding the ▲ or ▼ keys will initiate two speed auto scrolling. Press BACK to exit the screen.

Location: CONFIG → XMTR → LCD → LABELS → TAG

3.4.5 PASSWORD PROTECTION

PASSWD Enter 4 character password to protect access to MENU Level, CAL Menu, CONFIG Menu and SIM Menu (simulate). Each level can be turned ON or OFF and can have a unique password. Upper Case Characters and Numbers are available for use.

Place the cursor in front of the level to be changed and Press **OK**. Move the cursor to **ON** and press **OK** to change the password status from OFF to ON.

Entry is accomplished by scrolling through the alphanumeric list with the ▲ (forward →) and ▼ (backwards ←) arrows to the character of choice and then pressing **NEXT** to advance the cursor to the next digit. Pressing and holding the ▲ or ▼ keys will initiate two speed auto scrolling.

○	**MENU**	ON/OFF	_ _ _ _	Locks Main Menu
○	**CAL**	ON/OFF	_ _ _ _	Locks CAL and CONFIG
○	**CONFIG**	ON/OFF	_ _ _ _	Locks CONFIG
○	**SIM** CONFIG	ON/OFF	_ _ _ _	Locks SIM and

In the case of a **Lost or Forgotten password** enter **MSTR** to access the screen.

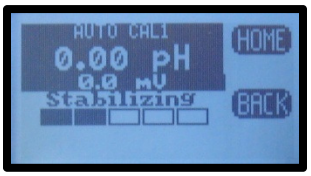
Location: CONFIG → XMTR → PSSWD

4.0 CALIBRATION

The Model T80 transmitter provides three methods of calibration:

4.0.1 AUTO CALIBRATION DESCRIPTION

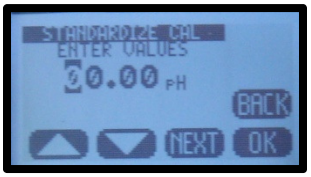
Auto calibration is the primary calibration method for all measurements. AUTO calibration automatically recognizes the calibration solution the sensor is in and proposes the actual temperature compensated value for acceptance. AUTO calibration can be a single point or two point calibration. A single point calibration sets the zero point or offset value of the sensor. The second calibration sets the slope or span of the sensor.



When the AUTO key is pressed the transmitter displays the PV (Process Variable) and the associated mV signal from the sensor. When the reading has stabilized a calibration value is AUTOmatically proposed, i.e. 7.00 pH, 10 ppm Fluoride ion, 0.00 mg/L Dissolved Oxygen. **The user is prompted to accept the proposed calibration value or enter and accept another value**. Once Cal 1 is accepted the user is ask to continue to Cal 2, yes/no. If yes, then a second calibration value is proposed when the sensor has stabilized in the second calibration solution. Accept the value and the calibration is complete.

At the end of each calibration the Offset and Slope are displayed in the respective units, pH, mV, ppm, mg/l.

4.0.2 STANDARDIZE CALIBRATION DESCRIPTION



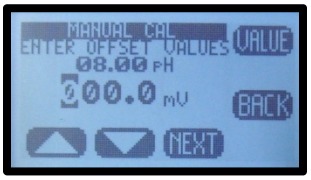
A Standardize Calibration is an online calibration where the transmitter's reading is adjusted to agree with a value determined from a grab sample or laboratory measurement. In many cases the constituents, pressure and temperature of the process solution are very different from the calibration solution. In these cases, once the sensor has equilibrated, the Zero Point or Offset value will have shifted from the original calibration point. The Standardization corrects for an offset error.

When the STAND key is pressed, the user is prompted to ENTER VALUE. The user enters the value they want the transmitter to read and press OK. The user is then prompted to accept the value, yes/no, and the calibration is complete. Standardizations are single point calibrations.

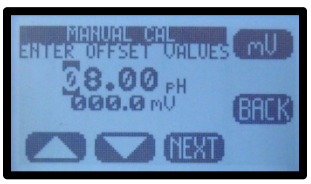
At the end of each calibration the Offset and Slope are displayed in the respective units, pH, mV, ppm, mg/l.

4.0.3 MANUAL CALIBRATION DESCRIPTION

Manual calibration allows the user to enter calibration data for an electrode into the transmitter without performing a calibration. A MANUAL Calibration requires the entry of three pieces of data, (1) A **concentration** with the (2) **corresponding mV** value and (3) a **slope** for an electrode. This allows laboratory generated calibration data for an electrode can be input to a remote analyzer where calibration is difficult or impractical.

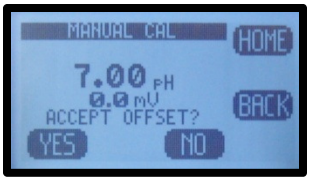


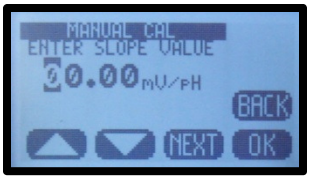
Example: MANUAL Calibration for a pH electrode



1. Calibrate the pH electrode in the laboratory
2. Record the mV value of some pH Standard, pH 7.00 buffer = 6.8 mV (any pH – mV pair will work)
3. Calculate and Record the slope of the electrode, 58.2 mV/pH

4. Install the electrode into the field mounted sensor
5. **Press MANUAL** and enter the pH value, 7.00 pH, **press mV** and enter the corresponding mV value, 6.8 mV, **press OK**, Accept Offset?, **press YES**, enter slope 58.2 mV/pH, **press OK**, Accept Slope?, **Press YES**
6. The Calibration is complete, the Offset and Slope values are displayed, **press OK** to exit.





4.1 pH Calibration Procedures

AUTO Calibration recognizes pH 4.01, pH 7.00 and pH 10.00 buffer solutions for automatic, temperature compensated calibrations. Any calibration solutions can be used but the pH value will have to be entered manually. Follow the steps below to accomplish a pH calibration. Example uses pH 7.00 and pH 4.01 buffers.

4.1.1 AUTO Cal using pH 4.01, 7.00, 10.00 buffers

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes erases CAL Log in INFO, NO adds CAL to existing Log)
Press **Yes**/NO	Place Sensor in CAL Solution (use pH 7.00 buffer)
Press **AUTO then CAL 1**	STABILIZING, 7.00 pH x.x mV, 7.00 pH corrected Accept Cal?
Press **YES**	CAL1 Value 7.00 pH, Continue to CAL2? Move sensor to 4.01 pH buffer solution
Press **YES**	STABILIZING, 4.00 pH xxx.x mV, 4.00 pH corrected Accept Cal?
Press **YES**	OFFSET: 7.00 pH x.x mV, SLOPE: 59.16 mV/pH (data written to Log)
Press **OK**	Calibration complete
Press **HOME**	Hold is ON
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **YES**	Main Display

4.1.2 AUTO Cal using other pH buffers

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes erases CAL Log in INFO, NO adds CAL to existing Log)
Press **YES**/NO	Place Sensor in CAL Solution
Press **AUTO then CAL 1**	STABILIZING, xx.xx pH x.x mV, 7.00 pH corrected Accept Cal?
Press **NO**	Enter CAL 1 Value
Press **▲ ▼ NEXT**	xx.xx pH (use arrows and NEXT to enter pH Buffer value)
Press **OK**	xx.xx pH, xxx.x mV, Accept this Value
Press **YES**	CAL 1 Value xx.xx pH, Continue to CAL 2? (Place Sensor in 2nd calibration buffer)
Press **YES**	STABILIZING, xx.xx pH xxx.x mV, 4.00 pH corrected Accept Cal?
Press **NO**	Enter CAL 2 Value
Press **▲ ▼ NEXT**	xx.xx pH (use arrows and NEXT to enter pH Buffer value)
Press **OK**	xx.xx pH, xxx.x mV, Accept this Value
Press **YES**	OFFSET: xx.xx pH x.x mV, SLOPE: 59.16 mV/pH (data written to Log)
Press **OK**	Calibration complete
Press **HOME**	Hold is ON
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **YES**	Main Display

4.1.3 Standardize

Leave the sensor in the process solution, take a grab sample from the process and determine the pH.

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF

Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes, erases CAL Log in INFO, NO adds CAL to existing Log)
Press **NO**	Place Sensor in CAL Solution (the process solution is the CAL Solution)
Press **STAND**	Enter Value
Press **▲ ▼ NEXT**	xx.xx pH (use arrows and NEXT to enter process pH value)
Press **OK**	xx.xx pH, xxx.x mV, Accept Value?
Press **YES**	OFFSET: xx.xx pH x.x mV, SLOPE: xx.xx mV/pH (this data written to Log)
Press **OK**	Back to Cal Menu
Press **HOME**	Hold is ON (Press HOLD to turn off Hold)
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **Yes**	Main Display

4.2 ORP Calibration Procedures

AUTO Calibration recognizes Quinhydrone solutions (Q solution), pH 7.00 quinhydrone solution (90 mV) and pH 4.01 quinhydrone solution (267 mV) for automatic ORP calibrations. Any calibration solutions can be used but the ORP value will have to be entered manually. Follow the steps below to accomplish an ORP calibration.

4.2.1 Auto Cal with Quinhydrone

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes erases CAL Log in INFO, NO adds CAL to existing Log)
Press **Yes**/NO	Place Sensor in CAL Solution (use pH 7.00 Q solution)
Press **AUTO then CAL 1**	STABILIZING, xxx.x mV, xxx.x mV_Q, 90.0 mV corrected Accept Cal?
Press **YES**	CAL1 Value 90.0 mV, Continue to CAL2? Move sensor to pH 4.01 Q solution
Press **YES**	STABILIZING, 269.2 mV 267.0 mV_Q, 267 mV corrected Accept Cal?
Press **YES**	OFFSET: 90.0 mV_Q, 87 mV, SLOPE: 1.02 mV/ mV_Q (data written to Log)
Press **OK**	Calibration complete
Press **HOME**	Hold is ON
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **YES**	Main Display

4.1.2 Standardize

Leave the sensor in the process solution, take a grab sample from the process and determine the ORP.

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes, erases CAL Log in INFO, NO adds CAL to existing Log)
Press **NO**	Place Sensor in CAL Solution (the process solution is the CAL Solution)
Press **STAND**	Enter Value
Press **▲ ▼ NEXT**	xx.xx mV (use arrows and NEXT to enter process ORP value)
Press **OK**	xxx.x mV, xxx.x mV, Accept Value?
Press **YES**	OFFSET: xxx.x mV xxx.x mV, SLOPE: xx.xx mV/mV (this data written to Log)
Press **OK**	Back to Cal Menu
Press **HOME**	Hold is ON (Press HOLD to turn off Hold)

Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **Yes**	Main Display

4.3 pION CALIBRATION PROCEDURES

AUTO Calibration recognizes 1, 10 or 100 ppm/ppb calibration solutions. Any calibration solutions can be used but the ppm value will have to be entered manually. Follow the steps below to accomplish a pION calibration.

4.3.1 AUTO CAL USING 1, 10, 100 PPM SOLUTIONS

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes erases CAL Log in INFO, NO adds CAL to existing Log)
Press **Yes**/NO	Place Sensor in CAL Solution (use 10 ppm solution)
Press **AUTO then CAL 1**	STABILIZING, 10.00 ppm, xxx.x mV, 10.00 ppm corrected, Accept Cal?
Press **YES**	CAL1 Value 10.00 ppm, Continue to CAL2? Move sensor to 100 ppm solution
Press **YES**	STABILIZING, 100.0 ppm, xx.xx mV, 100 ppm corrected, Accept Cal?
Press **YES**	OFFSET: 10.00 ppm, 310 mV, SLOPE: 55.1 mV/ decade (data written to Log)
Press **OK**	Calibration complete
Press **HOME**	Hold is ON
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **YES**	Main Display

4.3.2 AUTO CAL USING NON-DECIMAL PPM SOLUTIONS

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes erases CAL Log in INFO, NO adds CAL to existing Log)
Press **YES**/NO	Place Sensor in CAL Solution
Press **AUTO then CAL 1**	STABILIZING, xx.xx pH x.x mV, 10.00 ppm corrected Accept Cal?
Press **NO**	Enter CAL 1 Value
Press **▲ ▼ NEXT**	xxxx.x ppm (use arrows and NEXT keys to enter Cal value)
Press **OK**	xxxx.x ppm, xxx.x mV, Accept this Value
Press **YES**	CAL 1 Value xxxx.x ppm, Continue to CAL 2? (Place Sensor in 2nd calibration solution)
Press **YES**	STABILIZING, xxxx.x ppm xxx.x mV, xxx.x ppm corrected Accept Cal 1?
Press **NO**	Enter CAL 2 Value
Press **▲ ▼ NEXT**	xxxx.x ppm (use arrows and NEXT keys to enter Cal value)
Press **OK**	xxxx.x ppm, xxx.x mV, xxx.x ppm corrected Accept Cal 2?
Press **YES**	OFFSET: xxxx.x ppm xxx.x mV, SLOPE: 55.40mV/decade (data written to Log)
Press **OK**	Calibration complete
Press **HOME**	Hold is ON
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **YES**	Main Display

4.3.3 STANDARDIZE

Leave the sensor in the process solution, take a grab sample from the process and determine the Ion concentration.

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes, erases CAL Log in INFO, NO adds CAL to existing Log)
Press **NO**	Place Sensor in CAL Solution (the process solution is the CAL Solution)
Press **STAND**	Enter Value
Press **▲ ▼ NEXT**	xxxx.x ppm (use arrows and NEXT to enter process Ion ppm value)
Press **OK**	xxxx.x ppm, xxx.x mV, Accept Value?
Press **YES**	OFFSET: xxxx.x ppm xxx.x mV, SLOPE: xx.xx mV/DEC (this data written to Log)
Press **OK**	Back to Cal Menu
Press **HOME**	Hold is ON (Press HOLD to turn off Hold)
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **Yes**	Main Display

4.4 DISSOLVED OXYGEN CALIBRATION PROCEDURES

The dissolved oxygen AUTO Cal acknowledges zero ppm, mg/l, % SAT for CAL 1 and the temperature compensated value for atmospheric oxygen, 8.25 ppm, mg/l at 25°C or 100 % SAT for CAL 2.

The zero point is set by placing the sensor into an oxygen free solution and verifying the displayed value drops to a value below 1 mV. The sensor will take a few minutes to equilibrate to the zero oxygen solution but for the highest accuracy it is best to wait 15-20 minutes before initiating a calibration. The typical sensor will burn down to 0.5 – 0.7 mV in an hour or so in a zero ppm solution. A zero ppm O2 solution can be made by adding approximately 5 grams of sodium sulfite to a liter of distilled water or purging the sample with nitrogen gas.

The slope (CAL 2) is set by placing the sensor in air saturated distilled water or water saturated (100% humidity) air. The easiest method is to suspend the sensor vertically in beaker with a ½" of water in the bottom slightly above the water.

A STANDardize calibration adjusts the CAL 2 value, resetting the slope of the sensor, mV/ppm.

The actual concentration in mg/L (**C**) is equal to the Saturation value at the given temperature multiplied by the altitude and air pressure corrections. Determine the calibration temperature and look up the saturation value (**S**) in Table 1 below. Then determine the altitude correction (**K**) from Table 2 and the current air pressure in bar (**P**), 1 bar equals 14.7 psi. Use 1 bar if the actual air pressure is unknown.

C = S x K x P

Example:

Temperature = 20°C → Saturation = 9.08 mg/L, Altitude = 1200 ft → K = 0.960, Air Pressure 1.014 bar

C = 9.08 x 0.960 x 1.014 = 8.84 mg/L

The T80 transmitter uses the temperature compensated Saturation Index for AUTO Cal, however the user can enter the altitude and pressure compensated value of 8.84 ppm as the calibration value when prompted to "Accept Value?" in CAL 2.

Table 1 Saturation Index

Temperature °C (°F)	Saturation mg/L	Temperature °C (°F)	Saturation mg/L	Temperature °C (°F)	Saturation mg/L
0 (32)	14.64	**14 (57)**	10.28	**28 (82)**	7.82
1 (34)	14.23	**15 (59)**	10.06	**29 (84)**	7.69
2 (36)	13.83	**16 (61)**	9.85	**30 (86)**	7.55
3 (38)	13.45	**17 (63)**	9.64	**31 (88)**	7.42
4 (39)	13.09	**18 (64)**	9.45	**32 (90)**	7.30
5 (41)	12.75	**19 (66)**	9.26	**33 (91)**	7.18
6 (43)	12.42	**20 (68)**	9.08	**34 (93)**	7.06
7 (45)	12.11	**21 (70)**	8.90	**35 (95)**	6.94
8 (46)	11.81	**22 (72)**	8.73	**36 (97)**	6.83
9 (48)	11.53	**23 (73)**	8.57	**37 (99)**	6.72
10 (50)	11.25	**24 (75)**	8.41	**38 (100)**	6.61
11 (52)	10.99	**25 (77)**	8.25	**39 (102)**	6.51
12 (54)	10.75	**26 (79)**	8.11	**40 (104)**	6.41
13 (55)	10.51	**27 (81)**	7.96		

Table 2 Altitude Correction

Altitude m (ft)	K	Altitude m (ft)	K	Altitude m (ft)	K
Sea Level 0	1.000	**700 (2300)**	0.922	**1400 (4600)**	0.849
50 (160)	0.994	**750 (2450)**	0.916	**1450 (4750)**	0.844
100 (330)	0.988	**800 (2600)**	0.911	**1500 (4900)**	0.839
150 (500)	0.982	**850 (2800)**	0.905	**1550 (5100)**	0.834
200 (660)	0.977	**900 (2950)**	0.900	**1600 (5250)**	0.830
250 (820)	0.971	**950 (3100)**	0.895	**1650 (5400)**	0.825
300 (980)	0.966	**1000 (3300)**	0.890	**1700 (5600)**	0.820
350 (1200)	0.960	**1050 (3450)**	0.885	**1750 (5750)**	0.815
400 (1300)	0.954	**1100 (3600)**	0.879	**1800 (5900)**	0.810
450 (1500)	0.949	**1150 (3775)**	0.874	**1850 (6050)**	0.805
500 (1650)	0.943	**1200 (3950)**	0.869	**1900 (6200)**	0.801
550 (1800)	0.938	**1250 (4100)**	0.864	**1950 (6375)**	0.796
600 (2000)	0.932	**1300 (4250)**	0.859	**2000 (6550)**	0.792
650 (2150)	0.927	**1350 (4400)**	0.854		

4.4.1 AUTO CAL USING ZERO PPM SOLUTION AND AIR

Action	Prompt
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes erases CAL Log in INFO, NO adds CAL to existing Log)
Press **Yes**/NO	Place Sensor in CAL 1 Solution (use 0.00 ppm solution) or CAL 2 Solution (Air)
	To perform zero CAL press CAL 1, to skip zero cal press CAL 2
Press **AUTO then CAL ?**	STABILIZING, 0.00 ppm, xxx.x mV, 0.00 ppm corrected, Accept Cal?
Press **YES**	CAL 1 Value 0.00 ppm, Continue to CAL2? Move sensor to Air or saturated water
Press **YES**	STABILIZING, 8.25 ppm, xxx.x mV, 8.25 ppm corrected, Accept Cal?

Press **YES**	OFFSET: 0.00 ppm, 2.3 mV, SLOPE: 40.1 mV/ ppm (data written to Log)
Press **OK**	Calibration complete
Press **HOME**	Hold is ON
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **YES**	Main Display

4.4.2 STANDARDIZE

Leave the sensor in the process solution or in the air, take a grab sample from the process and determine the dissolved oxygen concentration or enter the temperature and pressure corrected value for air.

Action	**Prompt**
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes, erases CAL Log in INFO, NO adds CAL to existing Log)
Press **NO**	Place Sensor in Air or the process solution
Press **STAND**	Enter Value
Press **▲ ▼ NEXT**	xxx.xx ppm or % SAT (use arrows and NEXT to enter process value)
Press **OK**	xxx.xx ppm, xxx.x mV, Accept Value?
Press **YES**	OFFSET: 0.00 ppm xx.x mV, SLOPE: xx.xx mV/ppm (this data written to Log)
Press **OK**	Back to Cal Menu
Press **HOME**	Hold is ON (Press HOLD to turn off Hold)
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **Yes**	Main Display

4.4.3 MANUAL CAL

Leave the sensor in the process solution or in the air, take a grab sample from the process and determine the dissolved oxygen concentration or enter the temperature and pressure corrected value for air.

Action	**Prompt**
Double Press any Button	MENU HOME, Hold is OFF
Press **HOLD**	Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration
Press **CAL**	Is this a new Sensor? (Yes, erases CAL Log in INFO, NO adds CAL to existing Log)
Press **NO**	Place Sensor in Air or the process solution, it doesn't matter which
Press **MANUAL**	Enter Zero Value
Press **▲ ▼ NEXT**	000.00 ppm or % SAT (use arrows and NEXT to enter ppm value)
Press **mV** Button	Enter mV value for zero ppm solution (default use 0.5 mV)
Press **▲ ▼ NEXT**	000.00 mV (use arrows and NEXT to enter mV value)
Press **OK**	OFFSET: 0.00 ppm 00.5 mV, Accept Value?
Press **YES**	Slope 000.0 mV/ppm or 000.0 mV/% SAT
Press **▲ ▼ NEXT**	048.00 mV/ppm (use calculated value or 45 mV/ppm or 4.0 mV/% SAT)
Press **OK**	Slope 48.00 mV/ppm, Accept this Value?
Press **YES**	Back to Cal Menu
Press **HOME**	Hold is ON (Press HOLD to turn off Hold)
Press **HOLD**	Turn off Hold
Press **EXIT**	SAVE CHANGES?
Press **Yes**	Main Display

5.0 MAINTENANCE

No periodic maintenance is required for the ECD Model T80 Transmitter.

When you open the front cover and/or cable glands, make sure that the seals are clean and correctly fitted when the unit is re-assembled in order to maintain the housing's NEMA 4X weatherproof integrity against water and water vapor.

Fuse: There is a circuit board mounted fuse protecting the instrument. If you suspect that this needs to be replaced, contact the ECD service center for parts and instructions.

5.1 CLEANING

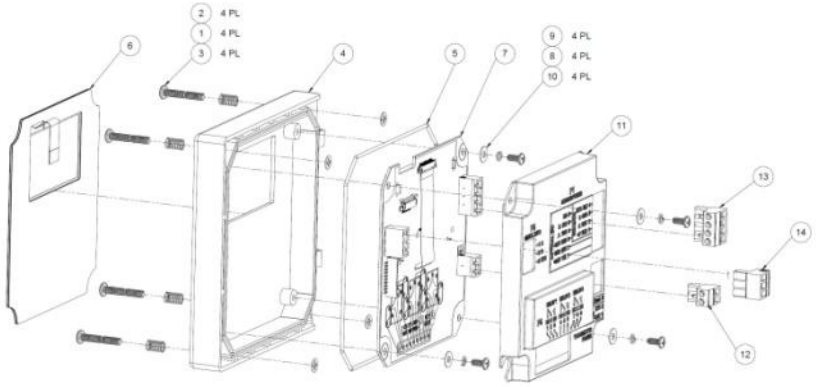
The Model T80 transmitter requires no periodic maintenance, except to make sure the front window is kept clean in order to permit a clear view of the display and allow proper operation of the navigation buttons. If the window becomes soiled, clean it using a soft damp cloth or soft tissue. To deal with more stubborn stains, a neutral detergent or spray cleaner like Windex may be used. Never use harsh chemicals or solvents.

6.0 TROUBLESHOOTING

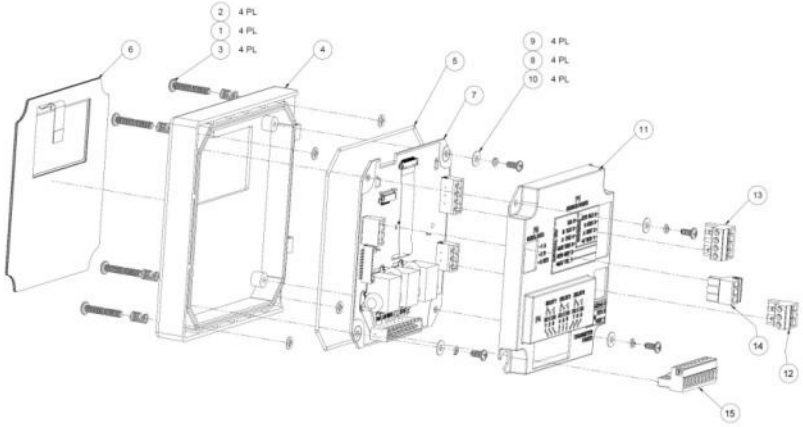
Symptom	Probable cause	Remedy
Blank Display	No Power	Check power source, 24VDC loop, 24VDC, 110/220VAC
	Sensor Failure, causing power draw down below transmitter threshold	Unplug sensor from transmitter, replace sensor if instrument powers up.
Incorrect Readings	Sensor needs calibration	Perform a standardization calibration. See INFO for calibration log
	Incorrect Temperature measurement	Calibrate/Trim Temperature to correct value
	Temperature Compensation set up incorrectly	Verify: 0.33% for pH, pIon 0.00% for ORP 4.0% for DO
"Looking For Sensor" prompt	Lost connection between sensor and transmitter	Check sensor connection to transmitter, loose connector? Visually inspect cable for cuts or crushed areas, replace sensor if cable is compromised

7.0 PARTS AND ACCESSORIES

7.1 FRONT PANEL CONTROL BOARD EXPLODED

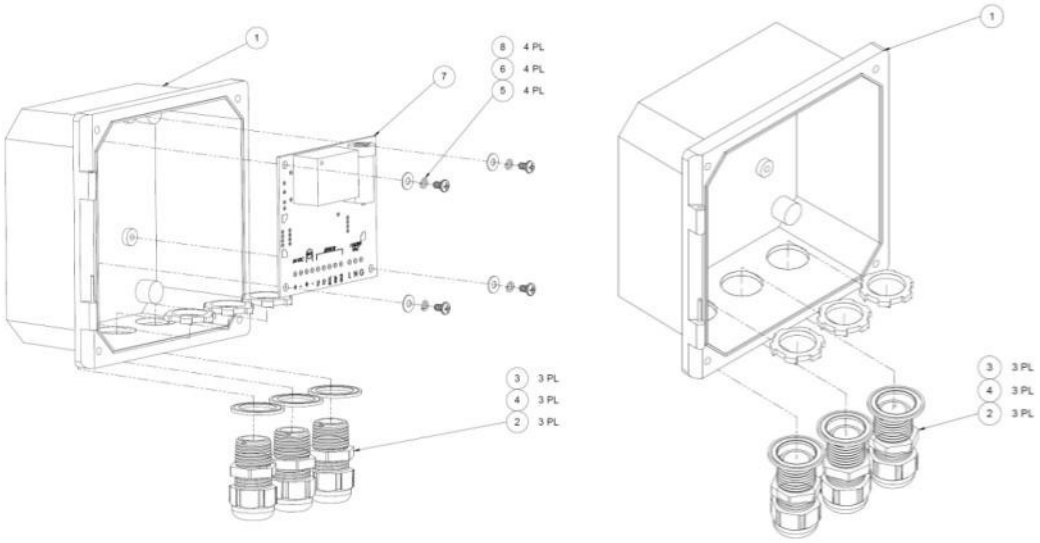


7.2 FRONT PANEL CONTROL BOARD EXPLODED, WITH RELAYS



Item #	Part #	Description
1	9630005	Spring, Mounting Screw Set
2	9870621	Retaining Washer, Mounting Screw Set
3	3600390	8-32 x 1” SS Screw, Mounting Screw Set
4	3400152	Front Housing
5	9560005	Sealing O-ring, grey silicone
6	9240503-1	Touch pad membrane
7	2101800-1	PCB, Control Board, Loop Powered
7	2101800-2	PCB, Control Board, Loop Powered, Relays
7	2101800-3	PCB, Control Board, Loop Powered, HART
8	9870650	Locking Washer, PCB Screw Set
9	9730905	6-32 x 5/16” SS Screw, PCB Screw Set
10	9870620	Flat Washer, PCB Screw Set
11	3400006-1	Control Board Cover
12	9090112	24 VDC, 4-20 mA Terminal Block/2 pins
13	9090114	Sensor Terminal Block/4 pins
14	9090113	Serial connection Terminal Block/3 pins
15	9090119	Relay Connection Terminal Block/9 pins

7.3 Transmitter Case, back with Cable Glands



Item #	Part #	Description
1	3600449	Transmitter Case
2	9360005	PVC Cable Gland, ½" NPT, Grey
3	9300034	Locking Nut, ½" NPT, Steel
4	9300017	Sealing ring, ½" elastomer
5	9870650	Split Washer, PS mounting
6	9870620	Flat Washer, PS mounting
7	2101820-1	Power Supply Board
8	9730604	6-32 x ¼" screw, SS, PS mounting

7.4 Replacement Parts

Part #	Description
2000002-1	Front Panel, Loop-Powered
2000002-2	Front Panel, AC/DC Powered
2000002-3	Front Panel, Loop-Powered, Hart Output
2101820-1	Power Supply Board, 110/220 VAC Input
2101820-3	Power Supply Board, 110/220 VAC Input, w/preamp
2101820-4	Preamp Board
3400006	Control Board Cover
9090112	Connector Plug, 2 Position (Loop, AC/DC, or Hart Versions)
9090113	Connector Plug, 3 Position (Loop or AC/DC Versions)
9090114	Connector Plug, 4 Position (Loop, AC/DC or Hart Versions)
9090119	Connector Plug, 9 Position (AC/DC Version)
9240503-1	Front Panel Membrane Switch
9300017	Sealing ring, Cable Gland
9300034	Locking Nut, Cable Gland
9360005	Fitting, Cable Gland
9830214	Screw, Front Panel

7.5 ACCESSORIES

Part #	Description
2000006	Kit, Universal Mount
2000007	Kit, Handrail Mount
2000008	Kit, Panel Mount
1000300-1	4-20 mA USB Data Logger
9130007	Replacement Battery for Data Logger
1000260-1	Sunshield for Pole Mount
1000260-2	Sunshield for Rail Mount

8.0 S80 SENSORS

S80 sensors are a family of digital sensors designed for use with ECD digital analyzers, the Model T80 transmitter or the Model C80 controller. S80 sensors accept the standard ECD electrode cartridges. The S80 sensors convert the analog signals into a temperature compensated digital protocol that allows two way communications with the transmitter. The type of sensor, identity and serial number are stored in the sensor's memory along with three calibration registers. When connected to an ECD digital analyzer the sensor's information is uploaded to the analyzer configuring the displays and outputs to the values appropriate to the sensor's measured parameter. Connect an S80 pH sensor to a Model T80 Transmitter and the Transmitter configures itself into a calibrated pH transmitter.

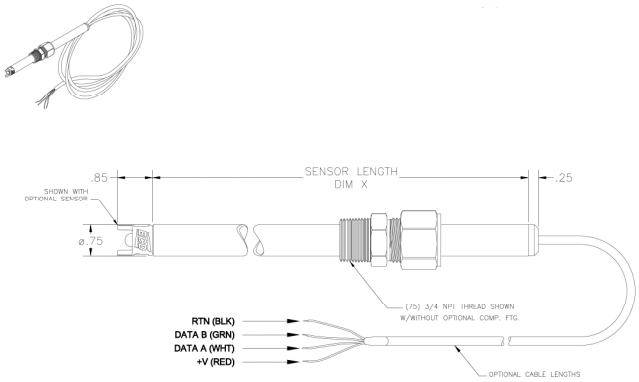
The internal components of the S80 sensors, the signal conditioner, temperature sensor and cable assembly are epoxy encapsulated inside the ¾" O.D. housing. Epoxy encapsulation of the components increases the reliability of the sensor by eliminating failures caused by wiring and connector breakage. The S80 sensors use the same easily replaceable electrode cartridges as the S10 and S17 sensor assemblies.

8.1 S80 INSTALLATION

Four typical installation configurations are available for ECD sensors: insertion, immersion, flow-through and valve-retraction. Although there are many ways to accomplish these mounting configurations, ECD recommends the following installation configurations.

8.1.1 INSERTION

The S80 sensor is installed using a ¾" MNPT compression fitting with choice of nylon, Teflon or 316 SS ferrule. The ¾" MNPT can be inserted into a pipe Tee or through a tank wall, the S80 is then inserted through the fitting and compression gland is tightened to secure the sensor in place. The torque specification for the gland fitting is 20-ft/lbs. Over-tightening of the nut may swage the nylon or Teflon ferrules to the housing crushing the internal sensor components.



8.1.2 IMMERSION

The ¾" MNPT compression fitting is reversed and threaded into an extension/immersion pipe so the compression gland is facing the measurement end of the sensor. Feed the cable through the immersion tube, insert the S80 sensor at least 5" into the tube and tighten the sensor in place.

8.1.3 FLOW THROUGH

Although the insertion configuration can be used as a flow-through mounting by inserting the S80 sensor into a pipe tee, ECD has various flow cells available for convenience. The flow cells are 2.0" diameter by 5" long, ported ½" FNPT through and ¾" FNPT for the sensor. The flow cells are available in 316 Stainless Steel, PVC and Kynar. Use of the flow cell can facilitate an optional spray cleaning nozzle for the electrode. Connecting 40+ psi of water or air to the nozzle will remove particulate materials or biofilms from the sensor tip. Detergents or solvents can be used to remove greases or oils from the sensor while acids can be used for hard water scale.

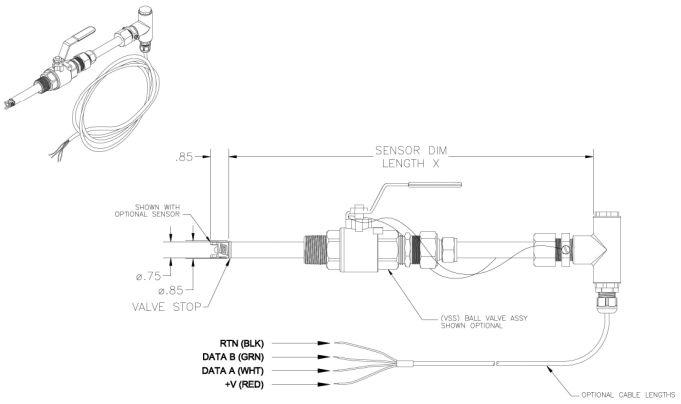
8.1.4 VALVE RETRACTABLE

The S80 sensor is optionally designed for valve retraction service, (-1) Sensor Style. Mounting is directly into a process line or through a tank wall. The ball valve system allows the sensor to be removed from service without shutting down the line or emptying the tank. ECD recommends the valve-retraction mounting for ease of maintenance or in applications where the process line cannot be shut down and the pressure does not exceed 100 psig.

To remove the sensor from the valve assembly refer to the following directions:

CAUTION: Do not put hands or fingers between the safety lanyard cables and any part of the sensor. Use the external cable seal/handle to pull or guide the sensor through the valve.

1. Loosen the small swage nut at the rear of the fitting assembly slowly as this compression fitting is holding the sensor in place. **CAUTION** the sensor may snap back quickly if it is under pressure. (do not remove the nut from the body of the fitting).
2. Slide the sensor to its stop by pulling it through the ball valve. The safety lanyards will be extended, confirming that the sensor is fully retracted. Note: the safety lanyards are redundant protection; the sensor will come to a stop when the high pressure stop reaches the front of the retainer fitting.
3. Close the ball valve.
4. Remove the **handle retaining nut** and the valve handle.
5. Remove the **safety lanyards** from the valve stem.
6. For the stainless steel ball valves, loosen and remove the large **retainer nut** from the **retainer fitting**. For Kynar ball valves, loosen and remove the union nut on the sensor side of the ball valve.
7. Firmly pull the **retainer fitting** from the valve. The sensor will be removed with the fitting.



8.1.5 FLANGE FITTINGS

Flange mountings can be accomplished with the insertion and valve-retraction configurations using the desired flange and by mounting the gland fitting or valve-retraction assembly to the flange.

8.2 S80 PART NUMBER CONFIGURATOR

S80 sensors are available in five measurement types, (-0) a millivolt style for pH, ORP and ion selective measurements, (-1) dissolved oxygen style, (-2) contacting conductivity style, (-3) inductive conductivity style and (-4) resistivity style. Each style is available in a variety of materials and insertion lengths.

S80 Digital Sensor							
Measurement Type							
-0 S80 Digital Sensor, pH, ORP, pION measurement							
-1 S80 Digital Sensor, Dissolved Oxygen measurement							
-2 S80 Digital Sensor, Contacting Conductivity, 1µS to 50 mS							
-3 S80 Digital Sensor, Inductive Conductivity, 50 mS to 1000 mS							
-4 S80 Digital Sensor, Resistivity							
	Sensor Style						
	0 Insertion Style **(Standard)**						
	1 Valve Retractable Style with flanged blow out protector						
		Housing Material					
		-0 Stainless Steel, ¾" O.D., **(Standard)**					
		-1 Titanium, ¾" O.D.					
		-2 Hastelloy, ¾" O.D.					
		-4 Kynar, ¾" O.D., Inductive Conductivity Only					
		-9 Other Material, Consult with Factory					
			Housing Length				
			0 10" length, ¾" O.D.				
			1 17" length, ¾" O.D.				
			2 24" length, ¾" O.D.				
			3 30" length, ¾" O.D.				
			4 36" length, ¾" O.D.				
				Process Connection			
				00 No Fitting or Valve Assembly			
				01 (75) ¾" MNPT SS Fitting with Nylon Ferrule			
				02 (75HT) ¾" MNPT, 316 SS gland, Teflon ferrule			
				03 (75SF) ¾" MNPT, 316 SS gland, SST ferrule			
				04 (75HC) ¾" MNPT, Hastelloy gland, Teflon ferrule			
				05 (75TT) ¾" MNPT, Titanium gland, Teflon ferrule			
				06 (75PP) ¾" MNPT, All Polypropylene gland fitting			
				07 (75K) ¾" MNPT, All Kynar gland Fitting			
				08 (75TFE) ¾" MNPT, All Teflon gland fitting			
				29 Other Fittings, Consult Factory			
				30 (VSS) 1" NPT 316 Stainless Steel Valve Retraction Assembly, nylon			
				31 (VSSHT) 1" NPT 316 Stainless Steel Valve Retraction Assembly, Teflon			
				32 (VSSE) 1" NPT 316 Stainless Steel Valve Retraction Assembly Toroidal			
				33 (VHC) 1" NPT Hastelloy Valve Retraction Assembly			
				34 (VTT) 1" NPT Titanium Valve Retraction Assembly			
				36 (VPP) 1" NPT All Poly Propylene Valve Retraction Assembly			
				37 (VKY) 1" NPT All Kynar Valve Retraction Assembly			
				59 Other Assemblies, Consult Factory			
				80 1/1.5" Sanitary Flange, 316ss, Viton o-rings, nylon ferrule			
				81 2" Sanitary Flange, 316ss, Viton o-rings, nylon ferrule			
				82 2 ½" Sanitary Flange, 316ss, Viton o-rings, nylon ferrule			
				99 Other Fittings, Consult Factory			
					Cable Length		
					-0 10 ft. (Standard)		
					-2 20 ft.		
					-3 30 ft.		
					-4 40 ft.		
					-5 50 ft.		
					-A 100 ft.		
						"T" Handle	

							0 No “T” Handle		
							1 “T” Style handle, ¾” polypro fitting		
							2 “T” Style handle, ¾” stainless steel fitting		
							3 “T” Style handle with Lanyards		
								Detachable Cable Connector	
								0 None	
								1 Straight (axial) Connector	
								2 Right Angle Connector	
									O-rings Guard & Fittings
									0 Viton Any/All
									1 HF Viton Cond Guard
									2 EPR Cond Guard
									3 Kalrez Cond Guard
									4 CV75 Cond Guard
									5 HF Viton Valve & Fitting
									6 EPR Valve & Fitting
									7 Kalrez Valve & Fitting
									9 CV-75 Valve & Fitting
									A HF Viton Grd & Val & Fit
									B EPR Grd & Val & Fit
									C Kalrez Grd & Val & Fit
									D CV-75 Grd & Val & Fit
S80	**-0**	**0**	**- 0**	**0**	**01**	**-0**	**1**	**1**	**0**

8.3 S80 Sensor Maintenance

All electrochemical sensors require periodic cleaning and/or replacement. The life of an electrode is dependent on the process conditions it is exposed to, a pH electrode may last a year or longer in potable water and only a few weeks in a hot caustic bath. The chemical constituents in the process may coat the electrode surfaces requiring the electrode to be removed and cleaned or replaced.

Cleaning agents should be specific to the type of coating, detergents and alcohols for removing greases and oils, acids for removing hard water scales and metallic deposits or spray washing for flocculants and biofilms.

8.3.1 Electrode Cartridge Installation

Unless ordered separately, electrode cartridges are generally shipped installed in a sensor. Sensors ordered without an electrode are shipped with a shipping plug to keep contamination from getting inside the sensor during shipment or storage. The following procedure explains how to install the electrode cartridge in the sensor assembly:

1. Remove the shipping plug by turning it counterclockwise.
2. Remove the electrode cartridge from the protective soaker boot. *Be careful not to flex the electrode body while removing the tape and the protective boot.*
3. Rinse the electrode tip in tap water and wipe the electrode body dry then lubricate the o-ring seals with the included lubricant. *Save the protective soaker boot in the event the electrode must be stored at a future time*.
4. Carefully insert the electrode cartridge into the sensor assembly by turning until **hand tight**. The first o-ring, closest to the front of the electrode, will be slightly visible if held horizontally.

NOTE: IF EXCESS FORCE IS REQUIRED DURING ELECTRODE INSTALLATION, CHECK FOR PROPER THREAD ENGAGEMENT OR FOR AN OBSTRUCTION.

8.3.2Electrode Cartridge Replacement

Periodic replacement of the electrode cartridge is required for pH, ORP and Specific Ion sensors. The following procedure explains how to replace the electrode cartridge in the sensor assembly:

1. Remove the electrode cartridge from the front of the sensor assembly by turning it counterclockwise.
2. For installation procedure follow steps 2, 3, and 4 in section 8.3.1 electrode cartridge installation.

8.3.3 Electrode Cleaning

An important aspect of sensor maintenance is the service of the electrode cartridge. After being in operation, an electrode may begin to exhibit slow response or non-reproducible measurements. This may be due to coating of the measurement electrode or clogging of the reference junction. Regular electrode cleaning reduces problems associated with the coating and clogging. Frequency of cleaning will depend on the process and application. The following procedures are used to clean pH and ORP electrodes.

If possible, the electrode should be cleaned without removing it from the sensor body. However, if the electrode must be removed, the o-rings must be inspected and re-lubricated. See section 3.10.

8.3.4 pH Electrode Cartridge Cleaning

Remove the sensor from the process and carefully wash the wetted end of the electrode cartridge in a mild solution of detergent and water or with methyl alcohol. If the electrode response is not improved, soak the electrode in 0.1 Molar HCl for 5 minutes. Remove and rinse the electrode with tap water and soak in 0.1 Molar NaOH for 5 minutes.

Remove the electrode from the NaOH solution, rinse the electrode and soak in a 4 pH buffer solution for 10 minutes. This should improve the response of the electrode. If not, replace the electrode.

If the electrode must be left out of the process for an extended period of time, store it in a solution of water saturated with KCl or a 4.0 pH buffer solution. *ECD does not recommend the storage of electrodes in distilled or deionized water*.

8.3.5 ORP Electrode Cartridge Cleaning

Cleaning the platinum surface to remove coating can be done using an abrasive cleaner like 600-800 grit wet/dry sand paper or chemical reagents specific for the type of coating. Abrasive cleaning is the most common method of cleaning and is usually sufficient to restore the platinum surface; however, some processes can form a hard coating requiring chemical cleaning with a strong acid solution. Acid solutions greater than 10% are not recommended.

8.3.6 pIon Electrode Cartridge Cleaning

Ion selective electrodes require periodic service. Weekly checks should be performed to assure the accuracy of the measurement.

The ion selective crystal that senses the ion concentration can become sluggish in response due to coating or reactions with the process solution. Periodic cleaning or polishing will minimize drift and maintain the sensors response.

CLEANING

The solid state crystal based electrodes, bromide, chloride, copper, cyanide, fluoride, silver, sulfide are fairly robust and can be cleaned with alcohols, detergents or dilute acids to remove coatings caused by greases, oils or films. A soft tooth brush or paper towel should be used to remove stubborn coatings. Do not clean with a wire brush. Metal carryover from the brush will compromise the measurement. Cleaning should be followed by polishing before calibrating the sensor.

The PVC membrane sensors, Ca++, K+, NH4+, NO3- are fragile membranes and should be cleaned using a soft artist style paint brush while rinsing with a stream of water. Dilute dish washing detergents can be used to remove oily films Solvents or strong acid/alkaline solution will irreparably harm the electrode.
Calibration may be necessary after cleaning.

POLISHING

Abrasive polishing is only recommended for the solid state crystal style Combination Electrodes. ECD supplies two styles of abrasive cleaning kits, a package of light blue colored polishing strips or a small vial of alumina powder with Q-tips with the fluoride electrodes.
The sensing surface of solid state electrodes can wear over time, which causes drift, poor reproducibility and loss of response in low level samples. The electrode can be restored by polishing the sensing surface with a polishing kit. The polishing kit can also be used if the sensing surface has been etched or chemically poisoned.

a. Moisten the end of the Q-tip with water and dip it in the alumina polishing powder to pick up a small amount of the powder.
b. Rub the polishing powder onto the fluoride crystal in a circular motion, moisten the tip if necessary to produce a liquid consistency more than a paste.
c. Polish the electrode for about 30 seconds and examine the tip for a shiny surface, repeat if necessary.
d. Rinse the electrode with distilled water and soak the electrode in a low ppm Calibration solution for a few minutes.
e. Perform a Two Point Calibration.

Other Solid State electrodes, Bromide, Cadmium, Chloride, Copper, Lead, Sulfide, Silver…

a. Place a few drops of distilled water on the blue polishing strip to wet the polishing surface.
b. Hold the electrode with the sensing surface facing up.
c. Slide the polishing strip back and forth across the electrode tip, the sensing tip will be abraded and a new electrode surface will be generated.
d. Polish the electrode for about 30 seconds and examine the tip for a shiny surface, repeat if necessary.
e. Rinse the electrode with distilled water and soak the electrode in a low ppm Calibration solution for a few minutes.
f. Perform a Two Point Calibration.

8.3.7 Dissolved Oxygen Cartridges

The Teflon membrane of the Dissolved Oxygen sensors is fragile and should be cleaned using a soft cloth or an artist style paint brush while rinsing with a stream of water. Dilute dish washing detergents can be used to remove oily films. Solvents are not recommended as they could diffuse through the membrane and harm the electrode. Strong acid/alkaline solutions should not harm the electrode but should only be used as a last resort before replacing the electrode.

8.4 S80 Sensor Specifications

Dimensions:

S80 - ¾"OD x 10" Length, optional lengths, 17", 24", 30", 36" …. in 6" increments to 8 ft.

Cable Length:

10 ' standard, Optional lengths in 10 ' increments

4 conductors shielded

Housing Materials:

Standard, 316 Stainless Steel, Optional, Titanium (T), grade 2, Hastelloy (H), C-22, PVDF (K),

O-Ring Materials:

Viton™ (VIT), Standard, Ethylene Propylene (EPR), Optional, Fluoro-silicone (FSIL), Optional, Silicone (SIL), Optional, KALREZ™ (KLZ), Optional, CV75 (CV), Optional

Process Connections:

-75 ¾" 316 SS gland fitting with nylon ferrule

-75PP ¾" poly propylene gland fitting with ferrule

-75SF ¾" 316 SS gland fitting with stainless steel ferrule

-75TFE ¾" Teflon™ gland fitting with Teflon™ ferrule

-100 1" Teflon™ glands fitting for PVDF housing only

-VSS 1" 316 SS valve retraction assembly

-VKY 1" PVDF valve retraction assembly

Shipping Weight:

S80 2.5 lbs (1.2 kg)

S80 with VSS 5.8 lbs (2.65 kg)

8.4.1 pH electrodes

Part#	Description	pH Range	Temperature	Max. Pressure
2005005-HPW	High Purity Water, RADEL Body, dbl jct TFE Ref, Full bulb pH glass,	2-12 pH	-10°-90°C	150 psig
2005145	General Purpose, RADEL body, dbl jct TFE Ref, Flat pH glass,	0-14 pH	-10°-90°C	150 psig
2005146	General Purpose, PEEK body, dbl jct ceramic Ref, Flat pH glass,	0-14 pH	-10°-90°C	150 psig
2005148	Non aqueous service, RADEL body, dbl jct TFE Ref, Flat pH glass,	0-14 pH	-10°-90°C	150 psig
2005157	Hi Temp/ Hi pH, PEEK body, dbl jct TFE Ref, Hemi pH glass,	0-14 pH	0°-130°C	150 psig
2005059	Recessed Bulb, RADEL Body, dbl jct TFE Ref, Hemi pH glass,	0-14 pH	-10°-90°C	150 psig
2005066	Chemical Resistant, PEEK body, triple jct TFE Ref, Flat pH glass,	0-14 pH	0°-130°C	150 psig
2005169	Chemical Resistant, PEEK body, dbl jct TFE Ref, Hemi pH glass,	0-14 pH	0°-130°C	150 psig
2005130	Sulfide Resistant, PEEK body, triple jct TFE Ref, Hemi pH glass,	0-14 pH	0°-130°C	150 psig
2005150	Solvent Resistant, PEEK body, dbl jct TFE Ref, Flat pH glass,	0-14 pH	-10°-90°C	150 psig

2005103	Fluoride resistant, Peek body, Rugged pH glass, dbl jct TFE Ref,	0-14 pH	-10°-90°C	150 psig
2005013	pH, antimony, RADEL body, TFE junction	3-10 pH	10°-50°C	150 psig

8.4.2 ORP ELECTRODES

Part#: 2005167
ORP sensor: Platinum
Construction: PEEK body,
Reference Electrode: double porous Teflon junction
Measurement Range: -1500 mV - +1500 mV
Temperature Range: -10° - 80°C
Pressure Range: 150 psig

8.4.3 DISSOLVED OXYGEN

Part#: 2005622
2 mil Teflon membrane
Galvanic cell: Silver/Lead
Construction: PEEK body,
Measurement Range: 0-20 ppm
Temperature Range: -10° - 130°C
Pressure Range: 30 psig

8.4.4 AMMONIUM ELECTRODE

Part #: 2005083
ISE sensor: PVC membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.05 - 18,000 ppm
pH Range: 2-10 pH
Temperature Range: 0°- 40°C
Pressure Range: 50 psig

8.4.5 BROMIDE ELECTRODE

Part #: 2005062
ISE sensor: solid state AgS/AgBr membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 0. 1 - 80,000 ppm
pH Range: 2-12 pH
Temperature Range: 0°-50°C
Pressure Range: 150 psig

8.4.6 CALCIUM ELECTRODE

Part #: 2005043
ISE sensor: PVC membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.1 - 40,000 ppm
pH Range: 2.5 - 10 pH

Temperature Range: 0°-40°C
Pressure Range: 50 psig

8.4.7 Chloride Electrode

Part #: 2005008
ISE sensor: solid state AgS/AgCl membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 2 - 35,000 ppm
pH Range: 2-12 pH
Temperature Range: 0°-80°C
Pressure Range: 150 psig

8.4.8Cupric Electrode

Part #: 2005058
ISE sensor: solid state CuS membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 1 ppb – 6,300 ppm
pH Range: 2 - 8 pH
Temperature Range: 0°-80°C
Pressure Range: 150 psig

8.4.9 Cyanide Electrode

Part #: 2005042
ISE sensor: solid state AgS/AgCN membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.1- 260 ppm
pH Range: 11-13 pH
Temperature Range: 0°-80°C
Pressure Range: 150 psig

8.4.10 Fluoride Electrode

Part #: 2005163
ISE sensor: solid state LaF crystal
Construction: PEEK body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.02 - 2,000 ppm
pH Range: 5-8 pH
Temperature Range: 0°- 80°C
Pressure Range: 50 psig

8.4.11 Potassium Electrode

Part #: 2005034
ISE sensor: PVC membrane
Construction: Radel (PES) body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.1- 40,000 ppm
pH Range: 2-12 pH

Temperature Range: 0°-40°C
Pressure Range: 50 psig

8.4.12 Silver Electrode

Part #: 2005016
ISE sensor: solid state AgS membrane
Construction: PEEK body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.1-107,000 ppm
pH Range: 2-14 pH
Temperature Range: 0°-80°C
Pressure Range: 150 psig

8.4.13 Sodium Electrode

Part #: 2005031
ISE sensor: Sodium selective Glass membrane
Construction: PEEK body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.2 - 23,000 ppm
pH Range: 2-14 pH (pH must be 3 units higher than pNa)
Temperature Range: 0°-80°C
Pressure Range: 150 psig

8.4.14 Sulfide Electrode

Part #: 2005122
ISE sensor: solid state AgS membrane
Construction: PEEK body,
Reference Electrode: double porous Teflon junction
Measurement range: 0.01 - 32,000 ppm
pH Range: 11-14 pH
Temperature Range: 0°-80°C
Pressure Range: 150 psig

APPENDIX

A. Auto Cal Buffer Tables

°C	pH	pH	pH
0	4.00	7.115	10.32
5	4.00	7.085	10.25
10	4.00	7.06	10.18
15	4.00	7.04	10.12
20	4.00	7.015	10.06
25	4.005	7.00	10.01
30	4.015	6.985	9.97
35	4.025	6.98	9.93
40	4.03	6.975	9.89
45	4.045	6.975	9.86
50	4.06	6.97	9.83
55	4.075	6.97	
60	4.085	6.97	
65	4.10	6.98	
70	4.13	6.99	
75	4.14	7.01	
80	4.16	7.03	
85	4.18	7.05	
90	4.21	7.08	

B. T80 HART Menu

T80 Root Menu					
1 DEVICE SETUP	DEVICE SETUP	CALIBRATION			
	1 CALIBRATION	1 AUTO			
		2 STANDARDIZE			
		3 MANUAL			
		4 TEMP			
	2 BASIC SETUP	CONFIG			
		1 XMTR	XMTR CONFIG	ANALOG CONFIG	
			1 ANALOG	1 SCALE	ANALOG SCALE
					1 UPPER
					2 LOWER
				2 PID	PID CONFIG
					1 P Term
					2 I Term
					3 D Term
				3 CALIBRATE	CALIBRATE
					1 Zero cal
					2 Gain cal
					3 Save
			2 ALARMS	ALARM CONFIG	
				1 Alrm 1 thresh	
				2 Alrm 1 hyst	

				3 Alrm 1 dly on	
				4 Alrm 1 dly off	
				5 Alrm 2 thresh	
				6 Alrm 2 hyst	
				7 Alrm 2 dly on	
				8 Alrm 2 dly off	
				9 Alrm 3 thresh	
				10 Alrm 3 hyst	
				11 Alrm 3 dly on	
				12 Alrm 3 dly off	
			3 Address		
		2 Device information	DEVICE INFORMATION		
			1 Distributor		
			2 Model		
			3 Dev ID		
			4 Cfg chng count		
			5 Tag		
			6 Long tag		
			7 Date		
			9 Descriptor		
			10 Message		
			11 Final asmbly num		
	3 INFORMATION	INFORMATION			
		1 XMTR	XMTR INFO		
			1 Serial #		
			2 FW Rev		
			3 HW Rev		
			4 Fld dev rev		
		2 SENSOR	SENSOR INFO		
			1 Serial #		
			2 FW Rev		
			3 HW Rev		
		3 DEVICE	DEVICE INFORMATION		
			1 Distributor		
			2 Model		
			3 Dev ID		
			4 Cfg chng count		
			5 Tag		
			6 Long tag		
			7 Date		
			9 Descriptor		
			10 Message		
			11 Final asmbly num		
2 PV					
3 Temperature					
4 Output %					
5 Sensor Name					

C. TEXT/ICON LEGEND

The Text button is paired with its corresponding Icon Button

4-20			HOME			RLY2			RAMP TIME	
ADDRESS			INFO			RLY3			RUN TIME	
ALARM			ISO PT			SCALE			CAL1	
AUTO			LABELS			SENSOR			CAL2	
BACK			LCD			SERIAL	0101			
BACK LIGHT			LEGEND	ABC		SETUP				
BAR			LINE			SIM				
BAUD			LOAD DEFAULT			STAND				
BRITE			LOOP			SYS				
CAL			MANUAL			T COMP	TC			
CANCEL			mV	mV		TAG				
CHANGE			NEXT			TAG ON				
CONFIG			NO			TEMP				
CONT			OFF			TEMP FORMAT	°F/°C			
DISABLE			OK			TIME				
DUTY			ON			TYPE				
ENTER			OUTPUT			VALUE				
EXIT			PASSWD			XMTR				
FAULT			POP UP			YES				
FIXED			RAMP							
FORMAT			RANGE							
GAUGE			RELAYS							
GRAPH			RESET							
HOLD			RLY1							

D. MODBUS RTU REGISTER LISTING

03 (0x03) READ HOLDING REGISTERS

This function code is used to read the contents of a contiguous block of holding registers in a remote device. The Request Protocol Data Unit specifies the starting register address and the number of registers. In the Protocol Data Unit Registers are addressed starting at zero. Therefore registers numbered 1-16 are address as 0-15.

The register data in the response message are packed as to bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Request

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Function code	1 Byte	0x03
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	1 to 125 (0x01 to 0x7D)
CRC	2 Bytes	calculated

Response

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Function code	1 Byte	0x03
Byte Count	1 Byte	2 X N*
Register Value(s)	*N X 2 Bytes	
CRC	2 Bytes	calculated
*N = Quantity of Registers		

Error

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Error Code	1 Byte	0x86
Exception Code	1 Byte	01, 02, 03 or 04
CRC	2 Bytes	calculated

06 (0x06) WRITE SINGLE REGISTER

This function code is used to write a single holding register in a remote device.

The Request Protocol Data Unit specifies the address of the register to be written. Registers are addressed starting at zero. Therefore register number 1 is addressed as 0.

The normal response is an echo of the request, returned after the register contents have been written.

Request

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Function code	1 Byte	0x06
Register Address	2 Bytes	0x0000 to 0xFFFF
Register Value	2 Bytes	0x0000 to 0xFFFF
CRC	2 Bytes	calculated

Response

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Function code	1 Byte	0x06
Register Address	2 Bytes	0x0000 to 0xFFFF

Register Value	2 Bytes	0x0000 to 0xFFFF
CRC	2 Bytes	calculated

*N = Quantity of Registers

Error

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Error Code	1 Byte	0x86
Exception Code	1 Byte	01, 02, 03 or 04
CRC	2 Bytes	calculated

65 (0x41) User Defined Function Code. Set register access password

This User Defined Function Code is used to write the register access password to a remote device. Once written, the password grants read or write privilege to specific registers.

Request

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Function code	1 Byte	0x41
Password High Word	2 Bytes	0x0000 to 0xFFFF
Password Low Word	2 Bytes	0x0000 to 0xFFFF
CRC	2 Bytes	calculated

Response

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Function code	1 Byte	0x41
CRC	2 Bytes	calculated

Error

Modbus ID (Slave Address)	1 Byte	1 to 247 (0x01 to 0xF7)
Error Code	1 Byte	0xC1
Exception Code	1 Byte	01, 02, 03 or 04
CRC	2 Bytes	calculated

Registers

Per the Modbus Application Protocol Specification (V1.1b)

Name	Meaning (2 bytes each register)	Number of Registers	Return Data Format	Read Write	Password		Register #	
					R	W	dec	hex
Modbus ID (slave address)	Defined as 1 to 247 per the Modbus Application Protocol Specification (V1.1b)	1	16 bit Integer	RW			0	00
Data Format	Data Format of the User Bus to the T80 (0-DF8N2, 1-DF8O1, 2-DF8E1, 3-DF8N1)	1	16 bit Integer	RW			1	01
Baud Rate	Baud Rate of the User Bus to the T80 (0-1200, 1-2400, 2-4800, 3-9600, 4-19.2K)	1	16 bit Integer	RW			2	02
BusMessage	total message count detected by the slave (remote device)	1	16 bit Integer	R			3	03
BusCommunicationsError	total CRC error count	1	16 bit Integer	R			4	04
SlaveExceptionError	total count of exceptions detected	1	16 bit Integer	R			5	05
SlaveMessage	total messages addressed to the slave (remote device)	1	16 bit Integer	R			6	06
SlaveNoResponse	total count of messages not responded to by the slave (remote device)	1	16 bit Integer	R			7	07
SlaveNAK	total Negative Acknowledges returned by slave (remote device)	1	16 bit Integer	R			8	08

SlaveBusy	total count of "slave busy" was returned for an address message	1	16 bit Integer	R			9	09
Reset all Modbus Error Counters	Resets all of the Modbus Error counters (defined in Modbus spec) to 0, Write any value.	1	16 bit Integer	W			11	0B
Product T80 Model Number (Modbus)	The Model Number of the Unit polled	1	16 bit Integer	RW		Y	12	0C
T80 Serial Number (hi word)	Unit Serial Number (32 bit integer hi word, bytes 3 and 2)	2	32 bit Long Integer	RW		Y	13	0D
T80 Serial Number (lo word)	Unit Serial Number (32 bit integer lo word, bytes 1 and 0)			RW		Y	14	0E
T80 Mode	Unit operating mode (0-Startup, 1-Sensor Search, 2-Operate)	1	16 bit Integer	R			15	0F
T80 Fault Status	Unit Fault flags, bit defined	1	16 bit Integer	R			16	10
T80 2nd Fault Status	Unit Fault flags (2nd word reserved, currently not used)	1	16 bit Integer	R			17	11
T80 Warning Status	Unit Warning flags, bit defined	1	16 bit Integer	R			18	12
T80 2nd Warning Status	Unit Warning flags (2nd word reserved, currently not used)	1	16 bit Integer	R			19	13
T80 FW Rev	Firmware revision of the Control BD in ASC, ex. " 1".	1	16 bit Integer	R			20	14
T80 HW Rev	Firmware revision of the Control BD in ASC, ex. " 1".	1	16 bit Integer	R			21	15
Relay 1 Type	Read/Write Relay Type (0 - Fault Type, 1 - Alarm Type, 2 - Disabled)	1	16 bit Integer	RW			22	16
Relay 1 ON Setpoint (hi word)	Read/Write Relay ON Setpoint (byte 3 and byte 2)	2	32 bit Floating Point	RW			23	17
Relay 1 ON Setpoint (lo word)	Read/Write Relay ON Setpoint (byte 1 and byte 0)			RW			24	18
Relay 1 OFF Setpoint (hi word)	Read/Write Relay OFF Setpoint (byte 3 and byte 2)	2	32 bit Floating Point	RW			25	19
Relay 1 OFF Setpoint (lo word)	Read/Write Relay OFF Setpoint (byte 1 and byte 0)			RW			26	1A
Relay 1 ON Delay (hi word)	Read/Write Relay turn on Delay time (byte 3 and byte 2)	2	32 bit Floating Point	RW			27	1B
Relay 1 ON Delay (lo word)	Read/Write Relay turn on Delay time (byte 1 and byte 0)			RW			28	1C
Relay 1 OFF Delay (hi word)	Read/Write Relay turn off Delay time (byte 3 and byte 2)	2	32 bit Floating Point	RW			29	1D
Relay 1 OFF Delay (lo word)	Read/Write Relay turn off Delay time (byte 1 and byte 0)			RW			30	1E
(reserved)							31	1F
(reserved)							32	20
Relay 2 Type	Read/Write Relay Type (0 - Fault Type, 1 - Alarm Type, 2 - Disabled)	1	16 bit Integer	RW			33	21
Relay 2 ON Setpoint (hi word)	Read/Write Relay ON Setpoint (byte 3 and byte 2)	2	32 bit Floating Point	RW			34	22
Relay 2 ON Setpoint (lo word)	Read/Write Relay ON Setpoint (byte 1 and byte 0)			RW			35	23
Relay 2 OFF Setpoint (hi word)	Read/Write Relay OFF Setpoint (byte 3 and byte 2)	2	32 bit Floating Point	RW			36	24
Relay 2 OFF Setpoint (lo word)	Read/Write Relay OFF Setpoint (byte 1 and byte 0)			RW			37	25
Relay 2 ON Delay (hi word)	Read/Write Relay turn on Delay time (byte 3 and byte 2)	2	32 bit Floating Point	RW			38	26
Relay 2 ON Delay (lo word)	Read/Write Relay turn on Delay time (byte 1 and byte 0)			RW			39	27
Relay 2 OFF Delay	Read/Write Relay turn off Delay time (byte 3 and byte 2)	2	32 bit	RW			40	28

(hi word)			Floating Point					
Relay 2 OFF Delay (lo word)	Read/Write Relay turn off Delay time (byte 1 and byte 0)			RW			41	29
(reserved)							42	2A
(reserved)							43	2B
Relay 3 Type	Read/Write Relay Type (0 - Fault Type, 1 - Alarm Type, 2 - Disabled)	1	16 bit Integer	RW			44	2C
Relay 3 ON Setpoint (hi word)	Read/Write Relay ON Setpoint (byte 3 and byte 2)	2	32 bit Floating Point	RW			45	2D
Relay 3 ON Setpoint (lo word)	Read/Write Relay ON Setpoint (byte 1 and byte 0)			RW			46	2E
Relay 3 OFF Setpoint (hi word)	Read/Write Relay OFF Setpoint (byte 3 and byte 2)	2	32 bit Floating Point	RW			47	2F
Relay 3 OFF Setpoint (lo word)	Read/Write Relay OFF Setpoint (byte 1 and byte 0)			RW			48	30
Relay 3 ON Delay (hi word)	Read/Write Relay turn on Delay time (byte 3 and byte 2)	2	32 bit Floating Point	RW			49	31
Relay 3 ON Delay (lo word)	Read/Write Relay turn on Delay time (byte 1 and byte 0)			RW			50	32
Relay 3 OFF Delay (hi word)	Read/Write Relay turn off Delay time (byte 3 and byte 2)	2	32 bit Floating Point	RW			51	33
Relay 3 OFF Delay (lo word)	Read/Write Relay turn off Delay time (byte 1 and byte 0)			RW			52	34
(reserved)							53	35
(reserved)							54	36
4-20 Analog Type	Read/Write 4-20 Type (0-Range, future expansion)	1	16 bit Integer	RW			55	37
4-20 Analog Range, 4mA range (hi word)	Read/Write 4mA range (bytes 3 and 2)	2	32 bit Floating Point	RW			56	38
4-20 Analog Range, 4mA range (lo word)	Read/Write 4mA range (bytes 1 and 0)			RW			57	39
4-20 Analog Range, 20mA range (hi word)	Read/Write 20mA range (bytes 3 and 2)	2	32 bit Floating Point	RW			58	3A
4-20 Analog Range, 20mA range (lo word)	Read/Write 20mA range (bytes 1 and 0)			RW			59	3B
S80 Mode	Unit operating mode (0-	1	16 bit Integer	R			60	3C
S80 Serial Number (hi word)	Unit Serial Number (32 bit integer hi word)	2	32 bit Long Integer	RW		Y	61	3D
S80 Serial Number (lo word)	Unit Serial Number (32 bit integer lo word)			RW		Y	62	3E
S80 Fault Status		1	16 bit Integer	R			63	3F
S80 Sensor Type	Specific chemicals the S80 is set to detect (see S80 Sensor Types tab)	1	16 bit Integer	R			64	40
S80 Max Range (hi word)	Max sensor range (bytes 3 and 2)	2	32 bit Floating Point	R			65	41
S80 Max Range (lo word)	Max sensor range (bytes 1 and 0)			R			66	42
S80 Min Range (hi word)	Min sensor range (bytes 3 and 2)	2	32 bit Floating Point	R			67	43
S80 Min Range (lo word)	Min sensor range (bytes 1 and 0)			R			68	44
S80 Sensor Value (hi word)	Current sensor value (bytes 3 and 2)	2	32 bit Floating Point	R			69	45

S80 Sensor Value (lo word)	Current sensor value (bytes 1 and 0)			R			70	46
S80 Sensor Voltage (hi word)	Corresponding sensor voltage to the sensor value (byte 3 and byte 2)	2	32 bit Floating Point	R			71	47
S80 Sensor Voltage (lo word)	Corresponding sensor voltage to the sensor value (byte 1 and byte 0)			R			72	48
S80 Sensor Temperature (hi word)	Sensor Temperature (bytes 3 and 2)	2	32 bit Floating Point	R			73	49
S80 Sensor Temperature (lo word)	(bytes 1 and 0)			R			74	4A
S80 Cal Log 1 slope (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			75	4B
S80 Cal Log 1 slope (lo word)	(bytes 1 and 0)			R			76	4C
S80 Cal Log 1 offset (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			77	4D
S80 Cal Log 1 offset (lo word)	(bytes 1 and 0)			R			78	4E
S80 Cal Log 1 offset Voltage (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			79	4F
S80 Cal Log 1 offset Voltage (lo word)	(bytes 1 and 0)			R			80	50
S80 Cal Log 2 slope (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			81	51
S80 Cal Log 2 slope (lo word)	(bytes 1 and 0)			R			82	52
S80 Cal Log 2 offset (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			83	53
S80 Cal Log 2 offset (lo word)	(bytes 1 and 0)			R			84	54
S80 Cal Log 2 offset Voltage (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			85	55
S80 Cal Log 2 offsetVoltage (lo word)	(bytes 1 and 0)			R			86	56
S80 Cal Log 3 slope (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			87	57
S80 Cal Log 3 slope (lo word)	(bytes 1 and 0)			R			88	58
S80 Cal Log 3 offset (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			89	59
S80 Cal Log 3 offset (lo word)	(bytes 1 and 0)			R			90	5A
S80 Cal Log 3 offset Voltage (hi word)	(bytes 3 and 2)	2	32 bit Floating Point	R			91	5B
S80 Cal Log 3 offset Voltage (lo word)	(bytes 1 and 0)			R			92	5C
93-107 reserved								
Read +Vin	Voltage into the unit (scaled as mV)	1	16 bit Integer	R	Y		108	6C
Read +12V	The 12Vdc voltage regulator output (scaled as mV)	1	16 bit Integer	R	Y		109	6D
Read +3.3V Condition	The 3.3Vdc voltage regulator power good indication (0 - fault, 1 - good)	1	16 bit Integer	R	Y		110	6E

Read Number of NVM Writes (MSW)	Reads the most significant word of the write counter for the number of NVM writes that have occurred	2		R	Y		111	6F
Read Number of NVM Writes (LSW)	Reads the least significant word of the write counter for the number of NVM writes that have occurred	2		R	Y		112	70

FAULT STATUS

Bit #	bit meaning
0	Not Used (NU)
1	Memory Error, either a Program Flash, RAM or NVM RAM checksum error has occurred
2	Input Voltage Out Of Tolerance
3	The On Board +12V is Out of Tolerance
4	The On Board +3.3V is Out of Tolerance
5	The Transmitter has lost communication link with the Sensor
6	There is no Sensor connected
7	Sensor Calibration Failed
8	Relay 1 on-time expired
9	Relay 2 on-time expired
10	Relay 3 on-time expired
11	NU
12	NU
13	NU
14	NU
15	NU

WARNING STATUS

Bit #	bit meaning
0	Not Used (NU)
1	The Sensor has changed from previously connect Sensor
2	NU
3	NU
4	NU
5	NU
6	NU
7	NU
8	NU
9	NU
10	NU
11	NU
12	NU
13	NU
14	NU
15	NU

SENSOR TYPE

Data	Meaning
0	Unknown Chemical
1	Ammonia
2	Ammonium
3	Bromide
4	Calcium
5	Chloride
6	Conductivity
7	Cupric
8	Cyanide
9	DO ppm
10	DO %Saturation
11	DO mg/L
12	Fluoride
13	Hardness
14	Nitrate
15	ORP
16	pH
17	Potassium
18	Resistivity

19	Silver
20	Sodium
21	Sulfide

E. SOFTWARE HISTORY

Date	Version	Changes
July 2012	Rev. A	Initial Release
Feb. 2013	Rev. B	Conductivity Resistivity added