



# Instruction Manual

## Model LQ800 Multi-Channel Controller



## 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 <https://ecdi.com/product-literature/product-literature/>.

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

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## 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. |
|  | No operator serviceable parts, service by authorized service personnel only.                                                                                    |
|  | This symbol is used to designate a WARNING “Risk of Electrical Shock”                                                                                           |
|  | Disconnect supply before servicing                                                                                                                              |
|  | Equipment protected throughout by double insulation.                                                                                                            |

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.
- There are no operator accessible parts. Service and maintenance to be done by authorized personnel only.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

|                                                                                     |                                                                    |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|
|  | Read the complete manual before installing or using the equipment. |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|

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# TERMS AND CONDITIONS OF SALE

1. **CEPTANCE.** If this writing differs in any way from the terms and conditions of Buyer's order or if this writing is construed as an acceptance or as a confirmation acting as an acceptance, then Seller's acceptance is **EXPRESSLY MADE CONDITIONAL ON BUYER'S ASSENT TO ANY TERMS AND CONDITIONS CONTAINED HEREIN THAT ARE DIFFERENT FROM OR ADDITIONAL TO THOSE CONTAINED IN BUYER'S WRITING.** Further, this writing shall be deemed notice of objection to such terms and conditions of Buyer. If this writing is construed as the offer, acceptance hereof is **EXPRESSLY LIMITED TO THE TERMS AND CONDITIONS CONTAINED HEREIN.** In any event, Buyer's acceptance of the goods shall manifest Buyer's assent to Seller's terms and conditions. No addition to or modification of these terms will be effective, unless set forth in writing and agreed to by Seller.
2. **WARRANTIES AND REMEDIES**
  - a. **Warranty.** Seller warrants to Buyer that it holds and will pass marketable title to the goods sold hereunder. Seller warrants to Buyer that the items and components manufactured by Seller will be free from defects in material and workmanship (subject, however, to tolerances and variances permitted by the trade hereunder) for a period one (1) year for non-consumable products. Consumable electrodes and sensors have a conditional warranty based shelf life and process conditions and is determined by Seller.
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3. **DISCLAIMER OF IMPLIED WARRANTIES.** Seller gives no warranties except those expressly contained herein. Seller **disclaims** all other warranties implied by law usage of the trade, course of dealing or course of performance including, but not limited to, **the implied warranties of MERCHANTABILITY and fitness for a particular purpose.**
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  - a. **Disclaimer of Damage.** In no event shall Seller be liable for special, indirect, consequential or incidental damages whether arising under contract, warranty, tort, strict liability or any other theory of liability. Such damages include but are not limited to loss of profits, loss of use of goods, damage to property, and claims of third parties.
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  - c. **Notice and Time of Claims.**
    - i. Buyer agrees to check and inspect all products against shipping papers and for damage or shortage upon receipt of goods at destination.
    - ii. Every claim for shortage, damage in transit, or other cause visible upon inspection shall be deemed waived by the Buyer, or the Buyer's customer in the case of resale, unless delivered in writing to Seller by Buyer thirty (30) days from the tender of delivery of the goods to Buyer, provided, however, that claims for shortage must be made within seven (7) days of receipt.
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9. **PAYMENTS.** If in the judgment of Seller the financial condition of Buyer at any time prior to shipment does not justify the terms of payment specified, Seller may cancel the order, withhold shipment, and/or require full or partial payment in advance. If payment is not made when due, Seller may suspend all future delivery or other performance with respect to Buyer without liability or penalty and, in addition to all other sums payable hereunder, Buyer shall pay to Seller (i) the reasonable costs and expenses incurred by Seller in connection with all actions taken to enforce collection or to preserve and protect Seller's rights hereunder, whether by legal proceedings or otherwise, including without limitation reasonable attorneys' fees, court costs and other expenses and (ii) interest on all amounts unpaid after 30 days charged at the monthly rate of 1-1/2% or the highest rate permitted by law, whichever is lower.
10. **CANCELLATION OR ALTERATION.** Buyer may not alter or cancel any order without Seller's written consent. For any order altered or cancelled with Seller's consent, Buyer must pay for all expenses and labor incurred up to the time of Seller's consent, plus a reasonable percentage for profit. Any order delayed or deferred by Buyer will be subject to price escalation for increased costs of production, and any other expenses caused by the delay. Material on such orders will be stored at Buyer's risk. Seller reserves the right to invoice Buyer and require payment before shipment of any delayed or deferred order.
11. **TITLE AND RISK OF LOSS.** Title and risk of loss shall pass to buyer at Anaheim, California, unless otherwise specified in the contract. If delivery is made by common carrier, risk of loss shall pass upon delivery to the carrier. Claims for loss or damage in transit must be made by Buyer to the carrier. Seller accepts no responsibility for loss or damage to product in transit.
12. **PATENT OR TRADEMARK INFRINGEMENT.** If the goods sold hereunder are to be prepared for manufacture according to Buyers specification, Buyer shall indemnify Seller against any claim or liability for patent, trademark, service mark or trade name infringement on account of preparation, manufacture and/or sale.
13. **NON-WAIVER.** If Government Contract Regulations require the addition, deletion, or modification of these terms and conditions upon prior notification to Seller and Seller's written acceptance thereof, such changes shall become a part of these terms and conditions. Seller shall not be bound by any Government Contract Regulations applicable to Buyer's contracts with the U.S. Government unless Buyer has expressly acknowledged, on the face of this document, the applicability of such Regulations to the transaction between Buyer and Seller contemplated herein. Absent such acknowledgement, Seller is making the assumption in issuing this document that no such Regulations apply.
14. **JURISDICTION.** All such disputes shall be resolved in a court of competent jurisdiction in Orange County, California. Buyer hereby consents to the jurisdiction of the State and Federal Courts sitting in Orange County. Notwithstanding the above, should either party contest the jurisdiction of such courts, the other party may institute its suit in any court of competent jurisdiction.
15. **APPLICABLE LAW.** All questions arising hereunder or in connection with the quotations or any order submitted in connection therewith and/or the performance of the parties hereunder shall be interpreted and resolved in accordance with the laws of the state of California without regard to its conflict of law provisions and excluding the United Nations Convention on the International Sale of Goods.

# RETURN GOODS POLICY

All requests for returned goods must be initiated through our Customer Service Department. Please call our phone number (714) 695-0051 with the specifics of your request. The following conditions must be satisfied for consideration of applicable credit for the return of products purchased from Electro-Chemical Devices:

- 1) The item is unused and in the original package.
- 2) The item was shipped directly from Electro-Chemical Devices.
- 3) The item has not been damaged in shipment to Electro-Chemical Devices.
- 4) Items containing date-sensitive parts such as electrodes, must be returned within 1 month of the invoiced date.
- 5) Items without date-sensitive parts must be returned within 3 months of the invoiced date.

A Return Merchandize Authorization Number must be obtained from Customer Service and be provided on all paperwork and packaging. To obtain a Return Merchandize Authorization Number, please provide the reason for return, the date of purchase, your original purchase order number, and either our order number or our invoice number. The issuance of a Return Merchandize Authorization Number is a verbal approval for return only and does not guarantee credit or allowance. Returned goods must be received within 30 days of the issuance date of the Return Merchandize Authorization Number or it will become null and void.

Necessary physical and mechanical inspection is completed upon receipt of the item. Applicable credit or equivalent allowance is determined after inspection of the returned item. If all of the above conditions are met, and the item has been approved to return to our stock, a restocking charge of 25% of the purchase price is deducted from the applicable credit

# 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), Canadian Electrical Code 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 DO82 Sensor 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.

# 1.0 GENERAL DESCRIPTION

The ECD Model LQ800 Controller is a one to eight channel, intelligent, multi- parameter controller designed for the online continuous measurement of pH, ORP, pION, dissolved oxygen, conductivity, resistivity, turbidity, flow, level, and many others in varying configurations for a given application. The Model LQ800 Controller digitally communicates with any ECD DS80 digital sensor, automatically configuring the controller's menus and display screens to the measured parameter.

The Model LQ800 Controller can be 24 VDC powered or 100-240 VAC line powered. Available options include, (8) 4 to 20 mA outputs, (8) configurable Relays (for Alarm, Timed Relay, and Fault), (4) 4-20 mA inputs, (4) digital inputs, and Ethernet communication.

## 1.1 FEATURES

- Multi-Parameter, pH, ORP, Specific Ion, Dissolved Oxygen, Conductivity, Resistivity, Turbidity, Flow, and Level
- Sensor compensation with two layers of compensation
- Simple, user friendly menu structure
- Noise free digital communication with sensors
- Reads and writes calibration data to sensor
- Non-Isolated 4-20 mA output
- Ethernet control and monitoring functions. With an Ethernet connection, a user can access the LQ800 functions via the screen as if he were in front of the analyzer.
- Datalogging of all sensors, 4-20 inputs and outputs, digital inputs, compensated sensor and events

## 1.2 SPECIFICATIONS

### 1.2.1 INPUT SPECIFICATION

Digital protocol, all ECD DS80 sensors

Optional analog to digital converter, 5 inputs [mV+, mV-, solution ground, temp + temp – (100 K-ohm)]

### 1.2.2 INPUT RANGES

|                  |                                                           |
|------------------|-----------------------------------------------------------|
| pH               | 0 – 14.00 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: $\mu$ S ↔ mS ↔ S             |
|                  | TDS 0.00 – 9999 ppm                                       |
| Resistivity      | 0.00 – 50.00 M $\Omega$                                   |
| Turbidity        | 0 – 4000 NTU/FNU, 0 – 9999 ppm, mg/l, 0 – 100% % solids   |

### 1.2.3 ACCURACY

|                  |                            |
|------------------|----------------------------|
| pH               | 0.02 pH                    |
| ORP              | ± 1 mV                     |
| pION             | Specific to electrode type |
| Dissolved Oxygen | 2% of range                |
| Conductivity     | 2% of range                |
| Resistivity      | 2% of range                |
| Turbidity        | 2% of reading              |

#### 1.2.4 INPUT SIGNALS

- Non-Isolated 4-20 mA Input
- Non-Isolated Digital Input

#### 1.2.5 OUTPUT SIGNALS

- Non-isolated 4-20 mA output
- Ethernet

#### 1.2.6 CONTACT RELAYS

Eight (8) SPDT, 1 form C (NO - Normally Open, C - Common, NC - Normally Closed), 250 VAC, 15 Amp resistive maximum relays, user configurable as Hi/Lo alarms with expiration timer, Periodic or Fault alarms

#### 1.2.7 DISPLAY

Color (4.6" x 3.5") LCD with resistive touch panel.

#### 1.2.8 ENCLOSURE

Beige Polycarbonate, IP65, weatherproof, ½ DIN, 17 in W x 11.7 in H x 9 in D / 43cm x 30cm x 23cm

#### 1.2.9 POWER

24 VDC (18-36 VDC @ 120W minimum)

100-240 VAC, 50/60 Hz, 0.7 to 1.4A, protected with 250V, 14A Breaker

#### 1.2.10 ENVIRONMENTAL CONDITIONS

Outdoor use (IP65)

Ambient Temperature -20°C - 70°C (24 VDC Models)

-20°C - 60°C (100-240 VAC Models)

Storage Temperature -30°C - 85°C

Relative Humidity 0 – 80%, up to 31°C

Decreasing linearly to 50% RH at 40°C

Altitude Up to 2000 m (6500 ft.)

Mains Supply Voltage Fluctuations up to ±10% of the nominal voltage

Transient over voltages: CAT II

Pollution Degree: 2

#### 1.2.11 SHIPPING

Size 17 in W x 11.7 in H x 9 in D / 43cm x 30cm x 23cm

Weight 20 lbs. (9 kg)

## 2.0 INSTALLATION

### 2.1 MOUNTING

Mount the LQ800 in a location where there is easy access to the controller 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 IP65 LQ800 is suitable for outdoor use but it is best to mount it with a protective cover or sunshield to prevent discoloring over the years.

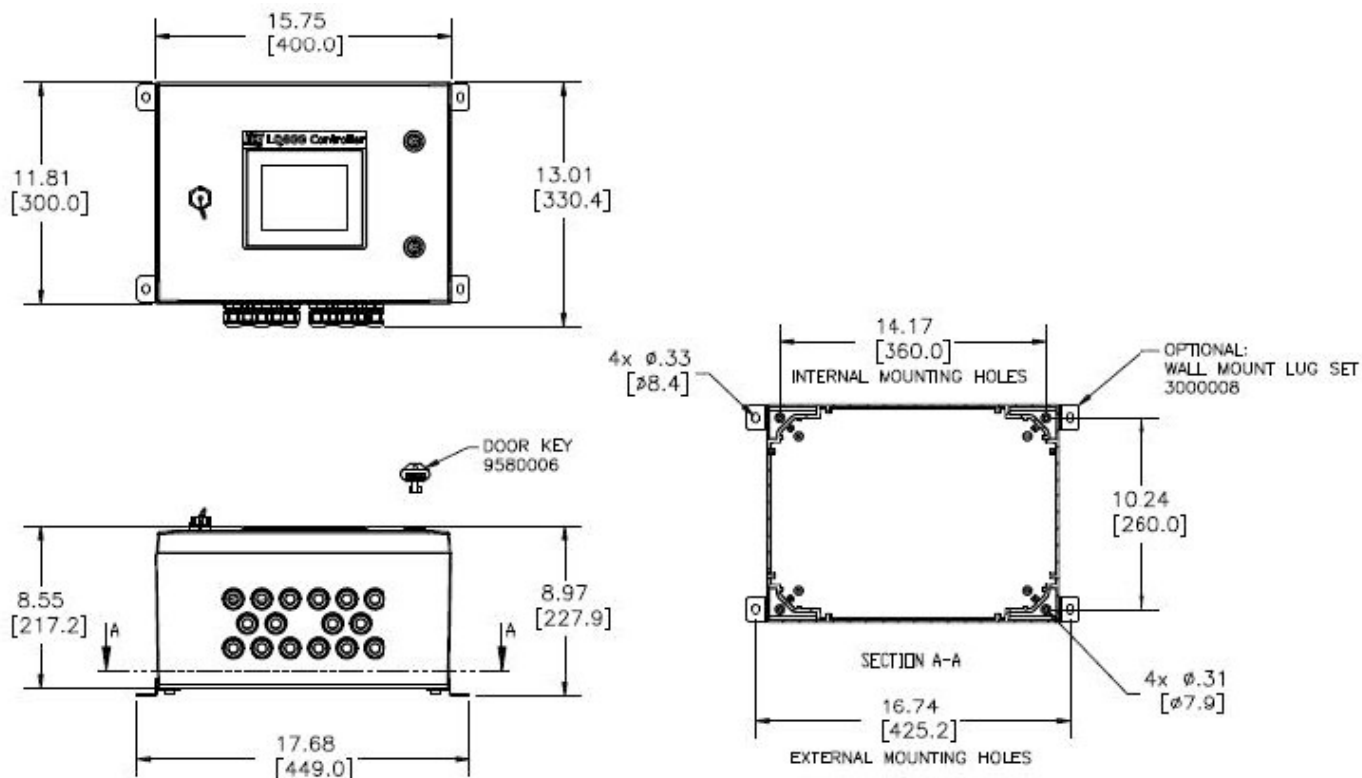


Figure 1 Mounting and Dimensions

## 2.2 WIRING

Electrical wiring should only be conducted by qualified personnel. See the LQ800 wiring diagrams in Figure 2 through Figure 5

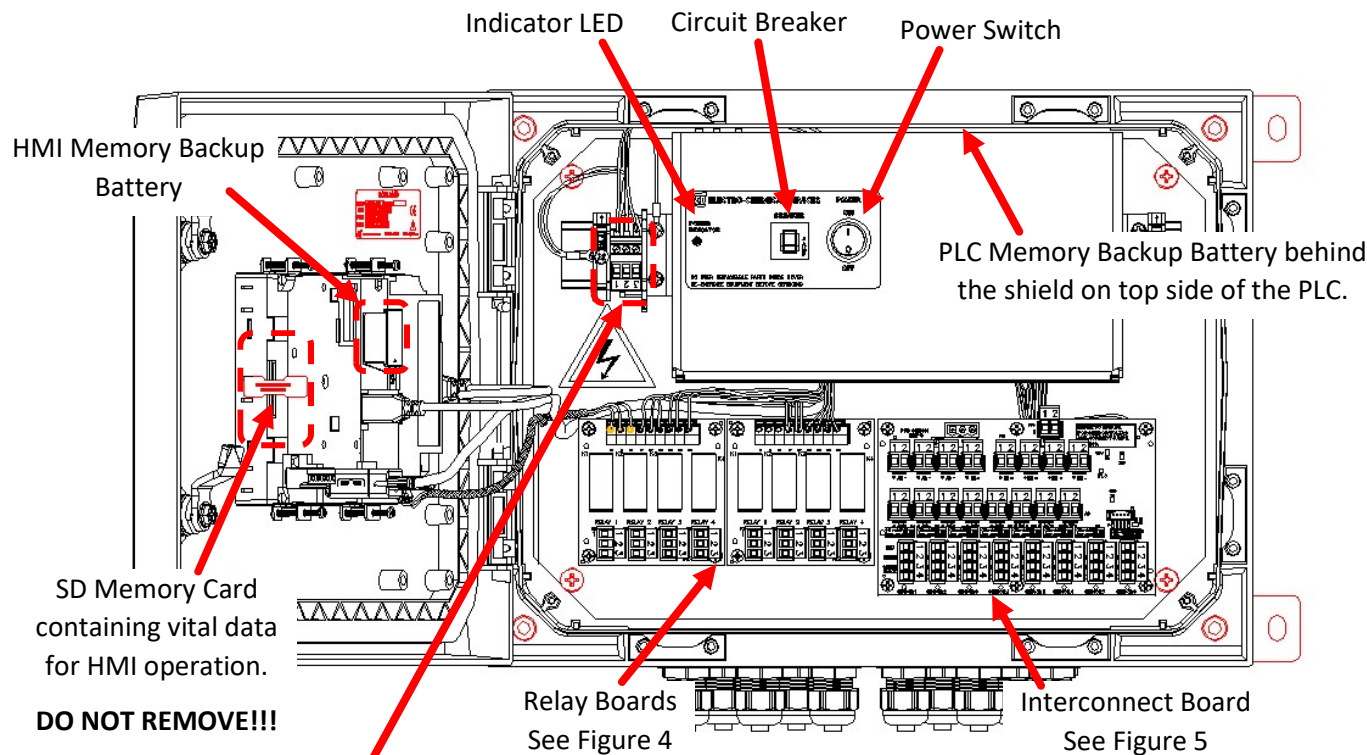


Figure 2 Internal Connections and Control

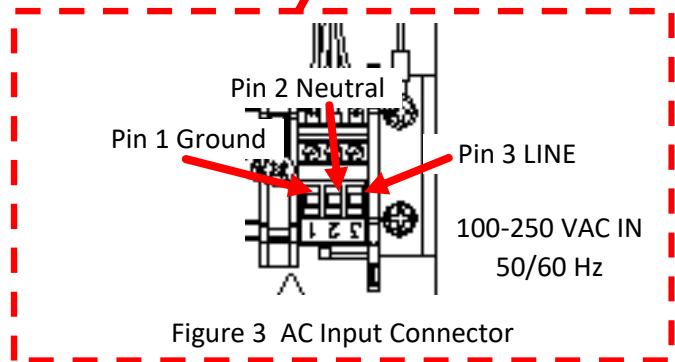


Figure 3 AC Input Connector

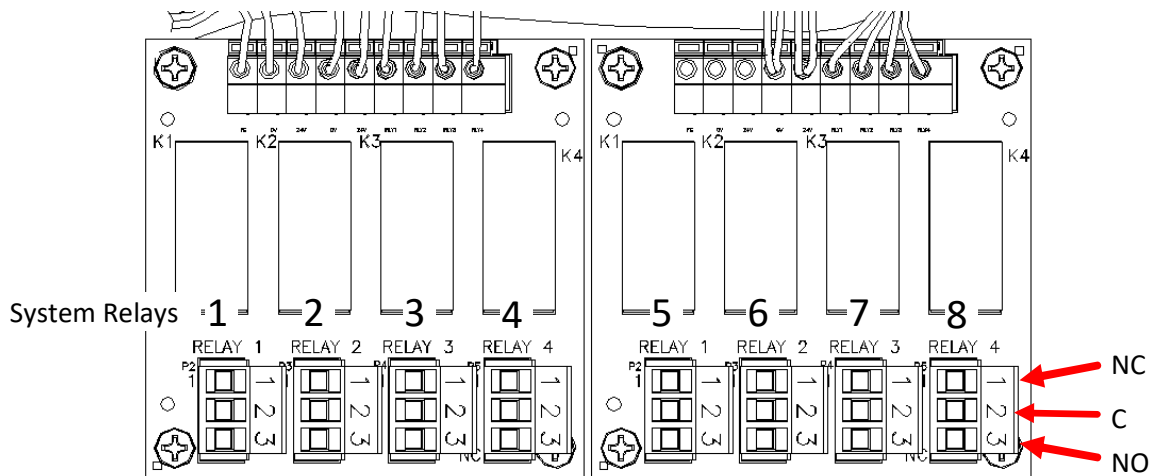


Figure 4 Relay Boards

Sensor Power Jumpers (see Figure 5 below) are set depending on the type; S80 jumper off +5V.

DS80, DO82, TR80, TR82, TR86 jumper on +24V.

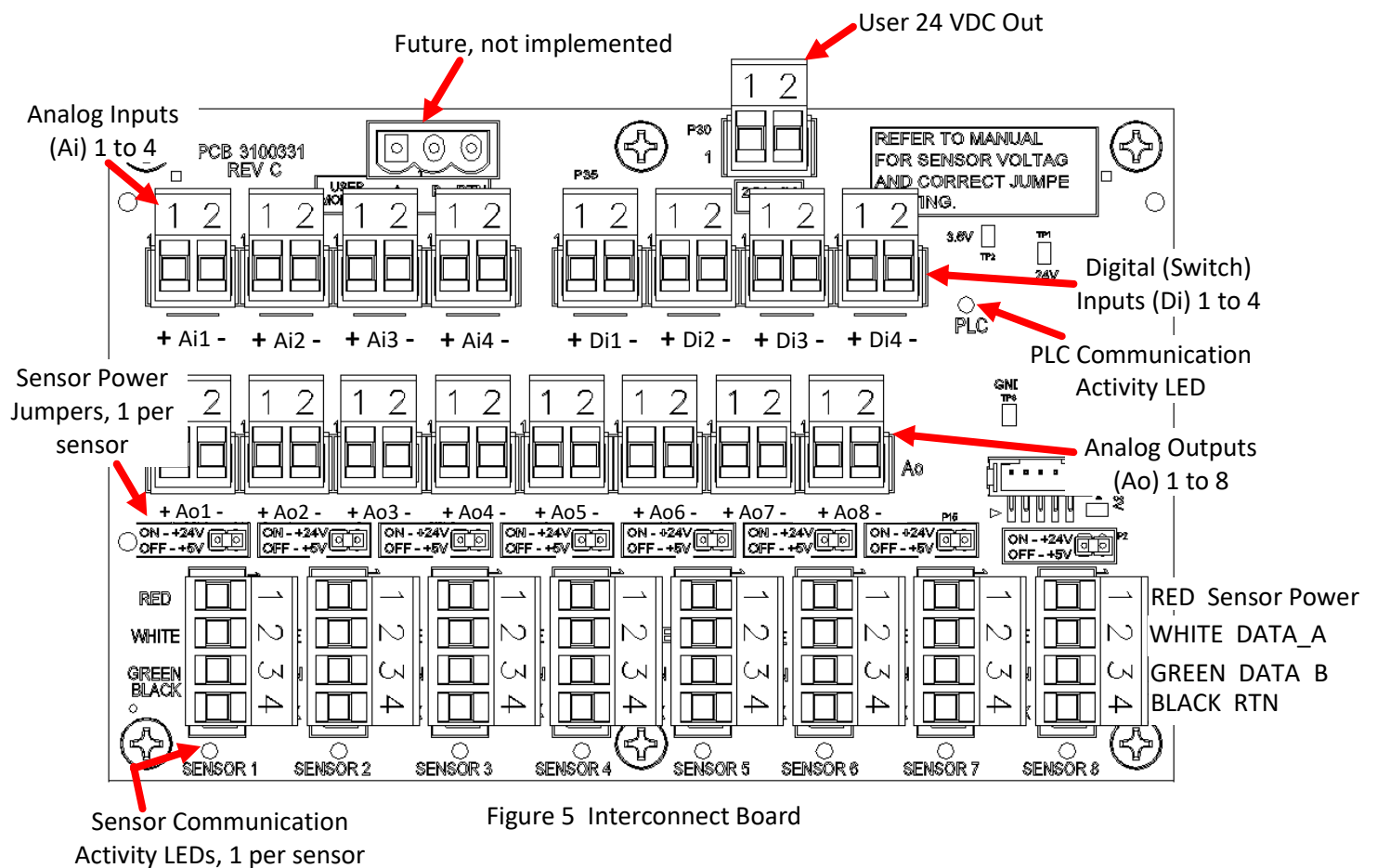


Figure 5 Interconnect Board

Before starting to install any wiring, please be aware of the following;

|                                                                                   |                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | 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), Canadian Electrical Code and/or any other applicable national or local codes. |

### 2.2.1 WIRING, POWER

ECD recommends using a thermoplastic, outdoor sunlight resistant jacketed cable, wet location rated, and ½" flexible conduit. The power should be hard wired with a switch or breaker to disconnect the controller from the main power supply. Install the switch or breaker near the controller, and label it as the Power Switch for the controller.

#### 110/220 VAC

Attach power cable as shown in Figure 3 AC Input Connector Page 4. Feed the cable through the gland fitting on the left hand side of the LQ800. 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 controller, but it is best to wait until the sensor is installed.

### 2.2.2 WIRING, SENSOR

Attach the sensor wires as depicted in Figure 5 Interconnect Board Page 5. Route the sensor cables through a gland fitting on the bottom of the LQ800. Sensor 1 is located on the far bottom left side of the circuit board, and will go in numerical succession with sensor 8 on the far bottom right. 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, ANALOG OUTPUTS (Ao)

The industry standard 4 to 20mA Analog Outputs (Ao) are shown in Figure 5 Interconnect Board Page 5 and are located above the Sensor connections on the circuit board. The analog outputs are labeled as **Ao1** to **Ao8**. Ao1 is located on the right side of the circuit board, and will go in numerical succession with Ao8 on the right side.

### 2.2.4 WIRING, CONTACT RELAY OUTPUTS

The standard configuration has 8 SPST 230V 15A relays that can be wired either **normally open (NO)** or **normally closed (NC)**. Diagram of the relays can be seen in Figure 4 Relay Boards Page 5.

### 2.2.5 WIRING, ANALOG INPUT (Ai)

The industry standard 4 to 20mA Analog Inputs (Ai) are shown in Figure 5 Interconnect Board Page 5 and are located above the analog output connections on the circuit board. The analog inputs are labeled as Ai1 to Ai4. Ai1 is located on the left side of the circuit board, and will go in numerical succession with Ai4 on the right side.

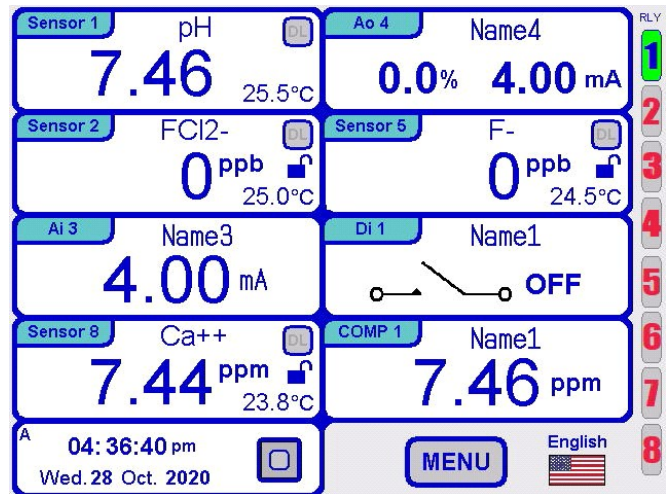
### 2.2.6 WIRING, DIGITAL INPUT (Di)

The Digital Inputs (Di) are shown in Figure 5 Interconnect Board Page 5 and are located above the output connections on the circuit board. The Digital inputs are labeled Di1 to Di4. Di1 is located on the left side of the circuit board, and will go in numerical succession with Di4 on the right side. The Digital Inputs are used by connecting the + and – of one of the Di channels together to provide an ON indication to the system, disconnecting or opening indicates the channel is OFF.

## 3.0 OPERATION

The ECD Model LQ800 Controller is an intelligent, eight channel multi-parameter controller designed for the online continuous measurement of pH, ORP, pION, conductivity, Resistivity and Dissolved Oxygen in a general purpose industrial environment. The Model LQ800 Controller digitally communicates with any ECD S80 or DS80 digital sensor. The measurement identity is contained in the Sensor's memory. When a (S)DS80 sensor is connected to the Controller it automatically configures the controller's menus and display screens to the measured parameter.

Programming or setup of the LQ800 is accomplished via the color LCD touch panel mounted on the front of the housing. The resistive touch panel requires more force to actuate selections than a typical cell phone capacitive touch screen; therefore, don't expect to soft-touch the screen button and get an action. Resistive touch screens have better characteristics suited for an industrial environment than capacitive touch screens; for example, resistance to false actuations by water droplets. Programming is done using a menu system that presents options to the user graphically. All selections are stored in a non-volatile memory for recall during power-up.



Base screen A



Only press on the Touch Screen using a finger or soft tipped stylus. **NEVER** use any hard object such as keys, screw drivers etc. The Touch Screen will be damaged and will be considered customer abuse thereby rendering the LQ800's warranty void.

### 3.1 CONVENTIONS

#### 3.1.1 DEFINITIONS

The following are useful definitions used in the manual and are included for clarity.

1. Base Screen A – The home screen of the LQ800 used to display device information. Base Screen A is where everything defaults or times out back to.
2. Device – Any of the various LQ800 resources available for the user, ex. Sensors, Relays etc.
3. (Display) Channels – Areas on the Base Screen A where information from or about the devices can be displayed.
4. Sensor – The metal or plastic tube (body) where a sensor element is screwed into and is connected directly to the LQ800 via a 4 conductor (wire) cable. There are sensors that don't require a sensor element as the sensor has its own sensing element built in, such as, the conductivity sensor, the dissolved oxygen sensor (not galvanic) etc.
5. Sensor Element or Electrode – The cartridge that is screwed into the sensor end, usually an ISE or pion sensor element meant for millivolt (mV) sensors.
6. ISE – Ion Selective Electrode.
7. Ai – Analog Input (4mA -20mA)
8. Ao – Analog Output (4mA -20mA)
9. Di – Digital Input (switch input)
10. COMP – Sensor Compensation
11. Screen – The Color LCD Panel that is the primary output to the user.
12. Touch Screen – The clear resistive membrane that is located on the face of the Screen and is the primary input for the user.

13. Popup Screen – Screens that are activated by buttons on the Base or other Popup Screens. Popup screens allow device configuration and access to device information. These screens will overlay Base Screen A.
14. Pulldown Screen - Screens that present a list of user choices and are activated from either a Popup or another Pulldown Screens. There isn't a title bar with screen name, the screen number is at the bottom and the Pulldown Screen over-lays the activating screen.
15. Title Bar – The bar at the top of a Popup Screen that has the screen number and name. Pulldown Screens don't have a title bar.
16. Screen Numbers – Numbers in the title bar (Popup Screens) or at the bottom left (Pulldown Screens) that can be used to reference the screen instead of the screen name.

### 3.1.2 COLORS

Various colors are used on the LCD panel to convey the operation of the LQ800 to the user.

1. Gray – The button or action is not available.
2. Light Blue –The parameter can be modified or denotes the current selection.
3. Green – The parameter or device has been activated.
4. Yellow or Orange – A warning that an action is occurring or the user is about to make a system change.

### 3.1.3 BUTTONS AND INDICATORS

Buttons are graphical elements on the Screen that can be activated by pressing the touch screen area of the button. Indicators are also graphical elements on the Screen but are only activated by an LQ800's parameter, pressing an indicator don't result in any action. Buttons can also be Indicators but retain the feature of touch activation.



Buttons will change color to light blue indicating the button press. Whatever action the button is for will soon follow.



Not all buttons look like the depictions above, for example, the buttons to the left are from a Pulldown Screen selection list. The top button highlighted in light blue indicates a current selection.



Indicators will change color or shape to show a state or parameter has changed. This example shows the state of datalogging, on – green, off – gray.

#### 3.1.3.1 Special Buttons

The EXIT and BACK buttons are on most if not all Popup Screens and have specific action relating to the menu screens.



Pressing EXIT will close all Popup Screens and return to Base Screen A.

The bar graph at the bottom of the EXIT button corresponds to the amount of time left before the Popup Screen is automatically closed. The bar turns red when there is ~ 20% of the time remaining before the screen back light will turn off.



Pressing BACK will close the current Popup Screen and return to the previous Popup Screen.



The left and right arrow buttons are used on specific screens and allow moving between screens related to that menu screen. For example, the system information screens use the left and right arrow buttons to move between system specific information.

### 3.1.4 POPUP SCREENS

Popup Screens have a title bar with screen name and screen number and are activated by buttons on the Base or other Popup Screens. Popup Screens allow device configuration and access to device information. The Popup Screen will close after a determined interval setup in the Display Configuration.

Popup Screen Number

Title Bar with screen name

49 Configure Relay - TIMED

Relay 1

ALARM TIMED FAULT DISABLE

Period 1 hr.

Duration 1 min.

Hold +30 sec.

YES Synchronize all Timed Relays to activate at the same time?

EXIT SAVE

Simulate

ONC C ONO

OFF

### 3.1.5 PULLDOWN SCREENS

Pulldown Screens present a list of user choices and are activated from either a Popup or another Pulldown Screen. There isn't a title bar with screen name but the screen number is at the bottom. The Pulldown Screen over-lays the activating screen and closes after 7 seconds if no selection has been made.

Pulldown Screen Number

15 min.

30 min.

1 hr.

2 hr.

4 hr.

8 hr.

24 hr.

49

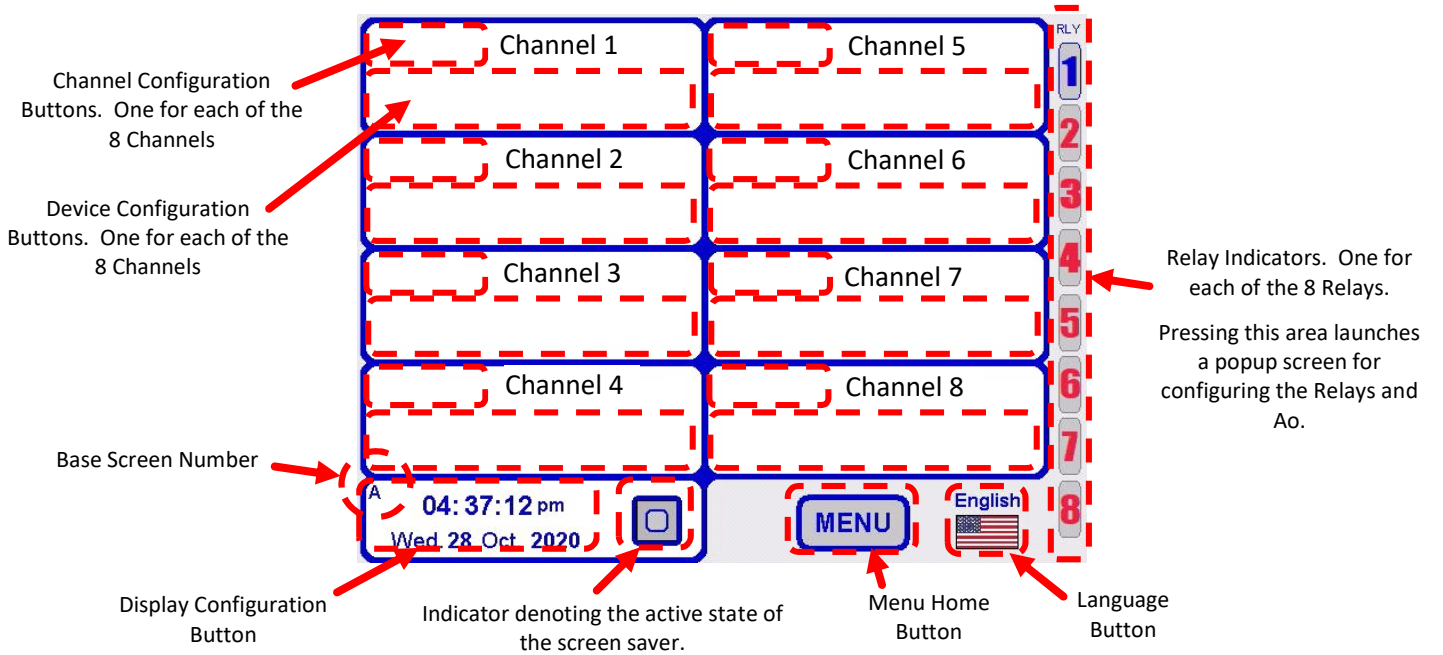
## 3.2 STARTUP SCREEN

The Startup Screen is the first screen presented after power is applied to the LQ800. While the Startup Screen is displayed, the system is initializing and the sensor inputs are being scanned for the presence of sensors. All found sensors are always polled for data and cannot be disabled.



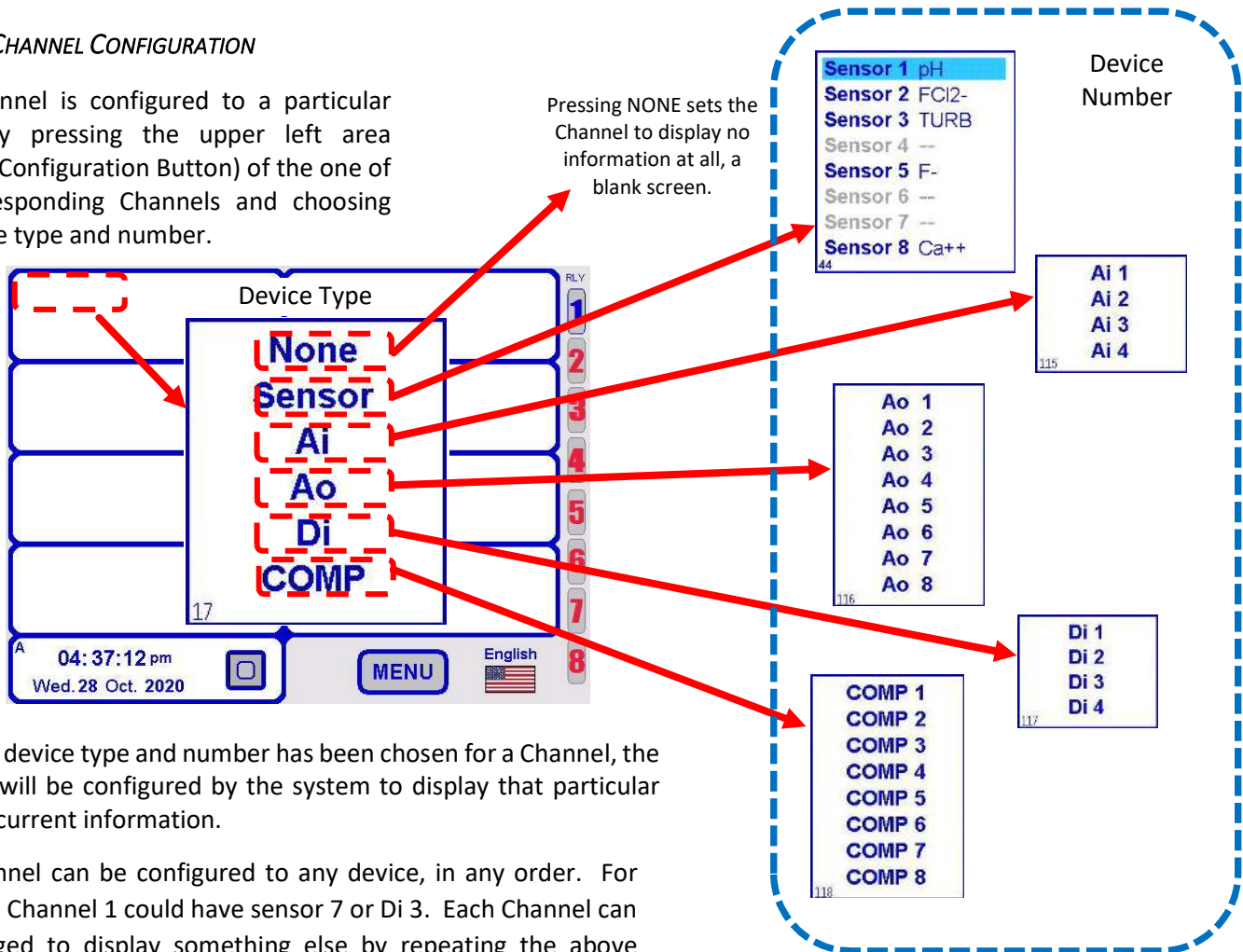
### 3.3 BASE SCREEN A (HOME)

Base Screen A is comprised of 8 Channels (used to display device information), 8 relay buttons/indicators, the day/date display with display configuration button and the menu home button.



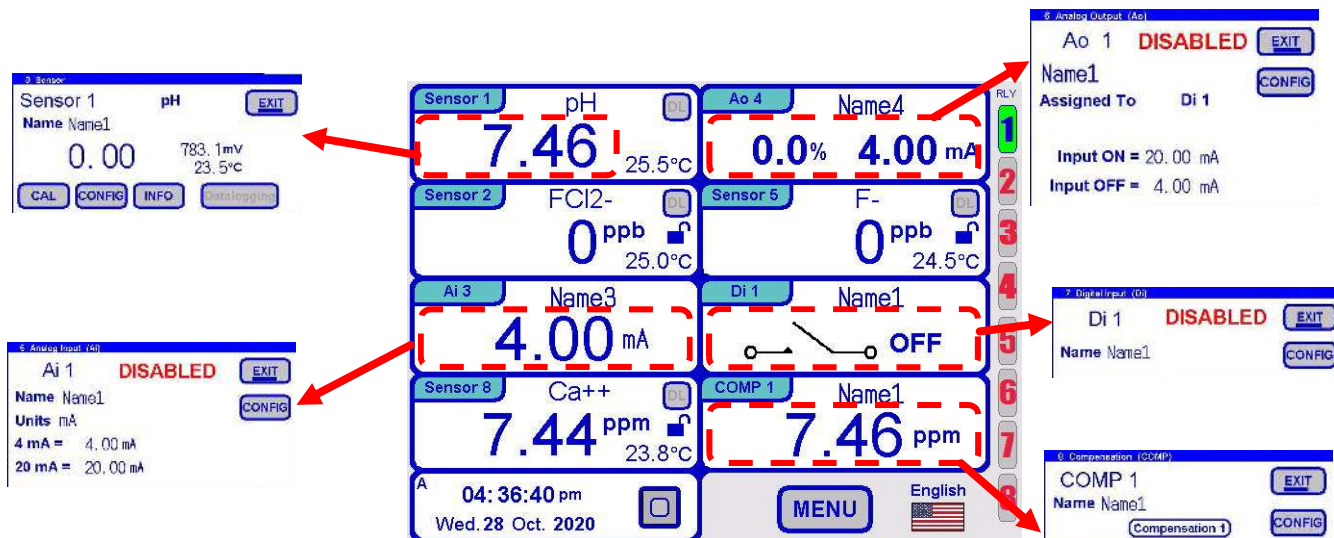
#### 3.3.1 CHANNEL CONFIGURATION

Each Channel is configured to a particular device by pressing the upper left area (Channel Configuration Button) of the one of the corresponding Channels and choosing the device type and number.



After the device type and number has been chosen for a Channel, the Channel will be configured by the system to display that particular device's current information.

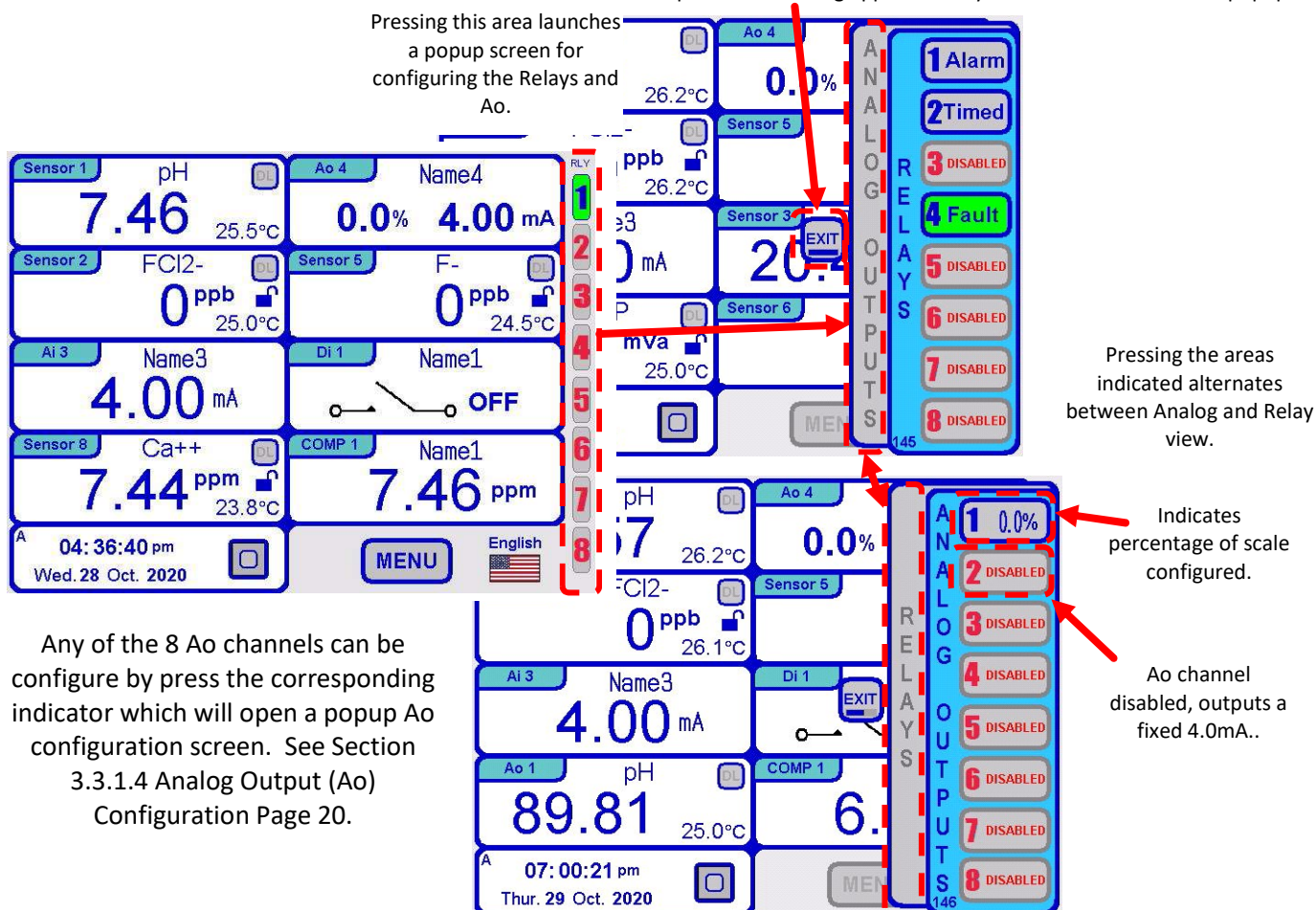
Any Channel can be configured to any device, in any order. For example, Channel 1 could have sensor 7 or Di 3. Each Channel can be changed to display something else by repeating the above procedure.



Pressing the information portion (Device Configuration Button) of the Channel allows the user access to the Channel device's Popup Screen showing more options for working with the particular device.

Pressing the Relay indicator portion of the HMI will launch a set of popup screens which allow access to the relay indicators and configuration buttons. See Section 3.3.4 Relay Configuration Page 34 for a complete description.

The exit button closes the popup screens and return to normal operation. Waiting approximately 7 seconds also closes the popups.

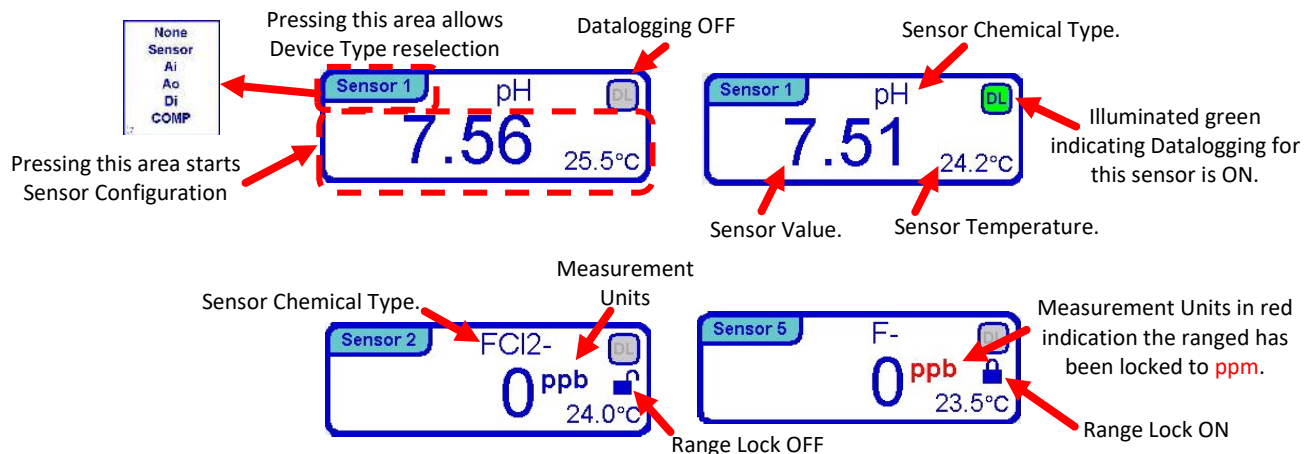


Any of the 8 Ao channels can be configure by press the corresponding indicator which will open a popup Ao configuration screen. See Section 3.3.1.4 Analog Output (Ao) Configuration Page 20.

### 3.3.1.1 Channel Indicators

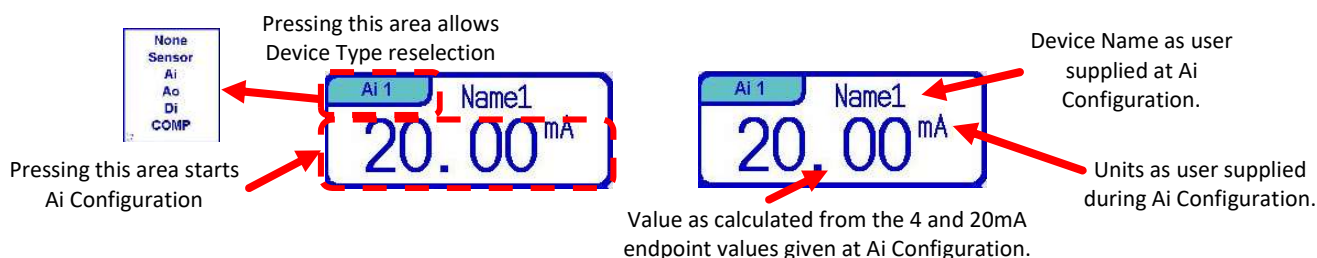
#### 3.3.1.1.1 Sensor

Datalogging is enabled in Sensor Configuration.



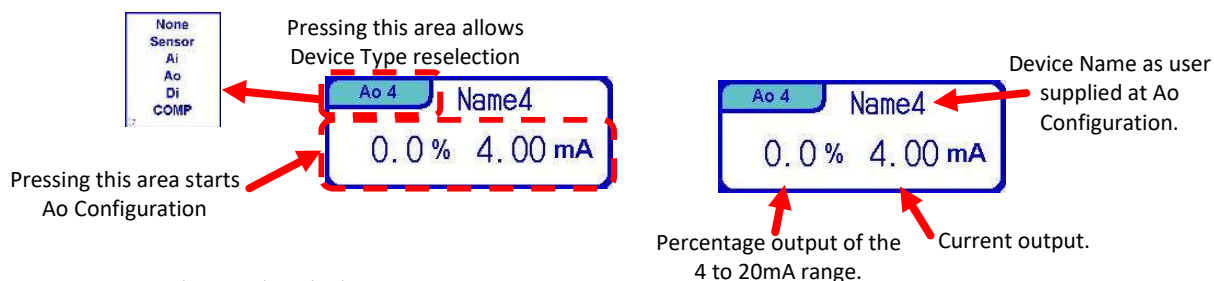
#### 3.3.1.1.2 Analog In (Ai)

Datalogging is enabled when the device is enabled.



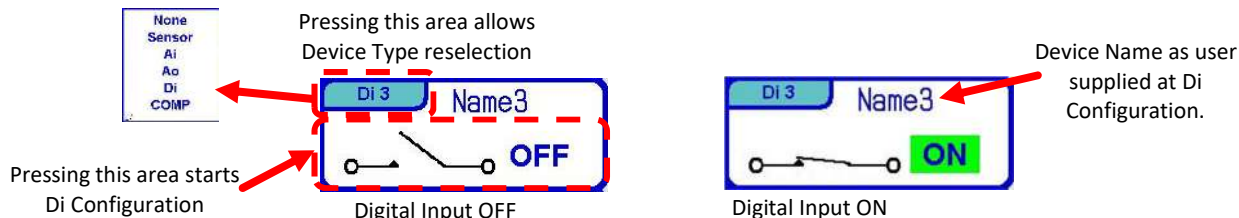
#### 3.3.1.1.3 Analog Out (Ao)

Datalogging is enabled when the device is enabled.



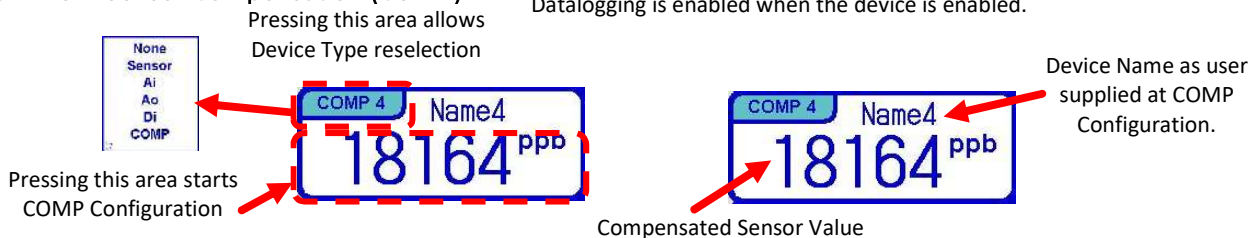
#### 3.3.1.1.4 Digital (switch) In (Di)

Datalogging is enabled when the device is enabled.



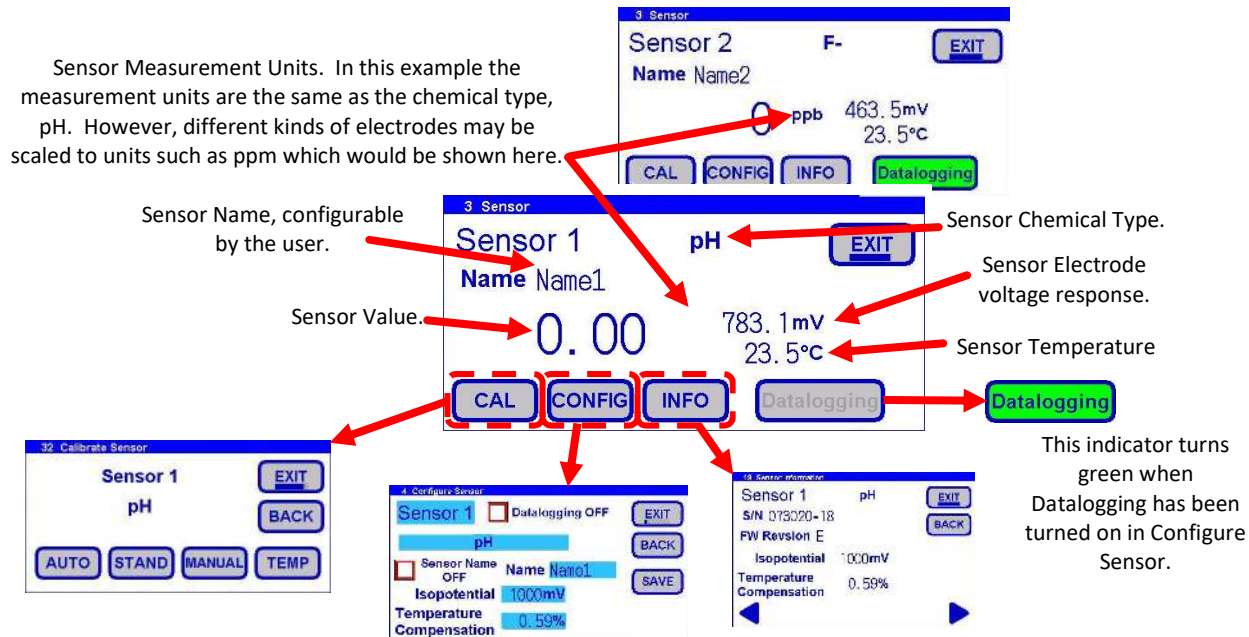
#### 3.3.1.1.5 Sensor Compensation (COMP)

Datalogging is enabled when the device is enabled.



### 3.3.1.2 Sensor Configuration

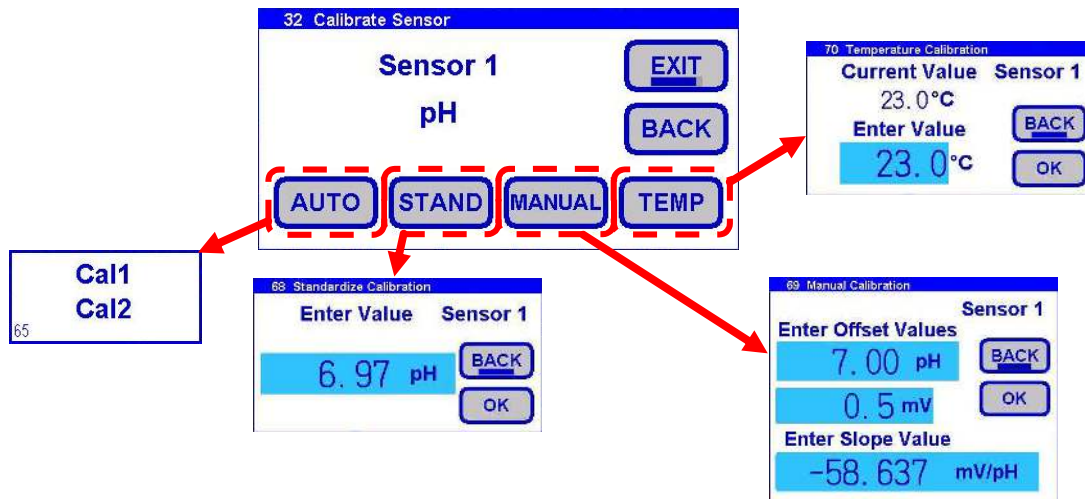
Sensor Configuration allows the user to calibrate (CAL), configure (CONFIG) and view information (INFO) about a sensor displayed in one of (Home ) Base Screen A Channels. Sensors cannot be disabled and are always polled for information regardless if displayed in a channel. Datalogging can be enable or disabled for each sensor via the configuration (CONF) Popup Screen.



#### 3.3.1.2.1 Calibrate Sensor

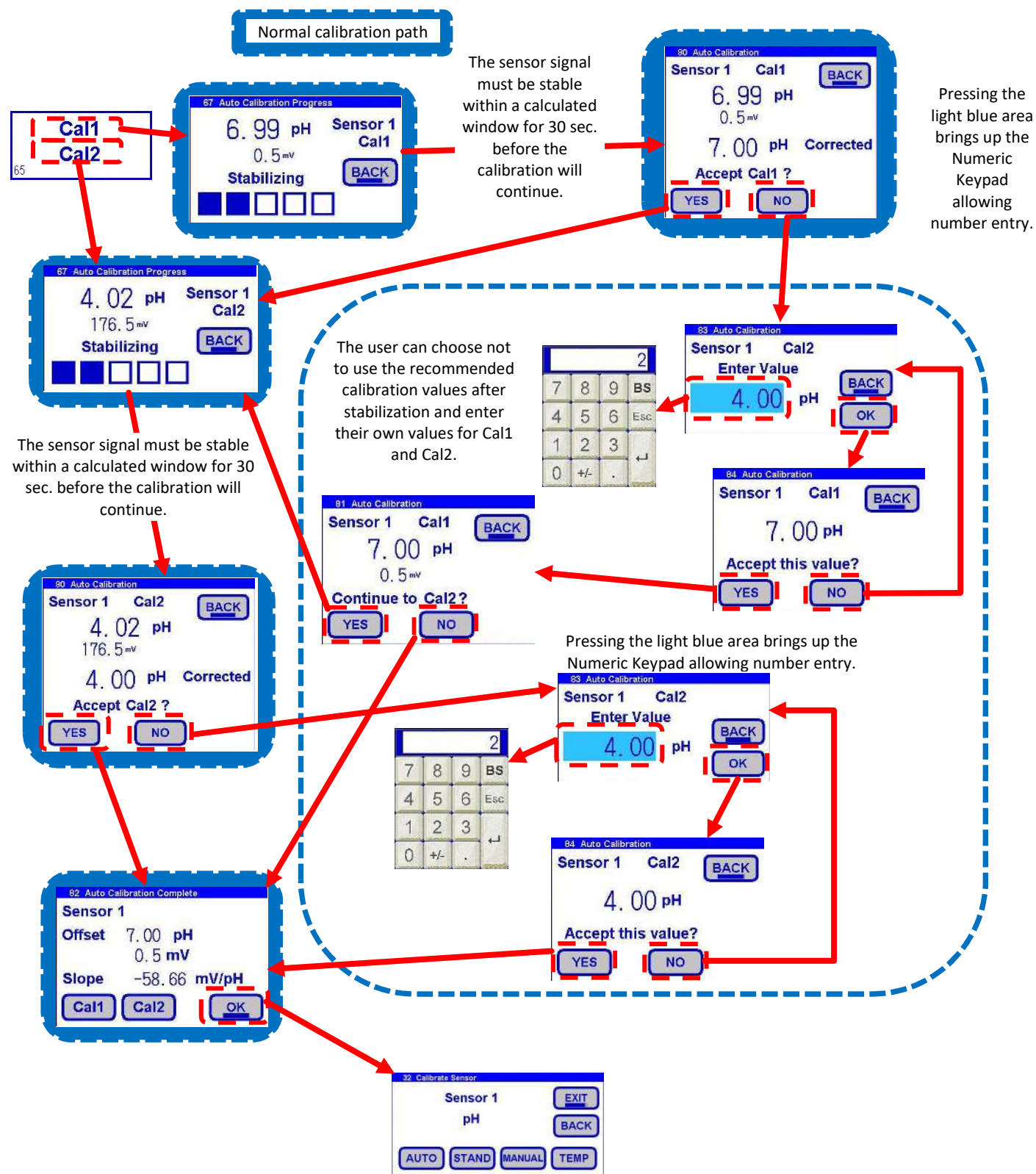
**CAL**

Sensor Calibration allows the user to adjust the sensor to known values in order to compensate for wear and tear on the electrode. There are four types of calibration; AUTO, STAND, MANUAL and TEMP each of which are described in separate sections below.



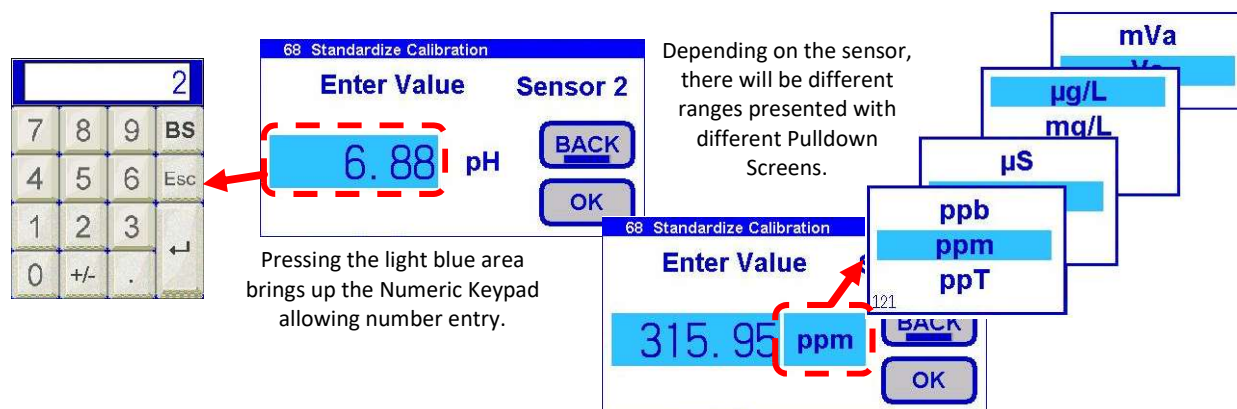
### 3.3.1.2.1.1 Auto Calibration AUTO

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.



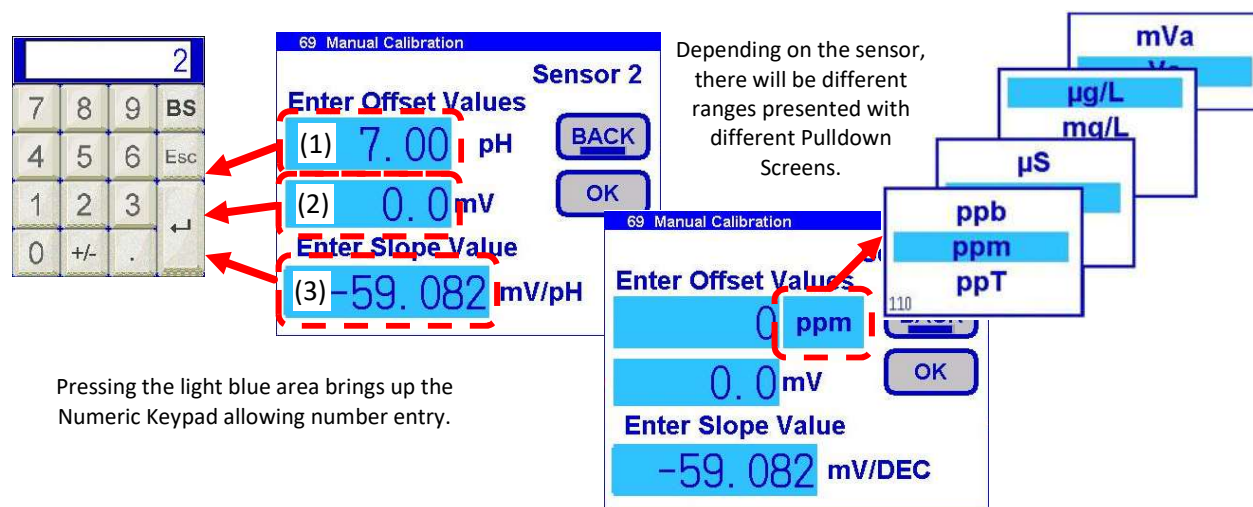
### 3.3.1.2.1.2 Standardize Calibration **STAND**

A Standardize Calibration is a single point calibration where the sensor's reading is adjusted to agree with a solution of known value, either a calibration standard, a grab sample or laboratory determined value.



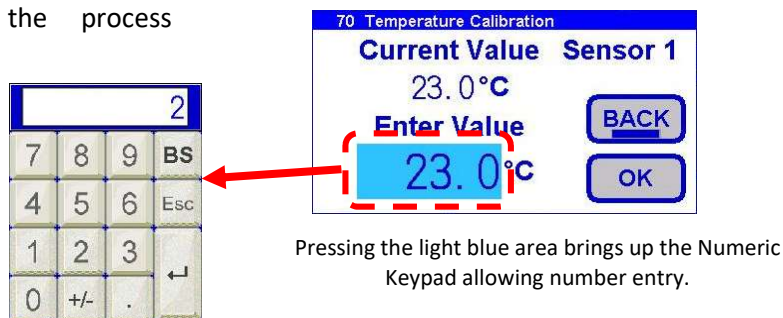
### 3.3.1.2.1.3 Manual Calibration **MANUAL**

Manual Calibration allows the user to enter calibration data for an electrode into the transmitter without performing a calibration. A Manual Calibration requires entry of three pieces of data, (1) A concentration with the (2) corresponding mV value and (3) a slope for the electrode. These values are derived when the electrodes are manufactured and have been entered into the sensor before shipment. There is a test sheet for the electrode that includes the above values.



### 3.3.1.2.1.4 Temperature Calibration **TEMP**

Temperature Calibration allows the user to correct the sensor's temperature to the process temperature.



### 3.3.1.2.2 Configure Sensor CONFIG

Configure Sensor allows the user to modify critical sensor parameters (Isopotential and Temperature Compensation), add a name to the sensor different from the chemical type and change the type of electrode being used. The user can also change to a different sensor while in Configure Sensor.

Use the up and down arrow keys to move along the list then press the desired chemical or the square button to exit.

Pressing the Checkmark Box enables datalogging for the particular sensor.

Enabling the Sensor Name feature allows the user to attach a custom name to the sensor instead of the chemical type. For example, instead of "TURB" for a turbidity sensor the user could enter "TSS". The user entered name will be shown next to the Channel Configuration Button area on Base Screen A instead of the chemical type.

Pressing the light blue area with numbers brings up the Numeric Keypad allowing number entry.

Pressing the light blue area with letters (such as Name1) brings up the Keyboard allowing text entry.

Pressing the CAPS button alternates between the upper and lower case keyboards.

#### 3.3.1.2.2.1 Range Lock

Sensors whose value can span several ranges such as; parts per billion (ppb), parts per million (ppm) and parts per thousand (ppt) can have the reading locked to a selectable range and not let the controller auto range between the sensor value scale. There are sensors that don't span a range of readings, such as pH, and therefore doesn't have the capability to be range locked.

Depending on the sensor, there will be different ranges presented to choose the locked range.

### 3.3.1.2.2.2 Isopotential and Temperature Compensation

Isopotential and Temperature Compensation are critical Electrode parameters loaded into the sensor at the factory but can be modified and reloaded while configuring the sensor. The Isopotential value is derived from Electrode testing and validation, and is included in the paper work supplied with the Electrode. Temperature Compensation is set to a default value of 0.33% but can change as needed for Electrode drift compensation. Some Electrodes may or may not have either or both parameters and is denoted with an N/A.

142 Configure Sensor

Sensor 8 ☐ Datalogging OFF

EXIT

BACK

SAVE

ORP

☐ Sensor Name OFF Name Name8

Range Lock Auto

Isopotential N/A

Temperature Compensation N/A

### 3.3.1.2.2.3 Total Dissolved Solids (TDS)

TDS is a derived value using input from a conductivity sensor and a correction factor that is defaulted to the TDS 442 table entry for typical fresh or natural water, 0.6712. The TDS Correction Factor can be changed to account for the expected types of salts dissolved in the liquid under test.

144 Configure Sensor

Sensor 6 ☐ Datalogging OFF

EXIT

BACK

SAVE

TDS

☐ Sensor Name OFF Name Name6

Range Lock Auto

Isopotential N/A

Temperature Compensation 0.32%

TDS Correction Factor 0.6712

2

7 8 9 BS

4 5 6 Esc

1 2 3 ←

0 +/- .

Pressing the light blue area brings up the Numeric Keypad allowing number entry.

### 3.3.1.2.2.4 Turbidity ppm and mg/L

Turbidity ppm and mg/L must have a correction factor applied for the correct conversion of the NTU/FNU measurement to ppm or mg/L. The default correction factor is 3 based on nationally derived factor but that value can varied depending on the consistency of the solution under measurement.

188 Configure Sensor

Sensor 3 ☐ Datalogging OFF

EXIT

BACK

SAVE

Turbidity mg/L

☐ Sensor Name OFF Name Name3

Range Lock Auto

Isopotential N/A

Temperature Compensation N/A

Turbidity Correction Factor 3.42

2

7 8 9 BS

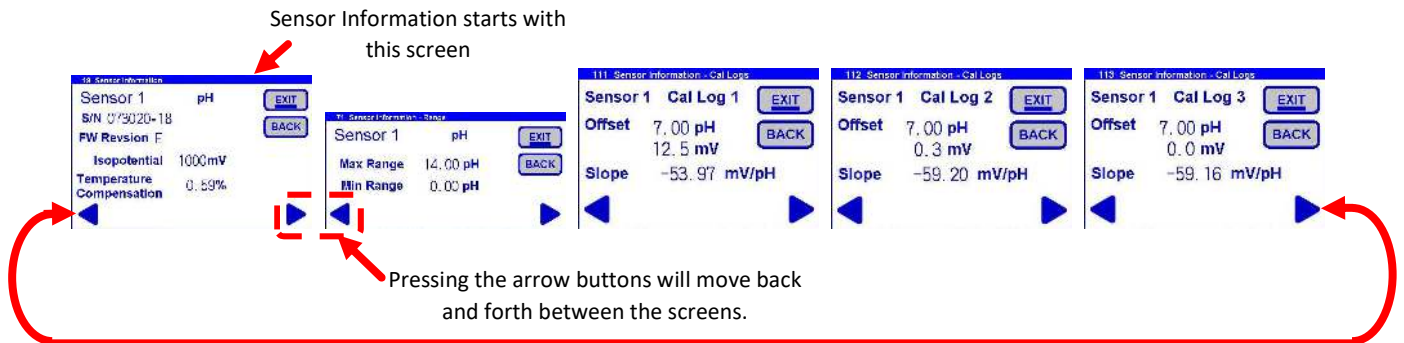
4 5 6 Esc

1 2 3 ←

0 +/- .

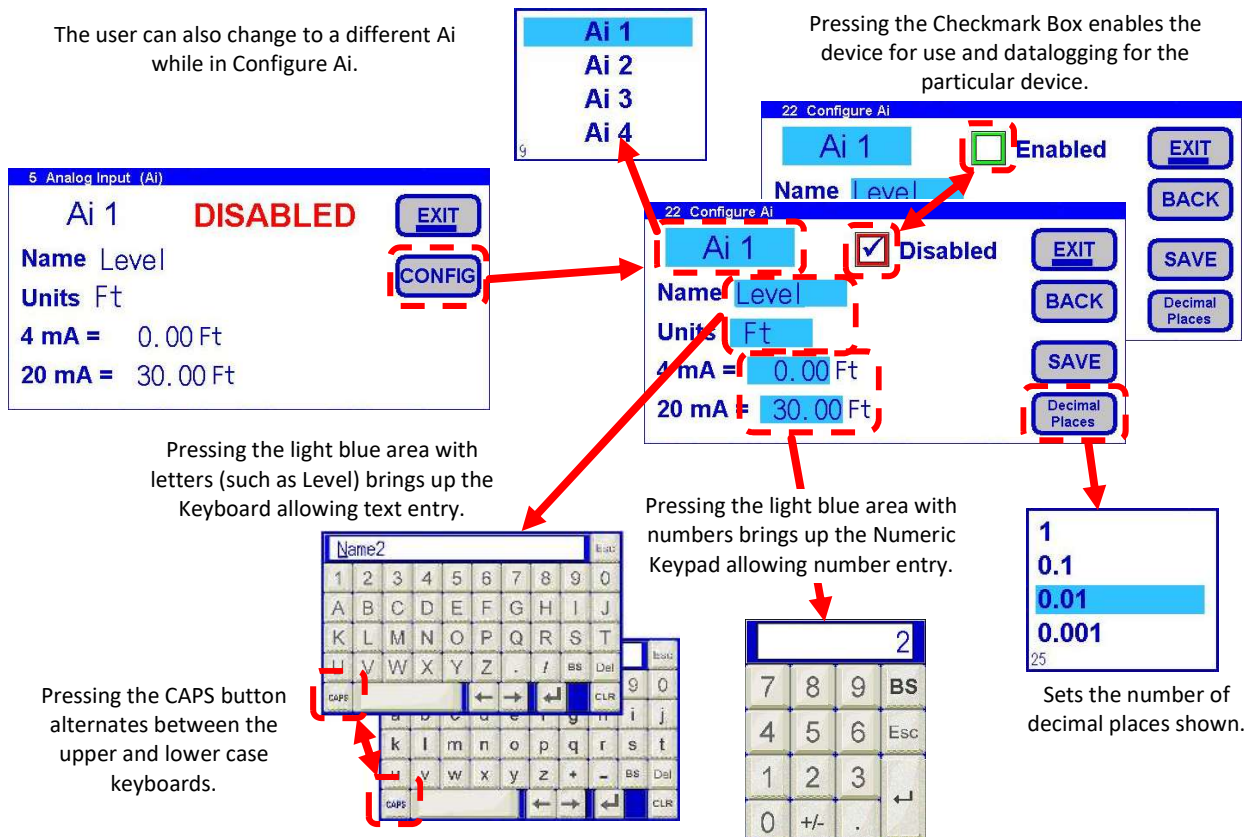
### 3.3.1.2.3 Sensor Information INFO

Sensor Information gives the user a single location to view data regarding the sensor. There are three calibration logs with Cal Log 1 being the most recent. As calibrations are performed, the logs are shifted to next higher log number with the highest log number written over and lost. For example, Cal Log 1 becomes Cal Log 2, Cal Log 2 becomes Cal Log 3 and Cal Log 3 is lost. The current calibration is then stored in Cal Log 1.



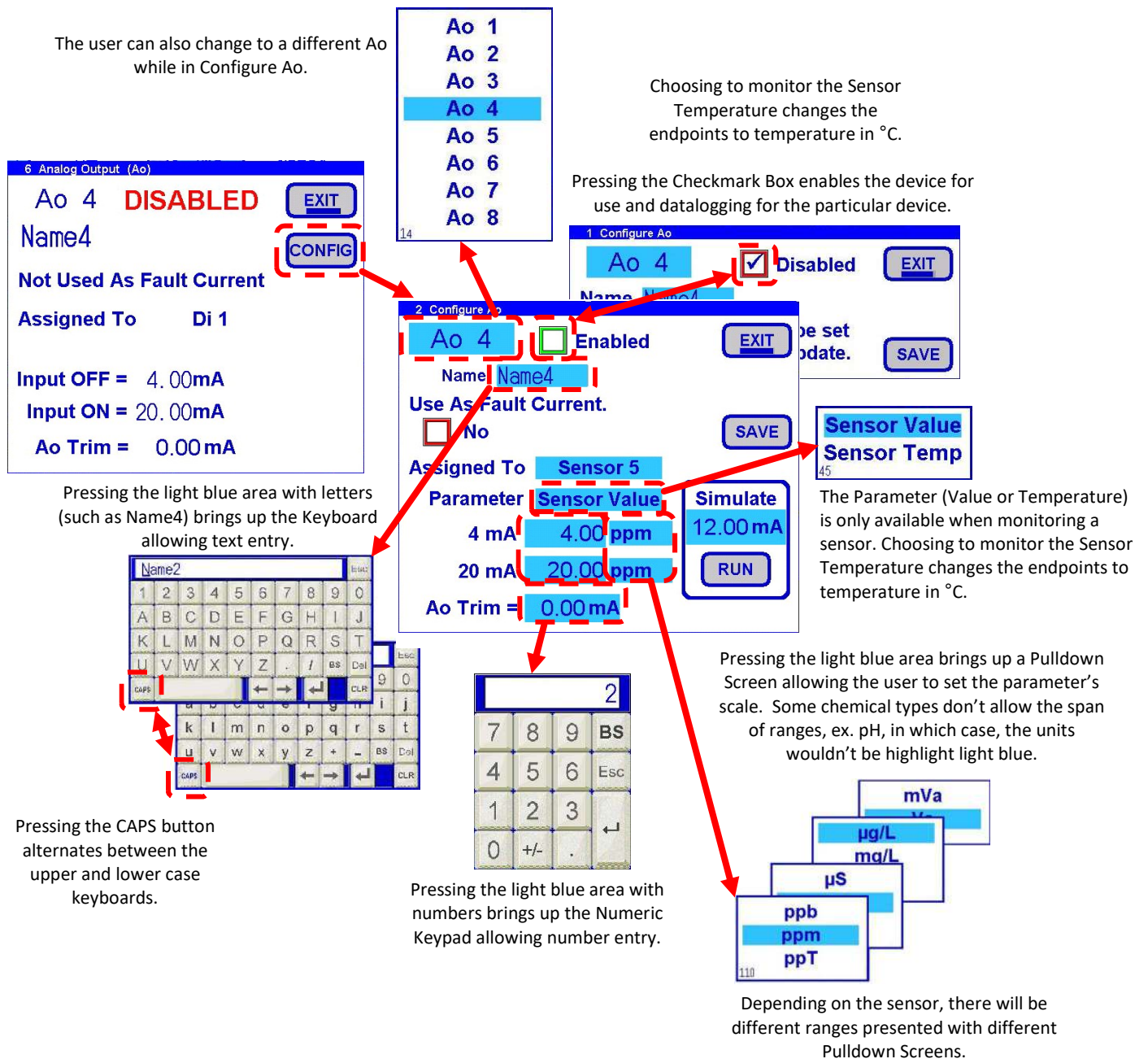
### 3.3.1.3 Analog Input (Ai) Configuration

The Analog Inputs allow monitoring of 4 to 20mA signals from external devices such as a level or flow sensors. The input will be scaled to a range depending on the values input for the 4 and 20mA endpoints. For example, if a level sensor has a range of 0 to 30 feet, then the 4mA value would be set to 0 and the 20mA value to 30. The slope and offset will be calculated scaling the 4 to 20mA input to read 0 to 30. The units can be entered to read any desired text, in the example the units would be set to "feet" or "ft". The Name is also a text input and in the example could be set to "Level". By default, the Ai device is set to display 4 and 20mA for an input of 4 and 20mA. The Ai device only has to be enabled for monitoring and datalogging to start, but the Ai device doesn't have to be displayed on Base Screen A for the input to be continually monitored.

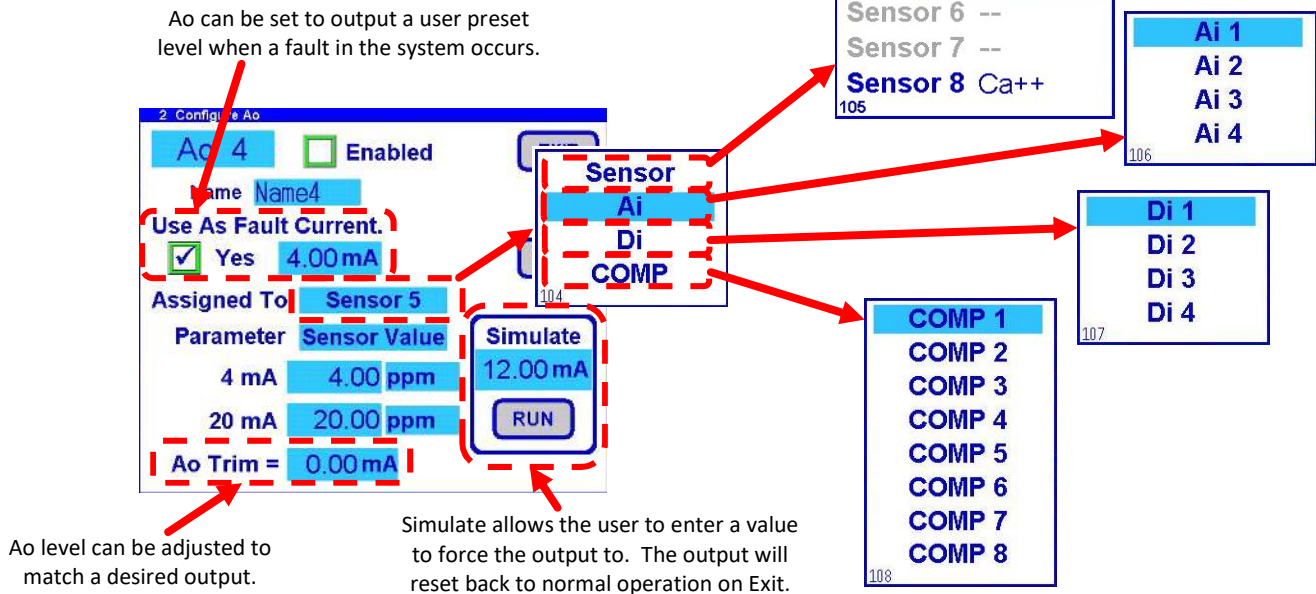


### 3.3.1.4 Analog Output (Ao) Configuration

Analog Outputs present proportional 4 to 20mA current output corresponding the signal level of any of the other LQ800 devices (Sensors, Ai, Di or COMP) assigned to the Ao channel. The 4 to 20mA output will correspond to the range starting and ending from the endpoints set by the user. For example, a sensor has a sensing range of 0 to 40,000ppm (40ppT), the user can choose to use an Ao to only monitor the sensing range from 500ppm (4mA) up to 1000ppm (20mA). A Name can be given to the Ao device in order to denote the meaning of the output. The Ao device only has to be enabled for monitoring and to start datalogging, the Ao device doesn't have to be displayed on Base Screen A for the input to be continually monitored.

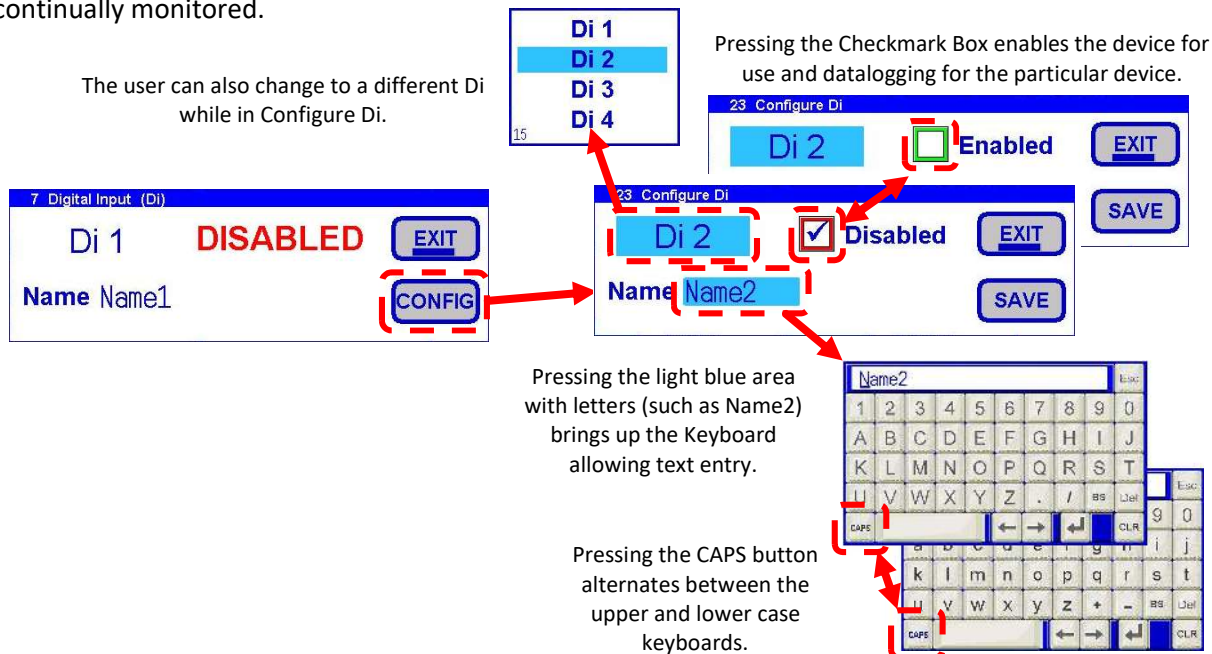


Ao can be assigned to any of the other LQ800 devices (the devices have to be enabled to be actively monitored).

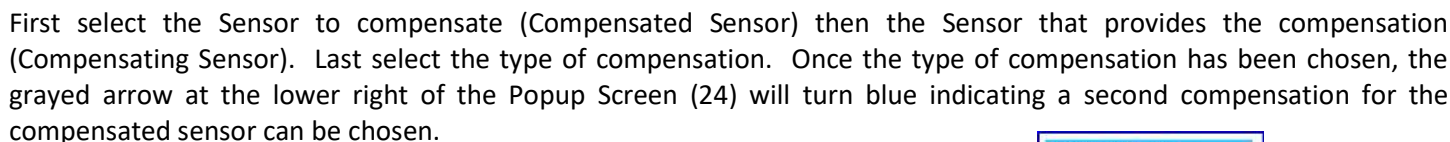


### 3.3.1.5 Digital Input (Di) Configuration

Digital Inputs are simple switch inputs where the corresponding +24Vdc connector pin is shorted to the corresponding input connector pin indicating an external switch is ON and left open indicating OFF. Di devices can be used to monitor various switch devices such as low volume or flow switches. The Di device can be given a descriptive Name such as “Lo Vol” in order to facilitate reading the LQ800 channel with the DI device. The Di device only has to be enabled for monitoring and to start datalogging, the Di device doesn’t have to be displayed on Base Screen A for the input to be continually monitored.



Any sensor can be compensated using the LQ800's COMP devices and up to two compensations can be applied per. After entering the required parameters such as the Sensor being compensated, the Sensor compensating and the type of compensation(s), calculations will be made for the compensation(s) in an ongoing basis. The compensation values can be displayed on Base Screen A (although not necessary for continued calculations) and datalogging of the COMP device value will start. Any of the COMP devices can be used by the Ao and Relay devices for activation or output. A descriptive Name can be given to the COMP device in order to facilitate reading the LQ800 channel with the COMP device.



There are three compensation types that can be used to compensate or correct a sensor reading influenced by factors or compounds in the sampled process (None is the same as disabling the compensation, 1 or 2). Knowing the composition of sampled process and what is the desired chemistry to measure will dictate which compensation type(s) would be used.

The diagram shows three compensation configuration screens, each titled "24 Configure COMP Compensation 1".

- Top Screen (Dissociation Type):**
  - COMP 5 ☒ Enabled
  - Name Name5
  - Compensation 1
  - Compensated Sensor: Sensor 1 NH4+
  - Compensating Sensor: Sensor 2 pH
  - Type: Dissociation pKa: 9.76 pH
- Bottom Left Screen (Percentage Type):**
  - COMP 5 ☒ Enabled
  - Name Name5
  - Compensation 1
  - Compensated Sensor: Sensor 1 NH4+
  - Compensating Sensor: Sensor 2 pH
  - Type: Percentage
  - Percentage: 10.00%
  - Correction Point: 7.80 pH
- Bottom Right Screen (Interference Type):**
  - COMP 5 ☒ Enabled
  - Name Name5
  - Compensation 1
  - Compensated Sensor: Sensor 1 NH4+
  - Compensating Sensor: Sensor 3 K+
  - Type: Interference
  - Ratio: 1 Part NH4+ to 8 Parts K+

Dissociation Type -

Interference Type - If two ions are interfering with each other, either adding or subtracting from the measurement, the ratio of the interference can be entered to correct the interference. For example, NH4+ has an interference with K+ of 1 part NH4+ to 8 parts K+. Entering the ratio as shown will correct for the K+ interference with NH4+.

Percentage Type - An ion that is affected by the pH of the solution can be compensated by entering the pH at which a percentage will be applied to correct the reading.

A numeric keypad interface with a display showing the number 2. The keypad includes digits 0-9, a decimal point, a sign toggle (+/-), and function keys BS, Esc, and a return key.

Pressing any of the light blue area with numbers brings up the Numeric Keypad allowing number entry.

24 Configure COMP Compensation 1

COMP 5 ☒ Enabled

Name Name5

Compensation 1

Compensated Sensor: Sensor 1 NH4+

Compensating Sensor: Sensor 2 pH

Type: Dissociation pKa: 9.76 pH

Compensation 2 is configured much the same way as Compensation 1 except a second Compensating Sensor is selected. The Compensated Sensor was chosen during configuration of Compensation 1 and this second Compensating Sensor will apply to it. Last the type of compensation is selected and the pertinent parameters are entered via the Numeric Keypad.

The diagram shows the transition from the Compensation 1 screen to the Compensation 2 screen. Red arrows indicate the flow: from the "Type" field of Compensation 1 to the "Type" field of Compensation 2, and from the "Ratio" field of Compensation 1 to the "Ratio" field of Compensation 2.

133 Configure COMP Compensation 2

COMP 5

Compensation 2

Compensating Sensor: Sensor 3 K+

Type: Interference

Ratio: 1 Part NH4+ to 8 Parts K+

Sensor List:

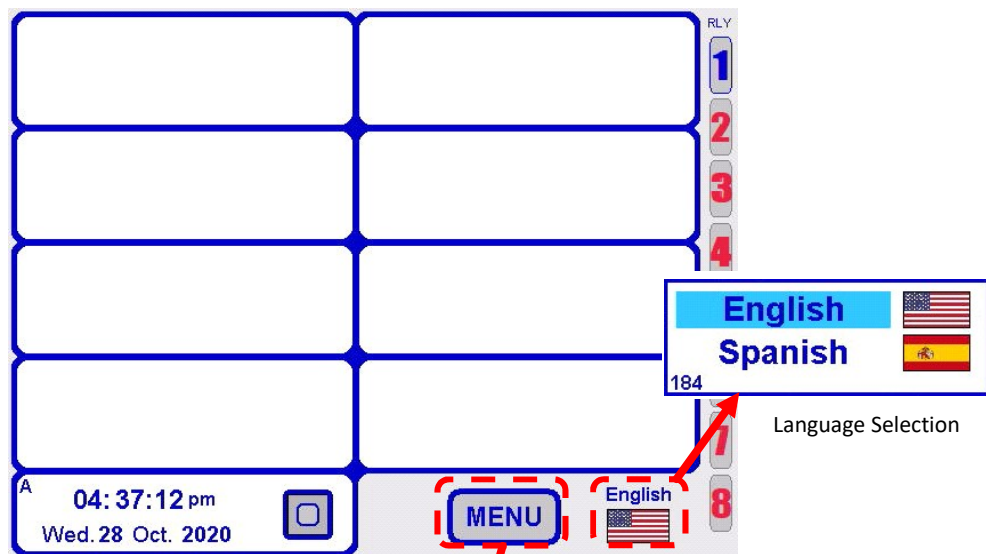
- Sensor 1 pH
- Sensor 2 FCl2-
- Sensor 3 TURB
- Sensor 4 --
- Sensor 5 F-
- Sensor 6 --
- Sensor 7 --
- Sensor 8 Ca++

After Compensation 1 has been setup, the Right Arrow Button will turn blue. Pressing the blue Arrow Button will open the Pulldown Screen for configuring Compensation 2.

Pressing the Left Blue Arrow Button will reopen the pulldown Screen for Compensation 1

### 3.3.2 MENU HOME MENU

The Menu allows access to system and sensor information and configuration. Much of what can be done with the devices (sensor, Ao, Ai, Di and COMP) via the Menu can also be done with the Device Configuration Button for the Channel the device information is displayed (see sections 3.3 Base Screen A and 3.3.1 Channel Configuration).

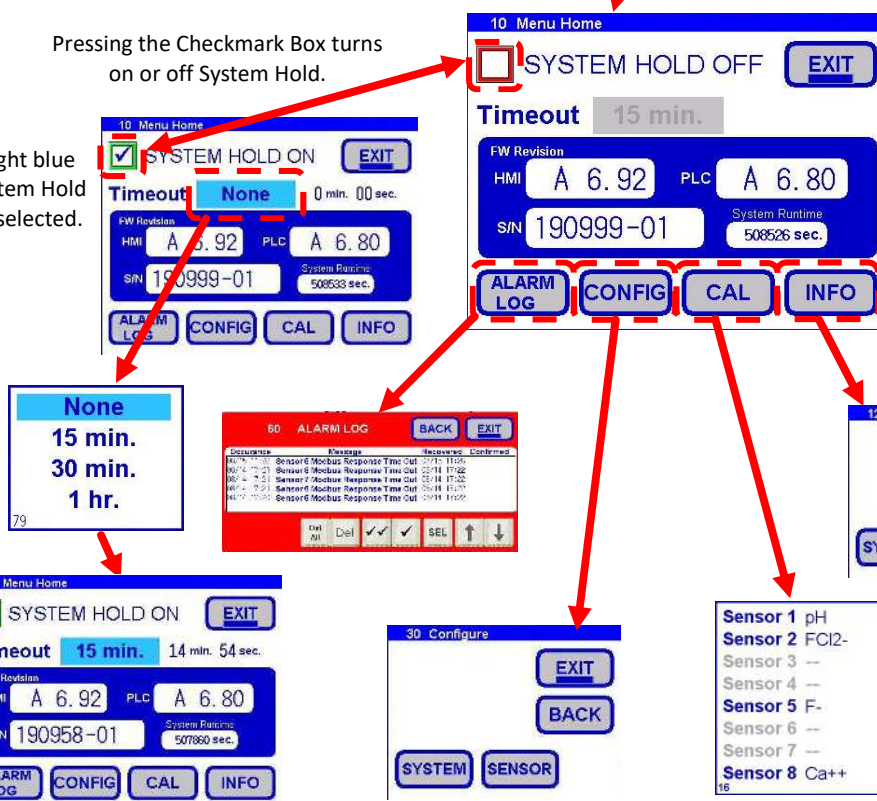


Language Selection

Pressing the Checkmark Box turns on or off System Hold.

Pressing the light blue area allows System Hold Timeout to be selected.

The light blue area indicates the current selection. Press any list item for that selection.



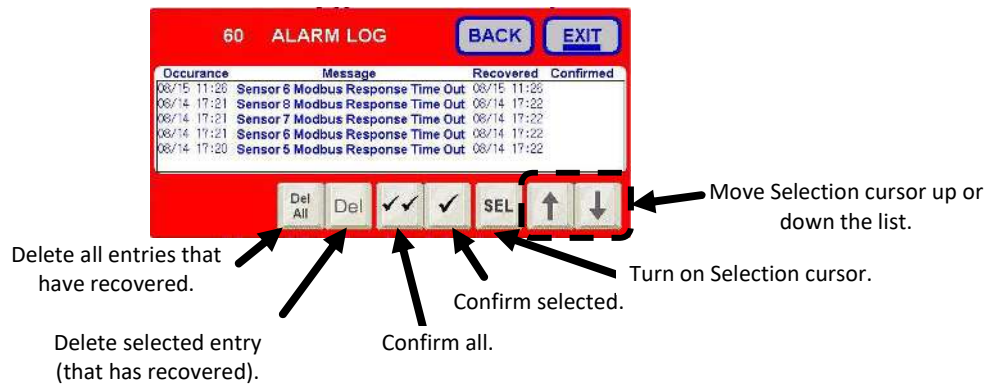
There is no BACK button on Popup Screen 10, Menu Home, as this screen is the start of the menu structure and BACK would be the same as EXIT.

While System Hold is active, the relay indicators will change to

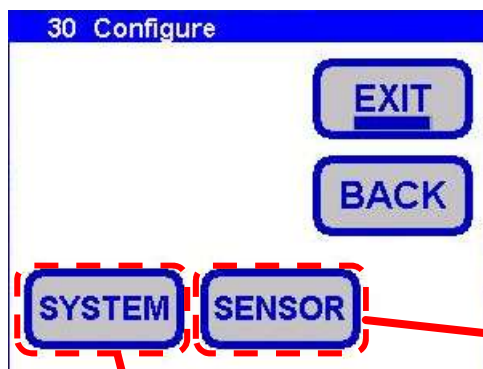


### 3.3.2.1 Alarm Log ALARM LOG

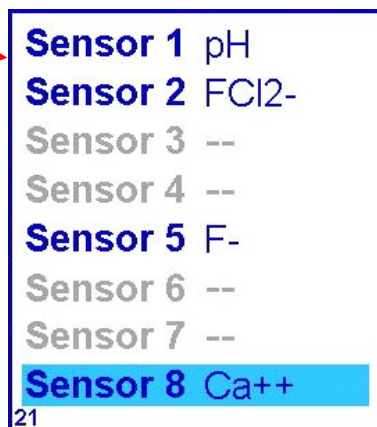
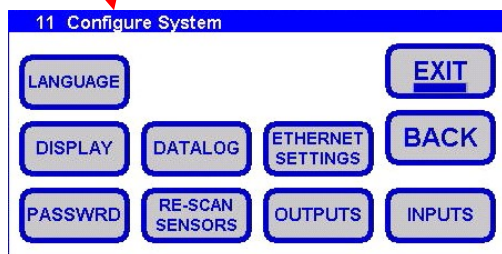
The Alarm Log contains Alarms (Faults) that have occurred (date and time of occurrence), the Alarm description (Message), the date and time when the Alarm recovered (blank if there hasn't been a recovery) and a listing when the operator confirmed (acknowledged) the Alarm. Each Alarm entry is color coded according to the Alarm's status, Red Alarm has occurred but is neither recovered or confirmed, Blue Alarm has recovered but is not confirmed, Green Alarm has been confirmed but may or may not have recovered. Alarms cannot be deleted until the Alarm has recovered. An entry that has a black background with yellow lettering indicates the entry has been Selected.



### 3.3.2.2 Configure CONFIG

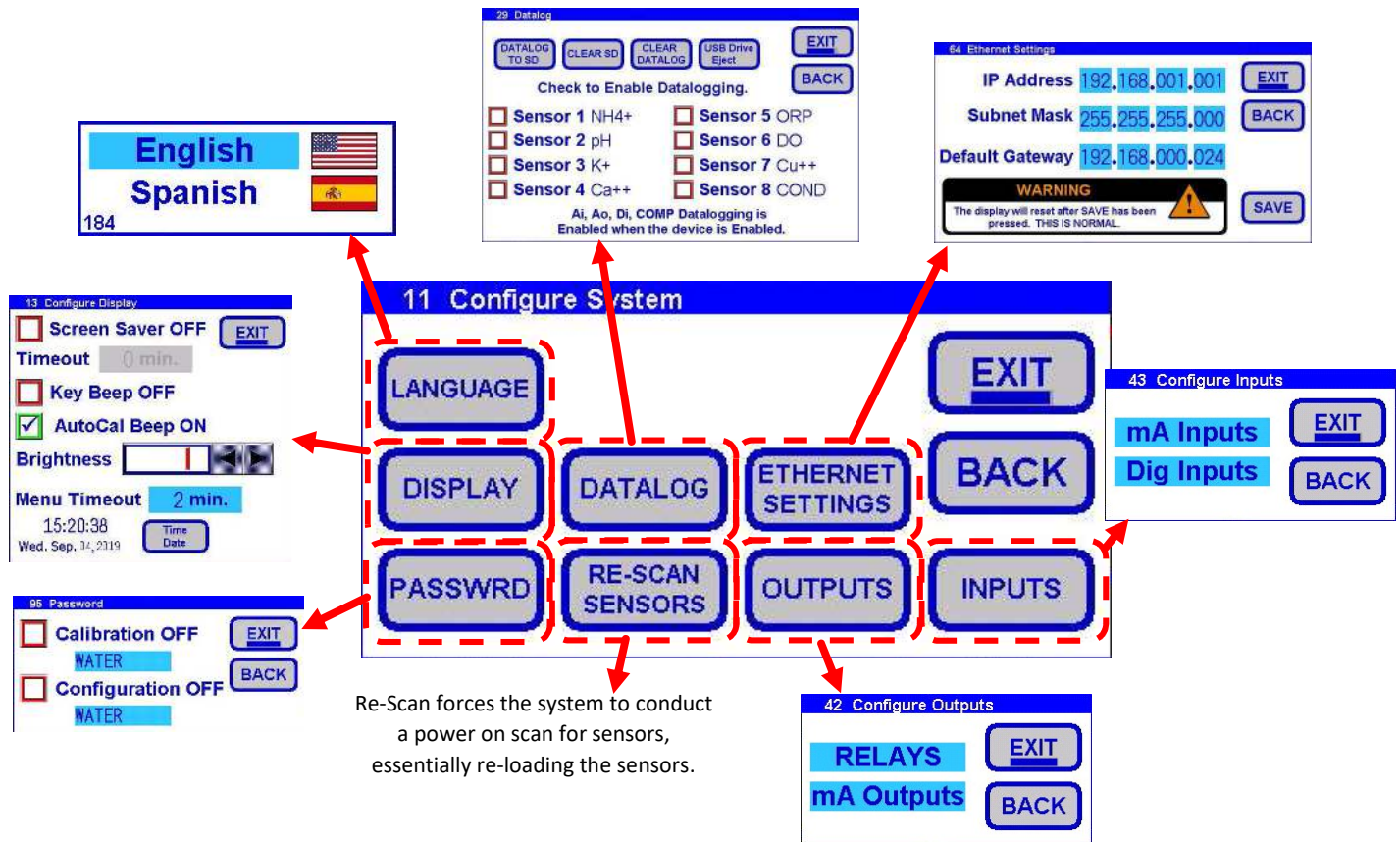


Pressing the SENSOR button opens a Pulldown Screen prompting the user to select the sensor to configure. After sensor selection, Sensor Configuration progresses the same as previously depicted in Section 3.3.1.2.2 Configure Sensor Page 17. Pressing the SYSTEM button opens the Configure System Popup Screen presenting configuration options for the rest of the system.



### 3.3.2.2.1 Configure System

**SYSTEM**



#### 3.3.2.2.1.1 Language Selection

**LANGUAGE**

Opens the same popup screen as using the Button on Home screen A allowing the user to switch between different languages from a list which will be expanded as translations become available.

### 3.3.2.2.1.2 Configure Display DISPLAY

Configure Display allows the setup of the Screen Saver, the Key Beep, AutoCal Beep, Display Brightness, Menu Timeout and Time/Date setting.

Pressing a check mark will turn on or off the parameter alternately.

Pressing the left or right arrow will decrease or increase the display brightness. Pressing the Exit Button will save the brightness setting, letting the Menu Timeout will reset the brightness.

Pressing the checkbox will change the time format between 12 and 24 hour..

Pressing the light blue area brings up the Numeric Keypad allowing number entry.

Pressing the checkbox will change the calendar format between MM/DD/YYYY and DD/MM/YYYY.

Time and date is changed by pressing each of the light blue areas and entering the change.

Pressing the light blue area will toggle between am and pm when in 12 hour format.

### 3.3.2.2.1.3 Datalog DATALOG

Erases all datalog files resident in the LQ800's memory.

Erases all datalog files from the SD card.

Closes all SD file activity allowing for a "safe" USB drive eject from the LQ800.

Forces the datalog to be written to the SD card otherwise the normal write cycle is approximately 3 minutes.

Datalogging can be enabled or disabled for each sensor by pressing the checkmark box.

☐

**Check to Enable Datalogging.**

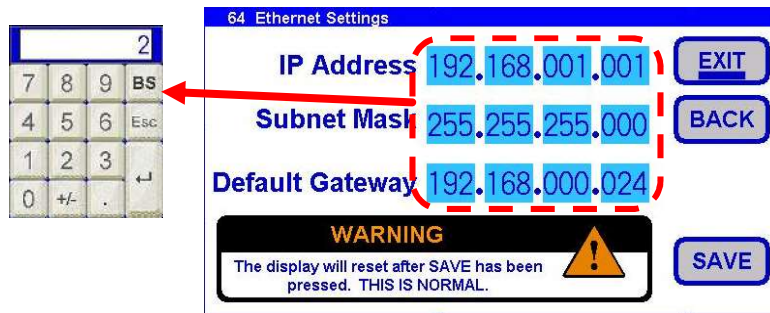
|                                               |                                               |
|-----------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> <b>Sensor 1</b> NH4+ | <input type="checkbox"/> <b>Sensor 5</b> ORP  |
| <input type="checkbox"/> <b>Sensor 2</b> pH   | <input type="checkbox"/> <b>Sensor 6</b> DO   |
| <input type="checkbox"/> <b>Sensor 3</b> K+   | <input type="checkbox"/> <b>Sensor 7</b> Cu++ |
| <input type="checkbox"/> <b>Sensor 4</b> Ca++ | <input type="checkbox"/> <b>Sensor 8</b> COND |

Ai, Ao, Di, COMP Datalogging is Enabled when the device is Enabled.

#### 3.3.2.2.1.4 Ethernet Settings



Configuration of the Ethernet Settings allow modification of the LQ800's Ethernet addresses and mask to suit the network that is being connected.



To access the LQ800 via Ethernet, physically connect your computer to the LQ800 using an Ethernet cable and ensure both devices are on the same local network, often by connecting them to a router. Using a web interface such as Chrome, Firefox, or Microsoft Edge, enter the IP address of the LQ800 to access analyzer functions.

For more detailed instructions on physical connections, contact the factory for the file “How to Connect the LQ800 to a local area network”.

### Ethernet Setup

SELECT “MENU” -> “CONFIG” -> “SYSTEM”

SELECT “ETHERNET SETTINGS”

#### ENTER NETWORK SETTINGS

**IP Address:** Assign the LQ800 an IP address. Make sure it is not an IP address that is already used in your Local Area Network. For example, in most small networks, 192.168.1.1 is usually already taken by your internet router, so don't use that address. For basic networks, the last field is all that is needed to be changed. For example, 192.168.1.069 is likely to be a valid IP address.

**Subnet Mask:** Enter the subnet mask that matches your network's. The default 255.255.255.000 should be fine for most small local networks.

**Default Gateway:** This is for the IP address of your router. For small networks not intended to be connected to the wider internet, you may leave this field alone. The default number should be fine.

**Port Number:** This is to set the port that is being used. The default number should be fine.

SELECT “SAVE”

The display will reset. This is normal. Please wait for the display to start up.

#### ENTER THE LQ800 IP IN YOUR BROWSER

You may now access the LQ800 through your local network. Enter the IP address you chose in your web browser. We have tested with Firefox and Edge.

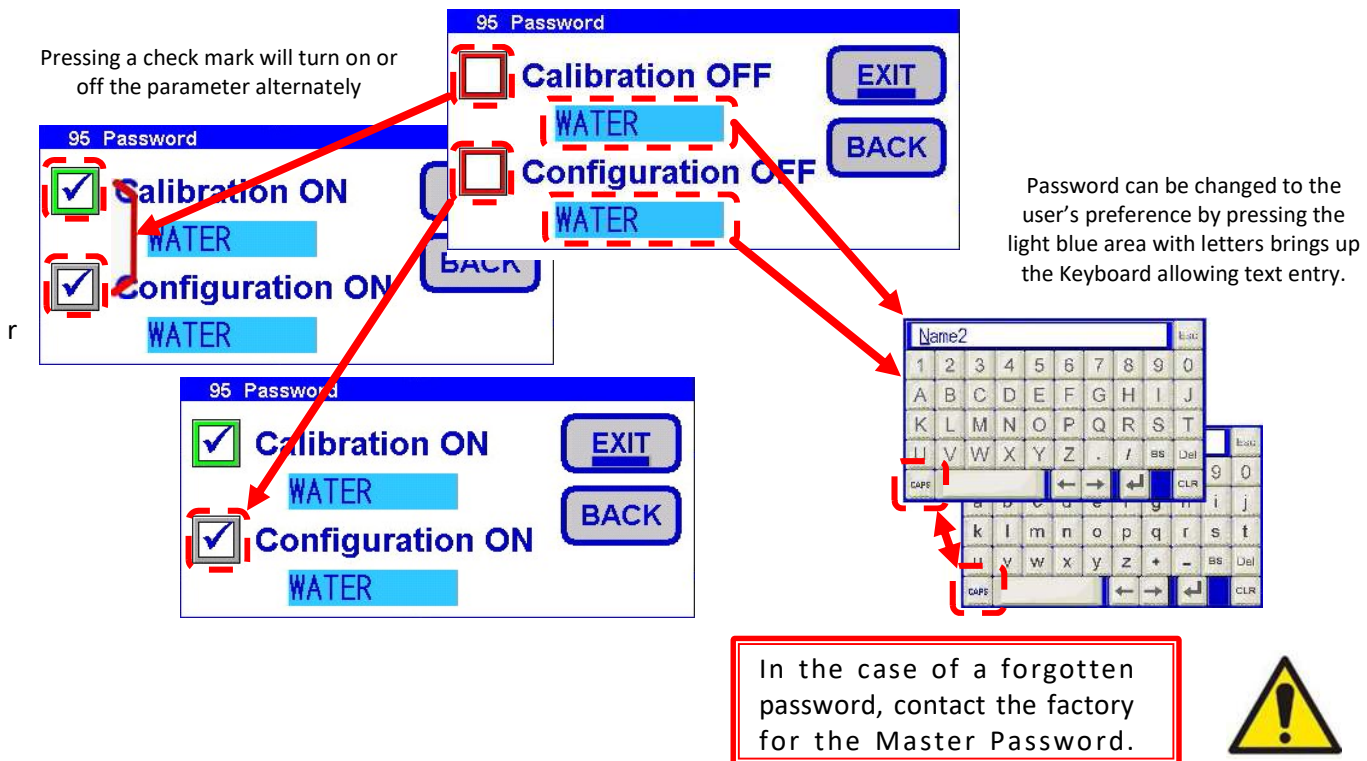
Enter the Username "User". Leave the password field blank. Sign in.

DONE

You may now monitor your LQ800. If you would like to interact with the screen, click “Control”. This will allow you to interact with the LQ800 interface.

3.3.2.2.1.5 Password 

Enabling passwords allows the user to protect the operation of the Unit by restricting access to Sensor Calibration and Unit Configuration. Enabling the Calibration Password automatically enables the Configuration Password but not visa-versa, enabling the Configuration Password will **not** automatically enable the Calibration Password (the Calibration Password can still be enabled).

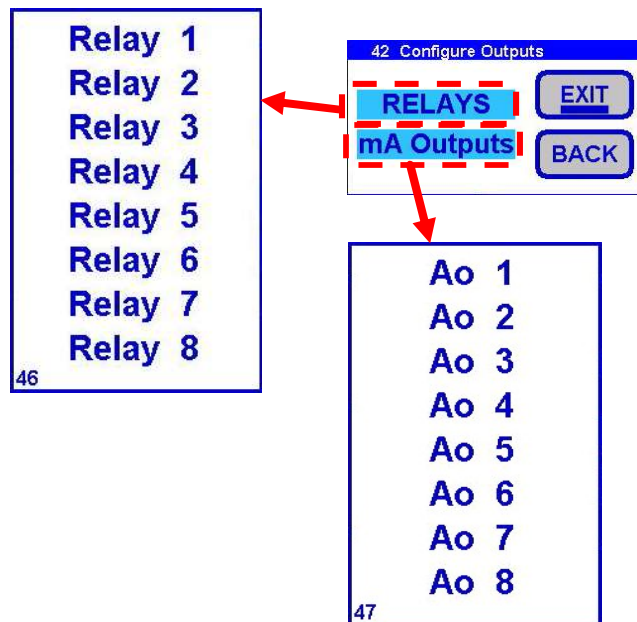


#### 3.3.2.2.1.6 Re-Scan Sensors

Re-scanning the sensor enables the user to add or change sensor locations in the Interconnector Board (see Figure 5 Interconnect Board Page 5) without the need to turn off the system; however, it is still recommended to turn off the system when changing the wiring including disconnecting and reconnecting sensors.

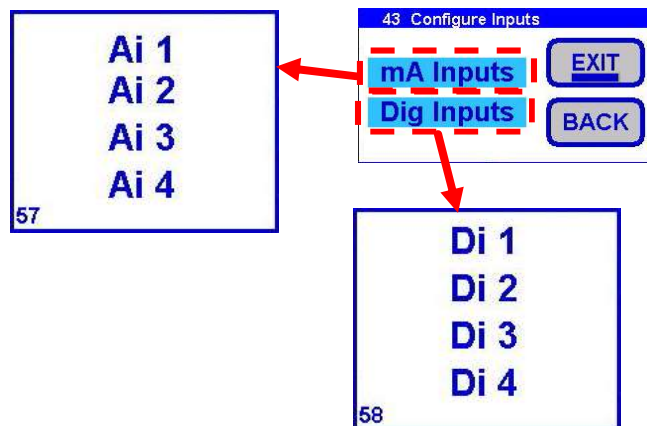
### 3.3.2.2.1.7 Outputs OUTPUTS

Pressing the OUTPUTS button on the Configure System screen will open a Popup Screen will presenting the choice of relays or mA Outputs (Ao) to configure. Pressing the light blue area around each option will open a corresponding Pulldown Screen presenting options as to which relay or Ao to configure. Once a selection has been made, configuration progresses the same as previously depicted in Sections 3.3.4 Relay Configuration Page 34 or 3.3.1.4 Analog Output (Ao) Configuration Page 20.



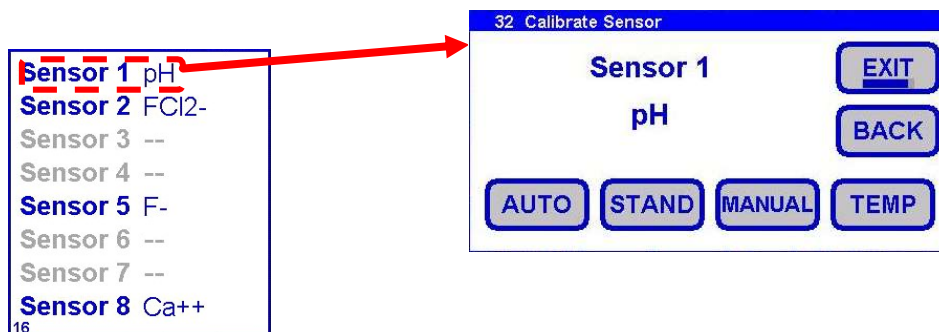
### 3.3.2.2.1.8 Inputs INPUTS

Pressing the INPUTS button on the Configure System screen will open a Popup Screen will presenting the choice of mA Inputs (Ai) or Digital Inputs (Di) to configure. Pressing the light blue area around each option will open a corresponding Pulldown Screen presenting options as to which Ai or Di to configure. Once a selection has been made, configuration progresses the same as previously depicted in Sections 3.3.1.3 Analog Input (Ai) Configuration Page 19 or 3.3.1.5 Digital Input (Di) Configuration Page 21.



### 3.3.2.3 Calibration CAL

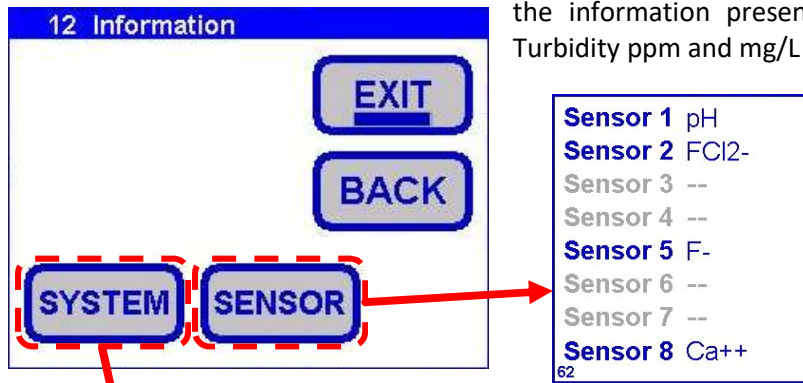
Pressing the CAL button will open a Pulldown Screen prompting the user to select the sensor to calibrate. After sensor selection, Pulldown Screen 32 Calibrate Sensor will open and operation is the same as depicted in section 3.3.1.2.1 Calibrate Sensor.



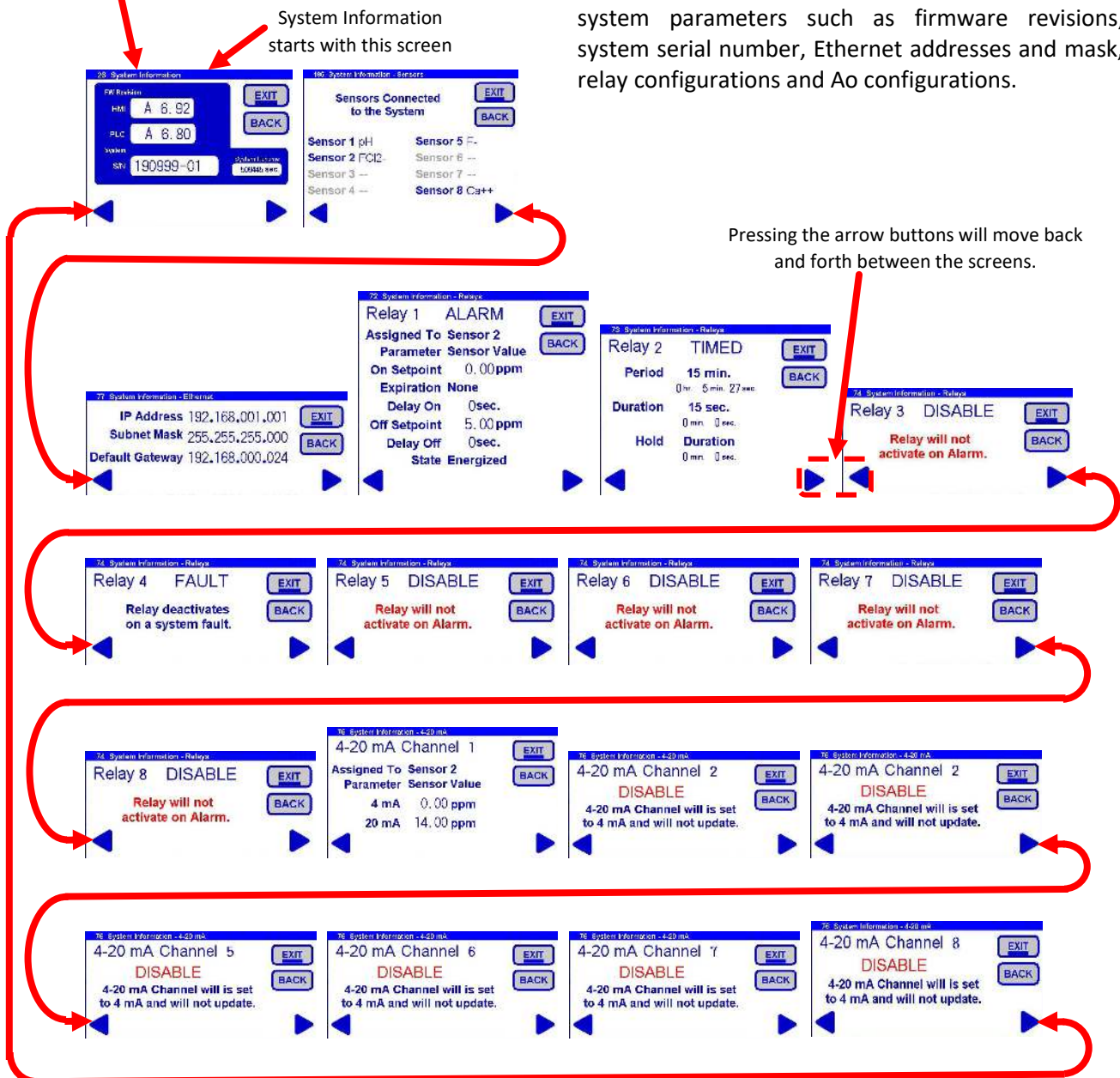
### 3.3.2.4 Information

INFO

Pressing the SENSOR button will open a Pulldown Screen prompting the user to select the sensor to get information on. After sensor selection, the information presented is the same as previously depicted in Turbidity ppm and mg/L



Pressing the SYSTEM button will present a series of Pulldown Screens containing information on various system parameters such as firmware revisions, system serial number, Ethernet addresses and mask, relay configurations and Ao configurations.



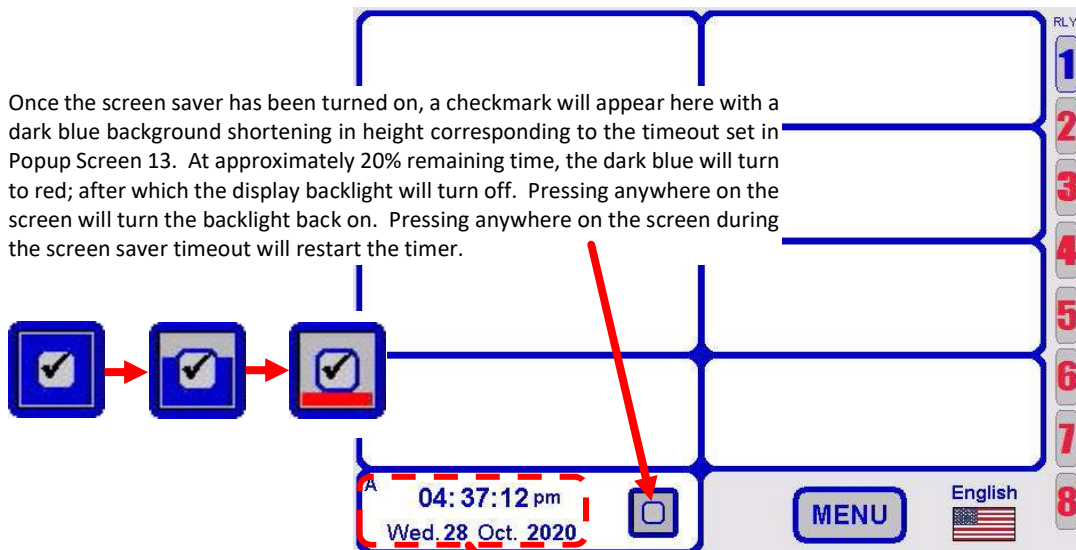
### 3.3.3 *DISPLAY CONFIGURATION*

3.3.3.1.1.1 Configure Display allows the setup of the Screen Saver, the Key Beep, AutoCal Beep, Display Brightness, Menu Timeout and Time/Date setting. See Section 3.3.2.1.1 Language Selection

Opens the same popup screen as using the Button on Home screen A allowing the user to switch between different languages from a list which will be expanded as translations become available.

Configure Display Page 26 for a complete description.

Once the screen saver has been turned on, a checkmark will appear here with a dark blue background shortening in height corresponding to the timeout set in Popup Screen 13. At approximately 20% remaining time, the dark blue will turn to red; after which the display backlight will turn off. Pressing anywhere on the screen will turn the backlight back on. Pressing anywhere on the screen during the screen saver timeout will restart the timer.



Pressing the area

13 Configure Display

☐ Screen Saver OFF EXIT

Timeout 0 min.

☐ Key Beep OFF

☒ AutoCal Beep ON

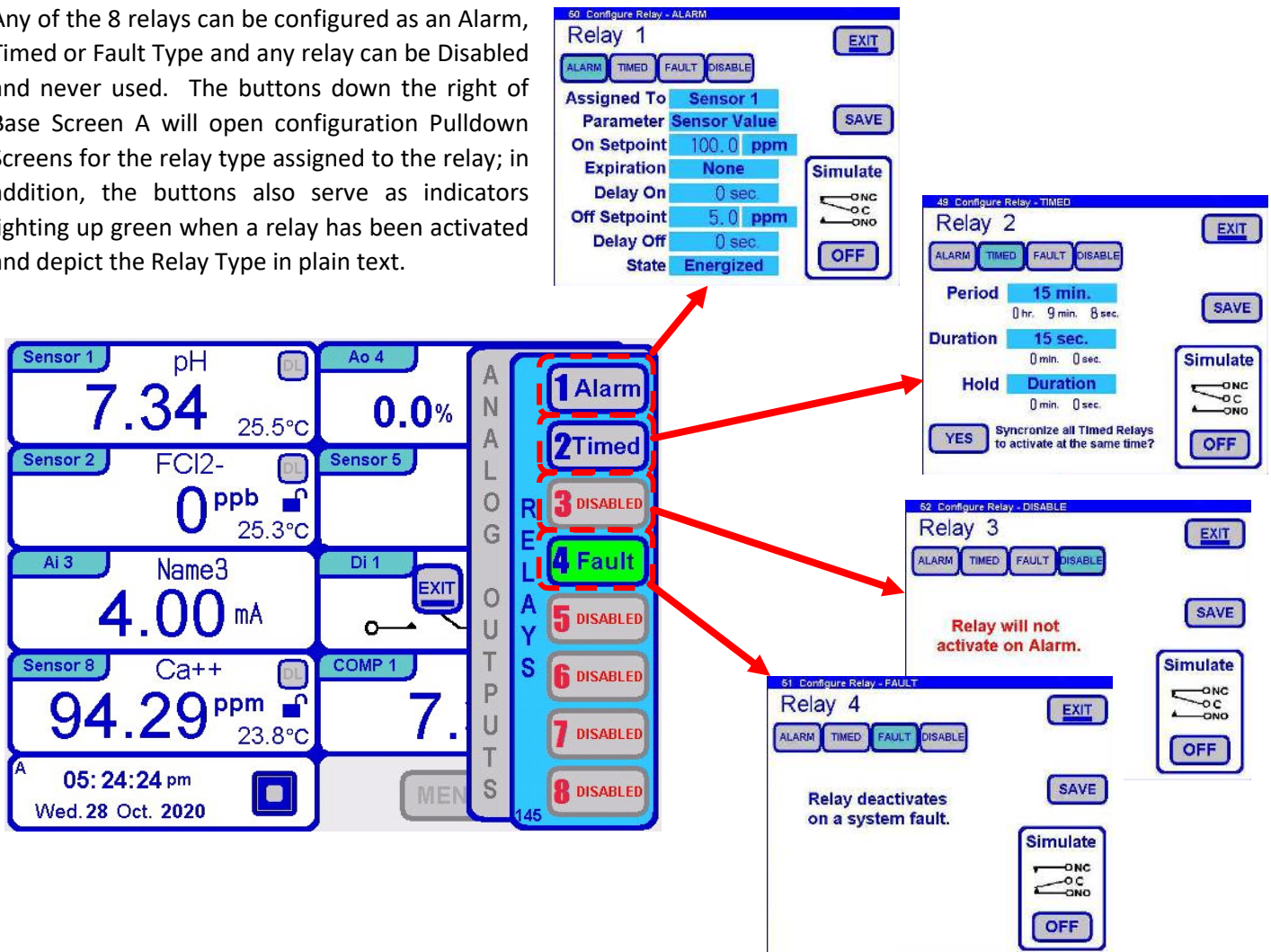
Brightness ◀▶

Menu Timeout 2 min.

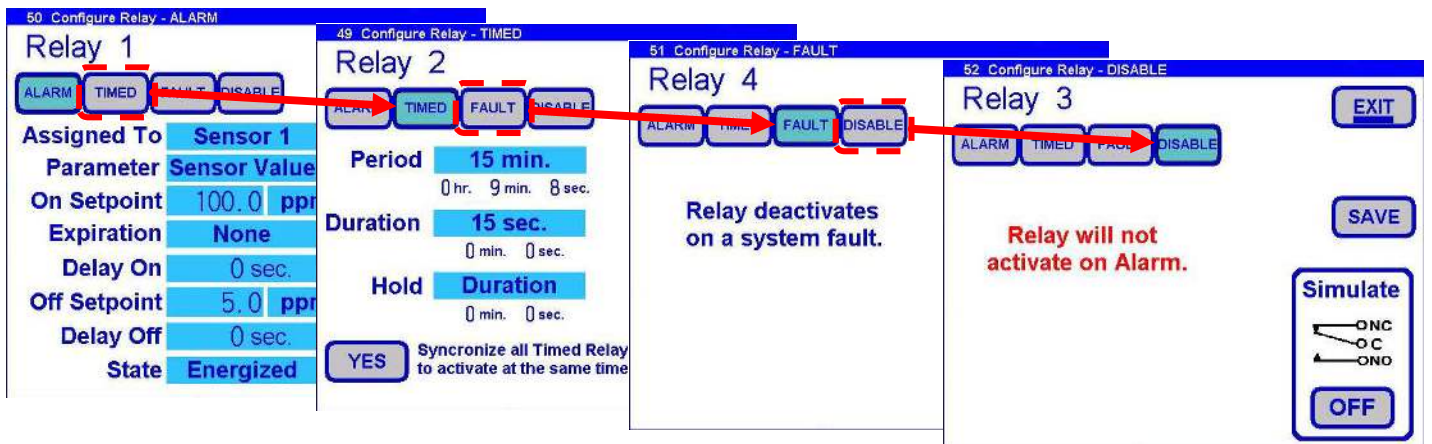
15:20:38  
Wed. Sep. 04, 2019 Time Date

### 3.3.4 RELAY CONFIGURATION

Any of the 8 relays can be configured as an Alarm, Timed or Fault Type and any relay can be Disabled and never used. The buttons down the right of Base Screen A will open configuration Pulldown Screens for the relay type assigned to the relay; in addition, the buttons also serve as indicators lighting up green when a relay has been activated and depict the Relay Type in plain text.

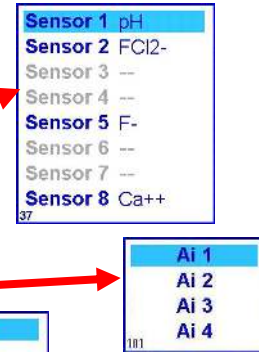


Relay Type can be changed while in the relay configuration menus by pressing the type desired. The example below depicts the choices being selected in order but the new type can be chosen with pressing the button / indicator directly. For example, an ALARM Type relay can be changed to DISABLE by directly pressing the Disable button / indicator.



### 3.3.4.1 Configure Relay - ALARM

Alarm type relays can be set to activate and deactivate at particular setpoints related to sensor readings or temperature, Analog Input (Ai device) levels, Digital Input (Di device) state or Sensor Compensation (COMP device) reading. There are various options to enable different uses of the Alarm type relay.



The Alarm Type relay can be set to monitor any of the LQ800 devices (Sensor, Ai, Di and COMP) for activation.

50 Configure Relay - ALARM

**Relay 1**

ALARM TIMED FAULT DISABLE

Assigned To **Sensor 1**

Parameter **Sensor Value**

On Setpoint **100.0 ppm**

Expiration **None**

Delay On **0 sec.**

Off Setpoint **5.0 ppm**

Delay Off **0 sec.**

State **Energized**

**Sensor Value**  
Sensor Temp

**None**  
5 min.  
10 min.  
15 min.  
30 min.  
A fault relay is recommended for external notification.

**Energized**  
**De-Energized**

The Parameter (Value or Temperature) is only available when monitoring a sensor. Choosing to monitor the Sensor Temperature changes the endpoints to temperature in °C.

Setting an expiration time for a relay allows for a level of fault detection in the relay circuitry, monitoring equipment and process control. As an example, a system is setup monitoring the pH of a process and uses a relay to start a pump adding caustic when the process becomes too acid. If there is a failure where the pH stays above the on setpoint, the relay will stay energized continuously adding caustic until the caustic tank is empty. Setting an expiration time will de-energize the relay and set an expired relay fault. A different relay set as a Fault Type can be used for an external problem notification.

The energized state means the normally open (NO) contact is open until the relay is activated, then the NO contact will close. Then De-Energized state means the NO contact is closed until the relay is activated, then then NO contact will open.

The maximum and minimum values for the set points are dictated by the chemical type of the sensor chosen. The maximum and minimum time values are 1800 sec. (30 min.) and 0 sec.

Pressing any of the light blue area with numbers brings up the Numeric Keypad allowing number entry.

50 Configure Relay - ALARM

**Relay 1**

ALARM TIMED FAULT DISABLE

Assigned To **Sensor 1**

Parameter **Sensor Value**

On Setpoint **100.0 ppm**

Expiration **None**

Delay On **0 sec.**

Off Setpoint **5.0 ppm**

Delay Off **0 sec.**

State **Energized**

**EXIT**

**SAVE**

**Simulate**

**OFF**

**2**

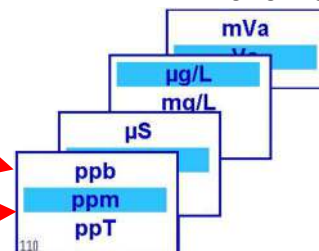
7 8 9 BS

4 5 6 Esc

1 2 3

0 +/- . ←

Pressing the light blue area brings up a Pulldown Screen allowing the user to set the parameter's scale. Some chemical types don't allow the span of ranges, ex. pH, in which case, the units wouldn't be highlight light blue.



Depending on the sensor, there will be different ranges presented with different Pulldown Screens.

50 Configure Relay - ALARM

Relay 1

ALARM TIMED FAULT DISABLE

Assigned To **Sensor 1**

Parameter **Sensor Temp**

On Setpoint **0 °C**

Expiration **None**

Delay On **0 sec.**

Off Setpoint **0 °C**

Delay Off **0 sec.**

State **Energized**

EXIT

SAVE

Simulate

OFF

The maximum and minimum values for temperature set points are -20°C and +70°C.

|   |     |   |     |
|---|-----|---|-----|
| 2 |     |   |     |
| 7 | 8   | 9 | BS  |
| 4 | 5   | 6 | Esc |
| 1 | 2   | 3 |     |
| 0 | +/- | . | ↵   |

Pressing any of the light blue area with numbers brings up the Numeric Keypad allowing number entry.

### 3.3.4.2 Configure Relays - TIMED

Timed Type relays allow for a periodic activation independent of any LQ800 device set points. This feature is especially useful for spray cleaners such as the ECD AC10. The timed relay can be set to activate the spray cleaner at a running period and for a duration of sparging. Since the sensor reading would be erratic due to the sparging, a hold can be set to avoid inadvertent relay activations and Ao outputs. The numbers under each of the parameters are the times remaining for the time set point.

49 Configure Relay - TIMED

Relay 2

ALARM TIMED FAULT DISABLE

Period **15 min.**

Duration **15 sec.**

Hold **Duration**

YES Synchronize all Timed Relays to activate at the same time?

EXIT

SAVE

Simulate

OFF

15 min.

30 min.

1 hr.

2 hr.

4 hr.

8 hr.

24 hr.

39

The period is the time between the relay activations.

15 sec.

30 sec.

1 min.

2 min.

5 min.

15 min.

30 min.

40

The duration is the amount of time the relay is activated. The duration time begins at the start of the timed period.

OFF

Duration

+15 sec.

+30 sec.

+1 min.

+2 min.

+5 min.

+15 min.

+30 min.

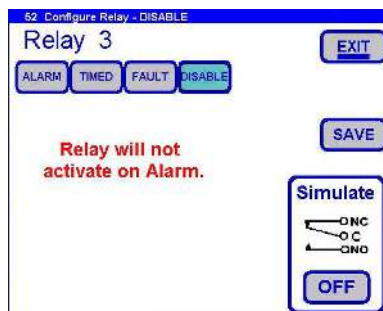
41

A hold can be activated where all sensors are not monitored in order to stop inadvertent relay activations and Ao outputs. Hold times can be set to the length of the timed duration or time intervals in addition to the timed duration.

Pressing this button will re-start all Timed Type relays synchronizing the start of each relay's period. The same result occurs when the power is cycled.

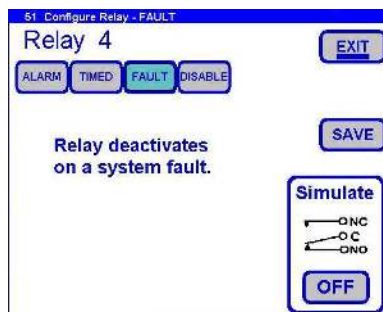
### 3.3.4.3 Configure Relays - DISABLED

Relays can be disabled when not in use or when diagnosing a problem where relay activation is undesired. Disable the relay in question and later set the relay back to the type previously configured. All the setpoints and other parameters will have been saved and reconfigured into the relay.



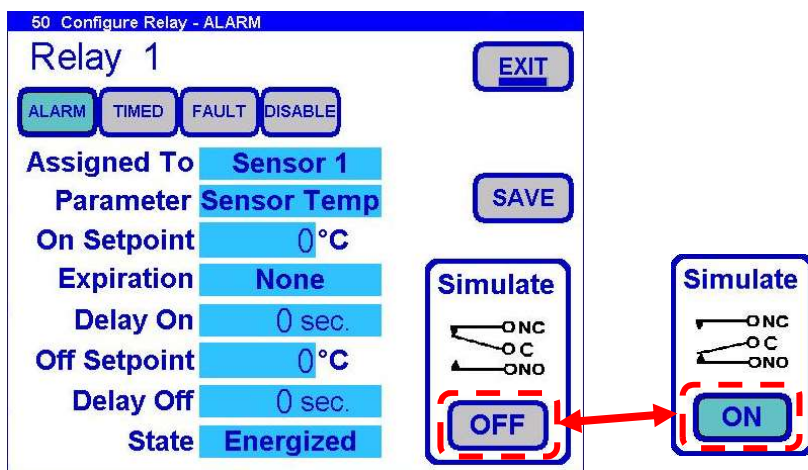
### 3.3.4.4 Configure Relays - FAULT

Selecting a Fault Type will automatically activate the relay (the normally open, NO, contact closes) until a fault occurs, after which, the relay will be deactivated (NO contact opens). The Fault Type operates this way as a fail-safe notification of the LQ800 loss of power where the Fault Type relay will open due to loss of power.



### 3.3.4.5 Relay Simulation

Relay Simulation allows at-will testing of relay connections independent of the relay configuration. Exiting the relay configuration will return the relay to its previous activation state.



## 4.0 CALIBRATION

The Model LQ800 Controller provides three methods of calibration:

### 4.1.1 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 processes 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 controller displays the PV (Process Variable) and the associated mV signal from the signal. 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 asked 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 and mg/l.

### 4.1.2 STANDARDIZE CALIBRATION DESCRIPTION

A Standardize Calibration is a single point calibration where the controller's reading is adjusted to agree with a solution of known value, either a calibration standard, a grab sample, or laboratory determined value. In many cases the constituents and the 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 may have shifted from the original calibration point. Standardization allows for correction of this type of offset.

When the STAND key is pressed, the user is prompted to ENTER VALUE. The user enters the value they want the controller 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.

### 4.1.3 MANUAL CALIBRATION DESCRIPTION

Manual calibration allows the user to enter calibration data for an electrode into the controller 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 the electrode. This allows laboratory generated calibration data for an electrode to be entered in a remote controller 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 come 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

#### 4.1.4 CAL (CALIBRATION MENU)

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

1. **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. Auto Cal provides automatic solution recognition of the calibration solutions used for each measurement in accordance with the following list:

- pH Calibration Buffers (US Standard), pH 4.01, pH 7.00, and pH 10.00 (see Appendix A)
- ORP Calibration Solutions: Quinhydrone saturated: pH 7.00 =  $\pm 89$  mV, pH 4.01 = +266 MV
- plon Calibration Solutions: 1.00, 10.00, 100.0 ppb, ppm, ppT (thousand)
- Dissolved Oxygen: Zero ppm (Sodium sulfite, Na<sub>2</sub>SO<sub>3</sub> 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.

2. **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.
3. **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 controller where calibration is difficult or impractical.
4. **TEMP** allows the displayed temperature to be trimmed to agree with actual process temperature.

#### 4.2 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.

##### 4.2.1 AUTO CAL USING PH 4.01, 7.00, 10.00 BUFFERS

| Action                                                          | Prompt                                                                       |
|-----------------------------------------------------------------|------------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                       |
| Press System <b>HOLD Off</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration    |
| Press <b>Exit</b>                                               | Return to Home Screen                                                        |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, pH, raw mV, Temperature                 |
| Press <b>CAL</b>                                                | Place Sensor in Cal Solution (use pH 7.00 buffer)                            |
| Press <b>AUTO</b> then <b>CAL 1</b>                             | STABILIZING, 7.00 pH x.x mV, 7.00 pH corrected Accept Cal 1?                 |
| Press <b>YES</b>                                                | CAL1 Value 7.00 pH, Continue to CAL2? Move sensor to 4.01 pH buffer solution |
| Press <b>YES</b>                                                | STABILIZING, 4.00 pH xxx.x mV, 4.00 pH corrected Accept Cal?                 |
| Press <b>YES</b>                                                | OFFSET: 7.00 pH x.x mV, SLOPE: -59.16 mV/pH (data written to Log)            |
| Press <b>OK</b>                                                 | Calibration complete                                                         |
| Press <b>EXIT</b>                                               | Main Display                                                                 |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                        |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                                |
| Press <b>EXIT</b>                                               | Main Display                                                                 |

#### 4.2.2 STANDARDIZE

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

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, pH, raw mV, Temperature              |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>STAND</b>                                              | Enter Value in the Highlighted Field                                      |
| Press <b>OK</b>                                                 | xx.xx pH, xxx.x mV, Accept Value?                                         |
| Press <b>OK</b>                                                 | Standardization Calibration Complete                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

### 4.3 ORP CALIBRATION PROCEDURES

AUTO Calibration recognizes Quinhydrone solutions ( $mV_a$ ), 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.

#### 4.3.1 AUTO CAL WITH QUINHYDRONE

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD Off</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, ORP $mV_a$ , raw mV, Temperature     |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (use pH 7.00 Q solution)                     |
| Press <b>AUTO</b> then <b>CAL 1</b>                             | STABILIZING, xxx.x mV, xxx.x $mV_a$ , 90.0 mV corrected Accept Cal?       |
| Press <b>YES</b>                                                | CAL1 Value 90.0 mV, Continue to CAL2? Move sensor to pH 4.01 Q solution   |
| Press <b>YES</b>                                                | STABILIZING, 269.2 mV 267.0 $mV_a$ corrected Accept Cal?                  |
| Press <b>YES</b>                                                | OFFSET: 90.0 $mV_a$ , 87 mV, SLOPE: 1.02 mV/ $mV_a$ (data written to Log) |
| Press <b>OK</b>                                                 | Calibration complete                                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON</b><br><b>Check Box</b>                 | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

#### 4.3.2 STANDARDIZE

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

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD Off</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, pH, raw mV, Temperature              |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>STAND</b>                                              | Enter Value in the Highlighted Field                                      |
| Press <b>OK</b>                                                 | xx.xx mV <sub>a</sub> , xxxx.x mV, Accept Value?                          |
| Press <b>OK</b>                                                 | Standardization Calibration Complete                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

### 4.4 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.

#### 4.4.1 AUTO CAL USING 1, 10, 100 PPM SOLUTIONS

| Action                                                          | Prompt                                                                     |
|-----------------------------------------------------------------|----------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                     |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration  |
| Press <b>Exit</b>                                               | Return to Home Screen                                                      |
| Press <b>Center of box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, PV Concentration, raw mV, Temperature |
| Press <b>CAL</b>                                                | Place sensor in 10 ppm calibration solution                                |
| Press <b>AUTO</b> then <b>CAL 1</b>                             | STABILIZING, 10.00 ppm, xxx.x mV, 10.00 ppm corrected, Accept Cal?         |
| Press <b>YES</b>                                                | CAL1 Value 10.00 ppm, Continue to CAL? Move sensor to 100 ppm solution     |
| Press <b>YES</b>                                                | STABILIZING, 100.0 ppm, xx.xx mV, 100 ppm corrected, Accept Cal?           |
| Press <b>YES</b>                                                | OFFSET: 10.00 ppm, 310 mV, SLOPE: 55.1 mV/ decade (data written to Log)    |
| Press <b>OK</b>                                                 | Calibration complete                                                       |
| Press <b>EXIT</b>                                               | Main Display                                                               |
| Press <b>Menu</b>                                               | MANU HOME, Hold is ON                                                      |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                              |
| Press <b>EXIT</b>                                               | Main Display                                                               |

#### 4.4.2 AUTO CAL USING NON-DECIMAL PPM SOLUTIONS

| Action                                                          | Prompt                                                                                           |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                                           |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration                        |
| Press <b>Exit</b>                                               | Return to Home Screen                                                                            |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, PV Concentration, raw mV, Temperature                       |
| Press <b>AUTO</b> then <b>CAL 1</b>                             | STABILIZNG, xx.xx pH x.x mV, 10.00 ppm corrected Accept Cal?                                     |
| Press <b>NO</b>                                                 | Enter CAL 1 Value                                                                                |
| Press <b>Value</b>                                              | xxx.x ppm                                                                                        |
| Press <b>OK</b>                                                 | xxx.x ppm, xxx.x mV, Accept this Value                                                           |
| Press <b>YES</b>                                                | CAL 1 Value xxx.x ppm, Continue to CAL 2? (Place Sensor in 2 <sup>nd</sup> calibration solution) |
| Press <b>YES</b>                                                | STABILIZING, xxx.x ppm xxx.x mV                                                                  |
| Press <b>NO</b>                                                 | Enter CAL 2 Value                                                                                |
| Enter <b>Value</b>                                              | xxxx.x ppm                                                                                       |
| Press <b>OK</b>                                                 | xxxx.x ppm, xxx.x mV, Accept this Value                                                          |
| Press <b>YES</b>                                                | OFFSET: xxx.x ppm xxx.x mV, SLOPE: 55.40 mV/decade                                               |
| Press <b>OK</b>                                                 | Calibration complete                                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                                                     |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                                            |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                                                    |
| Press <b>EXIT</b>                                               | Main Display                                                                                     |

#### 4.4.3 STANDARDIZE

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

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD Off</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, V Concentration, raw mV, Temperature |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>STAND</b>                                              | Enter Value in the Highlighted Field                                      |
| Enter <b>Value</b>                                              | Concentration (ppb, ppm, ppT)                                             |
| Press <b>OK</b>                                                 | xx.xx ppm, xxx.x mV, Accept Value?                                        |
| Press <b>OK</b>                                                 | Standardization Calibration Complete                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

## 4.5 TRITON® DISSOLVED OXYGEN CALIBRATION PROCEDURES

Before starting a calibration Enter the Salinity and Barometric pressure in the CONFIG→SENSOR menu. The default values are Salinity 0‰ and 1013 mbar. Use Table 2 above to calculate the pressure using elevation if the actual pressure is not known.

The TRITON® DO82 sensor was calibrated at the factory prior to shipment and should not require re-calibration at start up. Calibration is required whenever the fluorescence cap/membrane cap is replaced.

Calibrations can be performed as a one point (Air cal), a two point (zero point & Air cal) or a standardization, there is no Manual Cal option available for the TRITON® dissolve oxygen sensors.

The Auto Cal allows both 0% and 100% calibrations. The sensor senses the oxygen partial pressure, and if it is less than 20% of saturation it assumes a Zero Point calibration and calibrates to 0.00% saturation, 0.00 mg/l, or 0.00 mbar depending on the measurement mode. If the sensed value is above 75% of saturation it assumes an Air Calibration and calibrates to the value equivalent to 100% saturation.

The zero point of the sensor is relatively stable through the life of the fluorescence/membrane cap. The zero point is checked by placing the sensor into an oxygen free solution and verifying the displayed value drops to a value near zero ppm. The sensor will take a few minutes to equilibrate to the zero oxygen solution, but it is best to wait 15-20 minutes before initiating a calibration (up to a 10 minute cycle time) for the highest accuracy. A zero ppm O<sub>2</sub> 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.

Air saturated water and water saturated air (100% humidity) have the same oxygen partial pressure. The preferred calibration method uses water saturated air. The Protective Guard can be removed from the front of the sensor and filled a small amount of distilled water, ~5 ml, for an easy to use Calibration Cap.

The calibration cycle takes up to 10 minutes once initiated. The DO82 sensor should be equilibrated for 10-15 minutes to the air sample (100% humidity, 0‰ Salinity) and the ambient temperature before starting the calibration. When measuring the “% Saturation mode”, 100% will be reported as the calibration value.

### 4.5.1 AUTO CAL USING ZERO PPM SOLUTION AND AIR

| Action                                                                    | Prompt                                                                    |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                                         | MENU HOME, Hold is OFF                                                    |
| Press <b>System HOLD Off</b><br><b>Check box</b>                          | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                                         | Return to Home Screen                                                     |
| Press <b>Center of Box of the</b><br><b>required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, DO PPM, raw mV, Temperature          |
| Press <b>CAL</b>                                                          | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>Auto</b>                                                         | This will automatically calibrate. Leave sensor in Air                    |
| Press <b>OK</b>                                                           | Accept Value?                                                             |
| Press <b>OK</b>                                                           | Calibration Complete                                                      |
| Press <b>EXIT</b>                                                         | Main Display                                                              |
| Press <b>Menu</b>                                                         | MENU HOME, Hold is ON                                                     |
| Press <b>System HOLD ON</b><br><b>Check box</b>                           | Turn off Hold                                                             |
| Press <b>EXIT</b>                                                         | Main Display                                                              |

#### 4.5.2 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                                                                    |
|-------------------------------------------------------------|---------------------------------------------------------------------------|
| Press Menu                                                  | MENU HOME, Hold is OFF                                                    |
| Press System HOLD Off<br>Check box                          | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press Exit                                                  | Return to Home Screen                                                     |
| Press Center of Box of the<br>required Channel (Sensor 1-8) | Sensor Screen showing Sensor number, DO PPM, raw mV, Temperature          |
| Press Cal                                                   | Place sensor in a known solution                                          |
| Press STAND                                                 | Enter Value                                                               |
| Press OK                                                    | Calibration window will pop up. Wait until calibration is finished        |
| Press OK                                                    | Calibration Complete                                                      |
| Press EXIT                                                  | Main Display                                                              |
| Press Menu                                                  | MANU HOME, Hold is ON                                                     |
| Press System HOLD ON<br>Check box                           | Turn off Hold                                                             |

#### 4.6 TRITON® TR80/TR82 TURBIDITY/SUSPENDED SOLIDS SENSOR

Unlike the T80, the LQ800 only performs a two point calibration for the turbidity sensors, 0% and 100%.

The TRITON® TR80/TR82 turbidity sensors are dual range sensors available on four different ranges. The TR80/TR82 turbidity sensors have a non-linear output. The calculation of the turbidity is accomplished using a 2<sup>nd</sup> order polynomial of the millivolt output,  $NTU = ax^2 + bx + c$ , where  $x$  = millivolt output of the sensor. A two point calibration is required to define the shape of the curve. The Model LQ800 turbidity controller was calibrated at the factory before shipment in two Formazine solutions using the values listed below. The calibration was performed with the two solutions for the NTU range of the sensor ordered.

Changing the range of the sensor (Hi to Low, or Low to Hi) or changing the measurement unit will require a new two point calibration. The calibration points for the two point calibration are 50%, and 100% of the measurement range, NTU, ppm, mg/L, or % Solids. Calibrations of NTU or FNU can be made with Formazine solutions diluted from the 4000 NTU stock solution to the Values listed in the table below. Calibrations of ppm, mg/L, and % Solids require the actual process solutions to be used for the calibration. The 100% solution for the ppm, mg/L, and % solids should be near the high point of the measurement. The value of the solution must be known or determined by another method such as a grab sample and laboratory measurement. Then make the 50% solution from 1 part of the high sample to one part deionized water, its values in half of the high value.

Calibrations should be performed in a vessel with similar characteristics to the actual process installation. Black plastic containers work best, minimizing reflectance problems in lower NTU solutions. ECD offers a TRITON® TR80/TR82 Turbidity Calibration Kit that includes a TR80/TR82 Calibration Cup, 250 ml, 100 ml, and 50 ml graduated cylinders, and a 1 liter volumetric flask. The kit provides the necessary laboratory equipment to make calibration standards from a 4000 NTU Formazine stock solution, and an easy to use calibration cup. This kit is ideal for calibration of inline pipe mounted TR80/TR82 turbidity sensors.

*Example of mg/L Calibration: The process solution ranges around 3000 mg/L. A 2 liter sample was taken from the process and tested, it was determined to be 2850 mg/L. Keep one liter of the 2850 mg/L solution for the (100%) solution calibration, and mix 500 mls of the 100% solution with 500 mls of deionized water, making the (50%) solution. Start the calibration in the deionized water in the calibration cup, then put the sensor into the 1425 mg/L solution, and enter 1425 mg/L when*

prompted and finally into the 2850 mg/L solution, and enter 2850 mg/L. Accept the calibration, and put the sensor back into the process.

| Sensor Measurement Ranges | Low Calibration Values | High Calibration Values |
|---------------------------|------------------------|-------------------------|
| 0-250 NTU and 0-1000 NTU  | 125 NTU, 250 NTU       | 500 NTU, 1000 NTU       |
| 0-500 NTU and 0-2000 NTU  | 250 NTU, 500 NTU       | 1000 NTU, 2000 NTU      |
| 0-1000 NTU and 0-4000 NTU | 500 NTU, 1000 NTU      | 2000 NTU, 4000 NTU      |
| 0-2000 NTU and 0-4000 NTU | 1000 NTU, 2000 NTU     | 2000 NTU, 4000 NTU      |

#### 4.6.1 MANUAL CAL

Manual Cal provides two options, OFFSET, and SLOPE. OFFSET is an online/in process Zero Point Calibration Only. It is the same value that is adjusted in Standardize, and it is the set same way. SLOPE is an adjustment of the NTU/volt aspect of the turbidity curve pivoting from the Offset point. The SLOPE window displays a unit less number that is changed to adjust the calibration.

*Example: TRITON® TR80/TR82 in 400 NTU solution but reads 380 NTU. The SLOPE reads 108. The slope of the calibration curve needs to increase so that the voltage that is generating 380 NTU will generate 400 NTU. To determine the new slope, first divide the desired value (400 NTU) by the actual value (380 NTU) and multiply the current slope by that number.  $400 \text{ NTU} / 380 \text{ NTU} * 108 = 113.7$  the new slope. Enter 113.7 in the SLOPE window, save the calibration and the controller will read 400 NTU.*

#### SLOPE ADJUSTMENT

| Action                                                          | Prompt                                                                |
|-----------------------------------------------------------------|-----------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Place Sensor in Air or with the sensor in the process solution        |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, Turbidity, raw mV, temperature   |
| Press <b>Cal</b>                                                |                                                                       |
| Press <b>MANUAL</b>                                             | Enter Value in the Highlighted Field Concentration (ppb, ppm, ppt)    |
| Press <b>OK</b>                                                 | xx.xx NTU, xxx.x mV, Accepted Value?                                  |
| Press <b>OK</b>                                                 | Manual Calibration Complete                                           |
| Press <b>EXIT</b>                                               | Main Display                                                          |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                 |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                         |
| Press <b>EXIT</b>                                               | Main Display                                                          |

## 4.7 CONDUCTIVITY SENSOR

AUTO Calibration recognizes Air for zero point (Cal 1) and 50 $\mu$ S, 100 $\mu$ S, 500 $\mu$ S, 1mS, 5mS, 10mS, 50mS and 100mS solutions for the span (Cal 2). Any calibration solutions can be used but the conductivity value will have to be entered manually. Use a calibration standard near the conductivity of the process solution. Example uses air and 1mS.

### 4.7.1 AUTO CAL USING AIR AND CONDUCTIVITY STANDARD

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, pH, raw mV, Temperature              |
| Press <b>CAL</b>                                                | Place Sensor in air                                                       |
| Press <b>AUTO</b> then <b>CAL 1</b>                             | STABILIZING, Air cal, Accept Cal 1?                                       |
| Press <b>YES</b>                                                | CAL1 Value 0mV, Continue to CAL2? Move sensor to Calibration solution     |
| Press <b>YES</b>                                                | STABILIZING, xxx.x mV, corrected, Accept Cal?                             |
| Press <b>YES</b>                                                | OFFSET: x.x mV, SLOPE: 1000 mV (data written to Log)                      |
| Press <b>OK</b>                                                 | Calibration complete                                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON</b><br><b>Check box</b>                 | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

### 4.7.2 STANDARDIZE

With the sensor in the process solution, take a grab sample from the process and determine the conductivity using a qualified laboratory conductivity meter.

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, raw mV, Temperature                  |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>STAND</b>                                              | Enter Value in the Highlighted Field                                      |
| Press <b>OK</b>                                                 | xx.xx pH, xxx.x mV, Accept Value?                                         |
| Press <b>OK</b>                                                 | Standardization Calibration Complete                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON</b> <b>Check box</b>                    | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

## 4.8 TDS CONDUCTIVITY SENSORS

The Total Dissolved Solids measurement (TDS) on the Model T80 transmitter is made with an S80 conductivity sensor and a correlation factor. (*Conductivity in  $\mu\text{S}$  x correlation factor = ppm*)

Conductivity is a measurement of a solution's electrolytic conductivity, 1/ohms. The type of dissolved ions in the solution is irrelevant to the measurement. TDS is a measurement of concentration, ppm (mg/L). Since different salts contribute different amounts of conductivity to a solution, TDS measurements are only valid between solutions of the same chemical makeup. As an example, 1000 ppm of TDS in natural waters has a conductivity around 1400  $\mu\text{S}$  (correlation factor 0.6712), 1000 ppm of KCl has a conductivity around 2000  $\mu\text{S}$  (correlation factor 0.5000) and 1000 ppm of NaOH has a conductivity around 6000  $\mu\text{S}$  (correlation factor 0.1667). All three solutions have a TDS of 1000 ppm but the conductivities are 1400  $\mu\text{S}$ , 2000  $\mu\text{S}$  and 6000  $\mu\text{S}$ . A TDS measurement is only valid for a solution with the same chemical make up as the solution used for calibration.

Calibration is accomplished in two steps; Step 1 Conductivity AUTO Calibration of the sensor (see section 4.7.1 above) and then Step 2 correlation of conductivity to the TDS. The second step can be done by entering the correlation factor into the CONFIG → SENSOR → TDS menu or by standardizing the sensor in a solution of known TDS in the CAL → STAND menu by entering the TDS value. Since the correlation of conductivity to concentration is not linear it is best to calibrate the sensor near the measured value.

### 4.8.1 STANDARDIZE

With the sensor in the process solution, take a grab sample from the process and determine the TDS using a qualified laboratory method.

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, raw mV, Temperature                  |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>STAND</b>                                              | Enter Value in the Highlighted Field                                      |
| Press <b>OK</b>                                                 | xx.xx pH, xxx.x mV, Accept Value?                                         |
| Press <b>OK</b>                                                 | Standardization Calibration Complete                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON Check box</b>                           | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

## 4.9 RESISTIVITY SENSORS

AUTO Calibration recognizes Air for zero point (Cal 1) and a Meg-Ohm process solution for the span (Cal 2). Use the actual process solution or a solution near the resistivity of the process solution. The example below uses air and 15 MΩ. The Cal 1, air calibration value is very stable and need not be done for every calibration.

### 4.9.1 AUTO CAL USING AIR AND MEG-OHM PROCESS WATER

| Action                                                                                                                     | Prompt                                                                    |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                                                                                          | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD Off</b><br><b>Check box</b>                                                                           | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                                                                                          | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b>                                                            | Sensor Screen showing Sensor number, pH, raw mV, Temperature              |
| <b>To perform zero CAL press CAL 1, to skip zero cal press CAL 2, only if a zero cal was previously done on the sensor</b> |                                                                           |
| Press <b>AUTO</b> then <b>CAL 1</b>                                                                                        | STABILIZING, 55.000 MΩ, 1.20 V, 55.000 MΩ corrected, Accept Cal?          |
| Press <b>YES</b>                                                                                                           | CAL 1 Value 55.000 MΩ, Continue to CAL2? Move sensor to MΩ solution       |
| Press <b>YES</b>                                                                                                           | STABILIZING, 9.875 MΩ, 517 mV, 9.875 MΩ corrected, Accept Cal?            |
| Press <b>NO</b>                                                                                                            | Enter actual MΩ value of the solution, Accept Cal                         |
| Press <b>YES</b>                                                                                                           | OFFSET: 55.000 MΩ, 1.20 V, SLOPE: 0.938 (data written to Log)             |
| Press <b>OK</b>                                                                                                            | Calibration complete                                                      |
| Press <b>HOME</b>                                                                                                          | Hold is ON                                                                |
| Press <b>HOLD</b>                                                                                                          | Turn off Hold                                                             |
| Press <b>EXIT</b>                                                                                                          | Main Display                                                              |

### 4.9.2 STANDARDIZE

With the sensor in the process solution, take a grab sample from the process and determine the conductivity using a qualified laboratory conductivity meter.

| Action                                                          | Prompt                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------------|
| Press <b>Menu</b>                                               | MENU HOME, Hold is OFF                                                    |
| Press System <b>HOLD OFF</b><br><b>Check box</b>                | Hold freezes all 4-20 mA Output and locks Alarm Relays during Calibration |
| Press <b>Exit</b>                                               | Return to Home Screen                                                     |
| Press <b>Center of Box of the required Channel (Sensor 1-8)</b> | Sensor Screen showing Sensor number, raw mV, Temperature                  |
| Press <b>CAL</b>                                                | Place Sensor in CAL Solution (or leave in the process solution)           |
| Press <b>STAND</b>                                              | Enter Value in the Highlighted Field                                      |
| Press <b>OK</b>                                                 | xx.xx pH, xxx.x mV, Accept Value?                                         |
| Press <b>OK</b>                                                 | Standardization Calibration Complete                                      |
| Press <b>EXIT</b>                                               | Main Display                                                              |
| Press <b>Menu</b>                                               | MENU HOME, Hold is ON                                                     |
| Press System <b>HOLD ON Check box</b>                           | Turn off Hold                                                             |
| Press <b>EXIT</b>                                               | Main Display                                                              |

## 5.0 MAINTENANCE

No periodic maintenance is required for the ECD Model LQ800 Controller.

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.

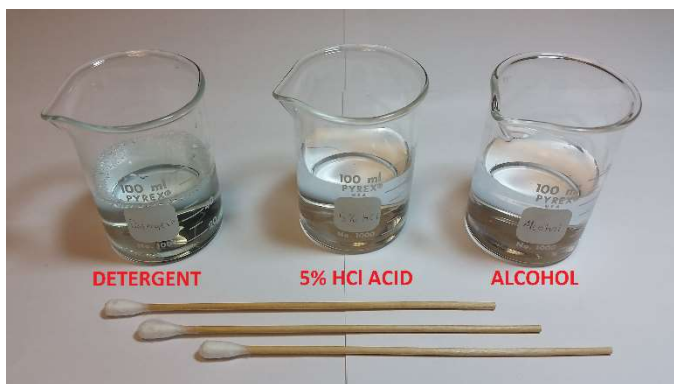
**Fuse:** There is a circuit board mounted fuse protecting the instrument. If you suspect that this needs to be replaced, contact the ECD service center for parts and instructions.

### 5.1 CLEANING

The Model LQ800 Controller 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.

### 5.2 HOW TO CLEAN THE SENSOR

If the process is especially dirty, the pH bulb may need to be cleaned periodically. A covered bulb will give incorrect readings and there are several ways to clean a bulb. The easiest way is to rinse it with De-Ionized water and wipe it off with a soft towel.



#### Special Cleaning Methods:

**Oils:** clean by warm water with a detergent solution for 10-20 min. An alternative is to rinse with an ethanol solution.

**Protein:** use 1% pepsin and 0.1 solution for 1 hour.

## 6.0 TROUBLESHOOTING

| Symptom                   | Probable cause                                | Remedy                                                                                                                                           |
|---------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank Display             | No Power                                      | Check power source, 24VDC, 110/220VAC                                                                                                            |
| 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, plon<br>0.00% for ORP<br>4.0% for DO                                                                                       |
| "Sensor Comm Lost" prompt | Lost connection between sensor and controller | Check sensor connection to controller, loose connector? Visually inspect cable for cuts or crushed areas, replace sensor if cable is compromised |

## 7.0 S80/DS80 SENSORS

S80/DS80 sensors are a family of digital sensors designed for use with ECD digital controllers, the Model LQ800 Controller. S80/DS80 sensors accept the standard ECD electrode cartridges. The S80/DS80 sensors convert the analog signals into a temperature compensated digital protocol that allows two way communications with the controller. 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 controller, the sensor's information is uploaded to the controller configuring the displays and outputs to the values appropriate to the sensors measured parameter. Connect a S80/DS80 pH sensor to a Model LQ800 Controller and the controller configures itself into a calibrated pH controller.

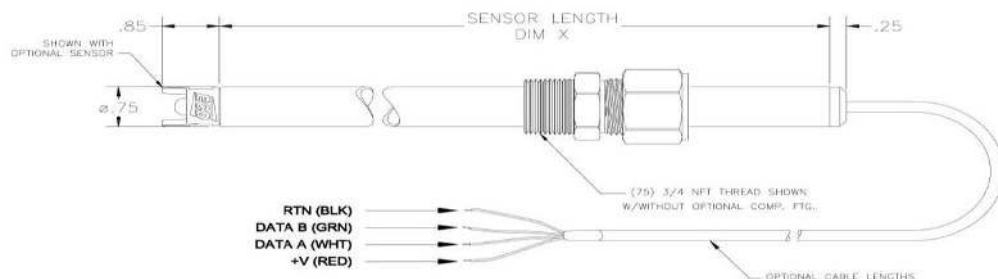
The internal components of the S80/DS80 sensors, the signal conditioner, temperature sensor, and cable assembly are epoxy encapsulated inside the  $\frac{3}{4}$ " O.D. housing. Epoxy encapsulation of the components increases the reliability of the sensor by eliminating failures caused by wiring and connector breakage. The S80/DS80 sensors use the same easily replaceable electrode cartridges as the S80, S10, and S17 sensor assemblies.

### 7.1 S80/DS80 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.

#### 7.1.1 INSERTION

The S80/DS80 sensor is installed using  $\frac{3}{4}$ " MNPT compression fitting with choice of nylon, Teflon, or 316 SS ferrule. The  $\frac{3}{4}$ " MNPT can be inserted into a pipe Tee or through a tank wall, the S80/DS80 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 sensors components.



#### 7.1.2 IMMERSION

The  $\frac{3}{4}$ " 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/DS80 sensor at least 5" into the tube and tighten the sensor in place.

#### 7.1.3 FLOW THROUGH

Although the insertion configuration can be used as a flow-through mounting by inserting the S80/DS80 sensor into a pipe tee, ECD has various flow cells available for convenience. The flow cells are 2.0" diameter by 5" long, ported  $\frac{1}{2}$ " FNPT through and  $\frac{3}{4}$ " 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.

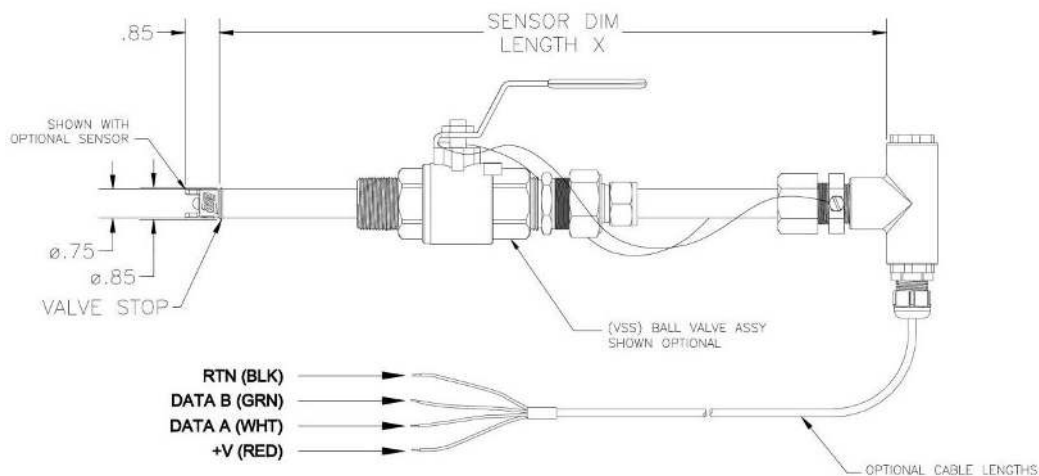
#### 7.1.4 VALVE RETRACTABLE

The S80/DS80 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 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 eternal 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.



#### 7.1.5 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.

## 7.2 DS80 PART NUMBER CONFIGURATOR

DS80 sensors are available in five measurement types, (-0,5) a millivolt style got pH, ORP, and ion selective measurements, (-1,6) dissolved oxygen style, (-2) contacting conductivity style, (-3) inductive conductivity style, and (-7) resistivity style. Each style is available in a variety of materials and insertion lengths.

| DS80 Digital Sensor |                                                                           |                                                                          |  |
|---------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------|--|
|                     | <b>Measurement type</b>                                                   |                                                                          |  |
|                     | -0 DS80 Digital Sensor, pH, ORP, pION measurement                         |                                                                          |  |
|                     | -1 DS80 Digital Sensor, Dissolved Oxygen measurement                      |                                                                          |  |
|                     | -2 DS80 Digital Sensor, Contacting Conductivity, 1µS to 50 mS             |                                                                          |  |
|                     | -3 DS80 Digital Sensor, Inductive Conductivity, 50 mS to 1000 mS          |                                                                          |  |
|                     | -5 DS80 Diagnostic Sensor, pH, ORP, pION measurement SENTINEL DS80 Sensor |                                                                          |  |
|                     | -6 DS80 Digital Sensor, ppb Dissolved Oxygen                              |                                                                          |  |
|                     | -7 DS80 Digital Sensor, Resistivity                                       |                                                                          |  |
|                     | <b>Sensor Style</b>                                                       |                                                                          |  |
|                     | 0 Insertion Style (Standard)                                              |                                                                          |  |
|                     | 1 Valve Retractable Style with flanged blow out protector                 |                                                                          |  |
|                     |                                                                           | <b>Housing Material</b>                                                  |  |
|                     |                                                                           | -0 Stainless Steel, ¾" O.D., (Standard)                                  |  |
|                     |                                                                           | 1 Valve Retractable Style with flanged blow out protector                |  |
|                     |                                                                           | <b>Housing Length</b>                                                    |  |
|                     |                                                                           | 0 10" length                                                             |  |
|                     |                                                                           | 1 17" length                                                             |  |
|                     |                                                                           | 2 24" length                                                             |  |
|                     |                                                                           | 3 30" length                                                             |  |
|                     |                                                                           | 4 36" length                                                             |  |
|                     |                                                                           | <b>Process Connection</b>                                                |  |
|                     |                                                                           | 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 (74HC) 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 (VSSHT) 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 316 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                                       |  |

|      |    |   |    |   |    |    |                                   |                                                               |   |
|------|----|---|----|---|----|----|-----------------------------------|---------------------------------------------------------------|---|
|      |    |   |    |   |    |    | <b>Detachable Cable Connector</b> |                                                               |   |
|      |    |   |    |   |    |    | 0 None                            |                                                               |   |
|      |    |   |    |   |    |    | 1 Straight (axial) Connector      |                                                               |   |
|      |    |   |    |   |    |    | 2 Right Angle Connector           |                                                               |   |
|      |    |   |    |   |    |    |                                   | <b>Cable Length</b>                                           |   |
|      |    |   |    |   |    |    |                                   | -0 No Cable (Detachable Cable Version only)                   |   |
|      |    |   |    |   |    |    |                                   | -1 10 ft. (Standard)                                          |   |
|      |    |   |    |   |    |    |                                   | -2 20 ft.                                                     |   |
|      |    |   |    |   |    |    |                                   | -3 30 ft.                                                     |   |
|      |    |   |    |   |    |    |                                   | -4 40 ft.                                                     |   |
|      |    |   |    |   |    |    |                                   | -5 50 ft.                                                     |   |
|      |    |   |    |   |    |    |                                   | -A 100 ft.                                                    |   |
|      |    |   |    |   |    |    |                                   | <b>"T" Handle</b>                                             |   |
|      |    |   |    |   |    |    |                                   | 0 No "T" Handle                                               |   |
|      |    |   |    |   |    |    |                                   | 1 (T) "T" Style handle with Lanyards for Valve Retractable    |   |
|      |    |   |    |   |    |    |                                   | 2 (TP) "T" Style handle, ¾" polypro fitting (1000096)         |   |
|      |    |   |    |   |    |    |                                   | 3 (TS) "T" Style handle, ¾" stainless steel fitting (1000098) |   |
|      |    |   |    |   |    |    |                                   | 4 (TN) "T" Style handle, 1" Nylon fitting (1000104)           |   |
|      |    |   |    |   |    |    |                                   | 5 (TD) ¾" Tee for INSERTION w/ Detachable Conn (2000092)      |   |
|      |    |   |    |   |    |    |                                   | 6 (TDV) ¾" Tee for VALVE w/ Detachable Conn (2000166)         |   |
|      |    |   |    |   |    |    |                                   | 7 (1TD) 1" Tee for INSERTION w/ Detachable Conn (2000119)     |   |
|      |    |   |    |   |    |    |                                   | 8 (1TDV) 1" Tee for VALVE w/ Detachable Conn (2000118)        |   |
|      |    |   |    |   |    |    |                                   | <b>O-rings Guard &amp; Fittings</b>                           |   |
|      |    |   |    |   |    |    |                                   | 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                                       |   |
| DS80 | -0 | 0 | -0 | 0 | 01 | -0 | 1                                 | 1                                                             | 0 |

## 7.3 TRITON® DO82 SENSORS

| DO82 Dissolved Oxygen Sensor |              |                            |                |                               |                     |  |  |
|------------------------------|--------------|----------------------------|----------------|-------------------------------|---------------------|--|--|
|                              | Sensor Style |                            |                |                               |                     |  |  |
|                              | -0           | (I) Immersion Style Sensor |                |                               |                     |  |  |
|                              | -1           |                            |                |                               |                     |  |  |
|                              | -2           |                            |                |                               |                     |  |  |
|                              | -3           |                            |                |                               |                     |  |  |
|                              |              | Spray Cleaner              |                |                               |                     |  |  |
|                              |              | 00                         |                |                               |                     |  |  |
|                              |              | 01                         |                |                               |                     |  |  |
|                              |              | 02                         |                |                               |                     |  |  |
|                              |              |                            | Cable Style    |                               |                     |  |  |
|                              |              |                            | -0             | Fixed Cable                   |                     |  |  |
|                              |              |                            | -1             | (DA) Axially Detachable Cable |                     |  |  |
|                              |              |                            |                | Cable Length                  |                     |  |  |
|                              |              |                            |                | 00                            | No Cable            |  |  |
|                              |              |                            |                | 10                            | 10 ft (3 meters)    |  |  |
|                              |              |                            |                | 20                            | 20 ft (6.1 meters)  |  |  |
|                              |              |                            |                | 30                            | 30 ft (9.1 meters)  |  |  |
|                              |              |                            |                | 40                            | 40 ft (12.2 meters) |  |  |
|                              |              | 50                         |                | 50 ft (15.2 meters)           |                     |  |  |
|                              |              | X0                         | Specify Length |                               |                     |  |  |
| DO82                         | -1           | 00                         | -1             | 10                            |                     |  |  |

## 7.4 TRITON® TR80/82 SENSORS

| TR86 Turbidity Suspended Solids Sensor |                      |                              |                                                                 |                                                          |
|----------------------------------------|----------------------|------------------------------|-----------------------------------------------------------------|----------------------------------------------------------|
|                                        | <b>Optical Style</b> |                              |                                                                 |                                                          |
|                                        | 1                    | Front Mounted Optics, CPVC   |                                                                 |                                                          |
|                                        | 2                    | Side Mounted Optics, PolyPro |                                                                 |                                                          |
|                                        |                      | <b>Process Connection</b>    |                                                                 |                                                          |
|                                        |                      | 0                            | None                                                            |                                                          |
|                                        |                      | 1                            | Nylon Gland Fitting                                             |                                                          |
|                                        |                      | 2                            | Flow Through Cell, 2 x 2" FNPT entries, 1 x 1" FNPT sensor port |                                                          |
|                                        |                      |                              | <b>Cable Type and Length</b>                                    |                                                          |
|                                        |                      |                              | 01                                                              | 10 ft. (3.0 meters) (Waterproof/Submersible Cable Style) |
|                                        |                      |                              | 02                                                              | 20 ft. (6.1 meters) (Waterproof/Submersible Cable Style) |
|                                        |                      |                              | 03                                                              | 30 ft. (9.1 meters) (Waterproof/Submersible Cable Style) |
|                                        |                      |                              |                                                                 |                                                          |
|                                        |                      |                              |                                                                 |                                                          |
|                                        |                      |                              |                                                                 |                                                          |
|                                        |                      |                              |                                                                 |                                                          |
|                                        |                      |                              | <b>Measurement Range</b>                                        |                                                          |
|                                        |                      |                              | 0                                                               | 0-1000 NTU                                               |
|                                        |                      |                              | 2                                                               | 0-4000 NTU                                               |
|                                        |                      |                              | 4                                                               | <40 NTU                                                  |
| TR86                                   | 3                    | 2                            | 01                                                              | 1                                                        |

## 7.5 S80/DS80 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 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. In general, a pH electrode can last from 12-15 months in potable water @ 25 deg. C with a max flow rate of 10 ft./sec. @ Atm pressures. Different conditions of the process will vary the electrode life.

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.

### 7.5.1 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.**

### 7.5.2 ELECTRODE CARTRIDGE REPLACEMENT

Periodic replacement of the electrode cartridges 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 8.5.1 Electrode Cartridge Installation.

### 7.5.3 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 measurement. 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 electrode.

If possible, the electrode 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).

### 7.5.4 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.*

#### **7.5.5 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.

#### **7.5.6 ION 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 reactions with the process solution. Periodic cleaning or polishing will minimize drift and maintain the sensor's 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,  $\text{Ca}^{++}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$ ,  $\text{NO}_3^{-}$  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 0.3 micron 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.

#### **Fluoride Electrodes:**

- 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 and moisten the tip of 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.



### 7.5.7 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.

### 7.5.8 TRITON DO82 DISSOLVED OXYGEN

The Triton DO82 sensor should receive maintenance on a regular basis. The maintenance interval should be determined empirically, as it will depend on the installation conditions and the nature of the media being measured. The interval should be no greater than every two months.

#### Maintenance Procedure

The typical procedure would include:

- Cleaning the sensor
- Check the measuring function:
  - Remove the sensor from the medium.
  - Clean and dry the sensor/membrane.
  - After about 10 minutes in air, measure the oxygen saturation index (without recalibration).
  - The measured value should be at  $100 \pm 4\%$  SAT
- If necessary, replace a defective membrane or one which cannot be cleaned anymore.
- Recalibration, if necessary.

#### Cleaning the Sensor

The fluorescence cap of the Triton DO82 sensor must be clean to ensure an accurate measurement. The measurement will degrade as the fluorescence cap gets coated. Build-up of material will increase the response time and decrease the slope. The sensor should be cleaned on a regular basis and before every calibration.

**\*\*\* Do not scrub the sensing portion of the cap with any abrasive material, use only a soft sponge or cloth and water to clean the tip \*\*\***

The cleaning method depends on the nature of the coating. For the insoluble mineral or salt deposits, the sensor should be soaked in a 1-55 solution of HCl, hydrochloric acid, for no more than 10 minutes. After this acid treatment, rinse the sensor with copious amounts of tap water, and then allow it to soak in the tap water for at least 5 minutes before evaluating the performance. Repeat if necessary.

For biological films or dirt, rinse the tap water and gently wipe the sensing with a soft sponge or cloth.

#### Cleaning Internal Optics

The internal optical surface should only need cleaning if the Fluorescence Cap is broken or defective. The following steps should be followed in the case of a leaking cap.

1. Unscrew the protective guard and the fluorescence cap from the sensor head.
2. Carefully clean the optical surface with a soft cloth and water until the buildup is fully removed.
3. Use only drinking or distilled water to clean the optics, do not scratch the optical surface.
4. Dry the optics with a soft lint free cloth, and screw on a new fluorescence cap.

### 7.5.8.1 Replacing the Fluorescent Cap

The Fluorescence Cap (P/N 2500207) can provide up to two years' service. If damaged or when it expires, it is easily replaced.

#### Removing the Old Fluorescence Cap:

- Remove the sensor from the medium.
- Unscrew the protection guard.
- Clean the protection guard.
- Clean the outside of the sensor.
- Unscrew the fluorescence cap.
- Clean and dry the optical surface if necessary.

#### Installing the New Fluorescence Cap:

- Make sure that there are no dirt particles on the sealing surface.
- Visually inspect the sealing o-ring, replace if necessary (P/N 1000225).
- Carefully screw the fluorescence cap onto the sensor head until the stop.
- Screw the protection guard back on.

**\*\*\* After replacing the Fluorescence Cap, the sensor must be calibrated \*\*\***

### 7.5.9 TRITON TR80/TR82 TURBIDITY

The TR80/TR82 Turbidity sensors don't require periodic service except in coating applications. Quarterly checks should be performed to assure the accuracy of the measurement.

The TR80/TR82 response can become sluggish due to coating from materials in the process solution. Periodic cleaning will minimize drift, and maintain the sensors response.

#### CLEANING

The most important maintenance item is keeping the optically clear epoxy window clean. The TR80/TR82 turbidity sensors are fairly robust, and can be cleaned with alcohols, detergents or dilute acids to remove coatings caused by greases, oils, or films. Do not use solvents such as MEK, Toluene, Acetone, or trichloroethylene on TR80/TR82 sensors. A soft tooth brush or paper towel should be used to remove soft coatings. A Scotch Brite scouring pad works well for most types of stubborn window fouling. First wet the pad, and then place it on a counter with a plastic-laminate top so that the pad until it is clean while removing as little epoxy as possible. If encrusting organisms, such as barnacles or tube worms, have attached to the sensor, it will have to be gently scraped with a flexible knife blade prior to using the pad.

#### POLISHING

Some applications will result in pitting of the sensor face. Pits can be removed with abrasive cloth. Polish the sensor window as follows:

1. Tape a strip of 400 grit wet-or-dry abrasive cloth to the edge of a counter.
2. Add a few drops of water to the abrasive and work the sensor window in smooth one-way strokes on the cloth using the counter edge as a guide.
3. Continue until the sensor is shiny and pit free.

**\*\*\* It is important to remove as little epoxy as possible. \*\*\***

### 7.5.10 CONDUCTIVITY AND RESISTIVITY SENSORS

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

Resistivity sensors rarely need cleaning due to the nature of the measurement. If cleaning is necessary, or the sensor has been in service for greater than two years, follow the instructions listed below.

Rinse the sensing end with alcohol, methanol, ethanol, or isopropyl will work fine.

Soak for 5 minutes in a dilute nitric acid solution, a 3.5% solution is made by a 20:1 dilution of concentrated Nitric Acid (5 ml HNO<sub>3</sub> in 100 ml of water).

Then rinse thoroughly with tap water and soak in distilled water for 5-10 minutes.

## 7.6 S80/DS80 SENSOR SPECIFICATIONS

### Dimensions:

S80/DS80 – 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:

Standard: Viton™ (VIT)

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

### 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™                |
| -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/DS80          | 2.5 lbs. (1.2 kg)  |
| S80/DS80 with VSS | 5.8 lbs. (2.65 kg) |

### 7.6.1 PH ELECTRODE

| 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      |
| 2005111     | Extended Life, RADEL body, TFE junction, Flat Glass                | 0-14 pH  | -10°-50°C   | 150 psig      |

### 7.6.2 ORP ELECTRODES

Part#: 2005167 (2005367 SENTINEL)  
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

### 7.6.3 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

#### **7.6.4 AMMONIUM ELECTRODE**

Part#: 2005083 (2005383 SENTINEL)  
ISE sensor: PVC membrane  
Construction: Radel (PES) body  
Reference Electrode: double porous Teflon junction  
Measurement range: 0.05 – 18,000 ppm  
pH Range: 2-12 pH  
Temperature Range: 0° - 50°C  
Pressure Range: 150 psig

#### **7.6.5 BROMIDE ELECTRODE**

Part#: 2005062 (2005362 SENTINEL)  
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

#### **7.6.6 CADMIUM ELECTRODE**

Part#: 2005140 (2005340 SENTINEL)  
ISE sensor: solid state CdC membrane  
Construction: Radel (PES) body  
Reference Electrode: double porous Teflon junction  
Measurement range: 100 ppb – 11,200 ppm  
pH Range: 3 – 9 pH  
Temperature Range: 0° - 80°C  
Pressure Range: 50 psig

#### **7.6.7 CALCIUM ELECTRODE**

Part#: 2005043 (2005343 SENTINEL)  
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° - 80°C  
Pressure Range: 50 psig

#### **7.6.8 CHLORIDE ELECTRODE**

Part#: 2005008 (2005308 SENTINEL)  
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

### 7.6.9 CUPRIC ELECTRODE

Part#: 2005058 (2005358 SENTINEL)  
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

### 7.6.10 CYANIDE ELECTRODE

Part#: 2005042 (2005342 SENTINEL)  
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

### 7.6.11 FLUORIDE ELECTRODE

Part#: 2005163 (2005363 SENTINEL)  
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

### 7.6.12 LEAD ELECTRODE

Part#: 2005141 (2005341 SENTINEL)  
ISE sensor: solid state PbS membrane  
Construction: Radel (PES) body  
Reference Electrode: double porous Teflon junction  
Measurement range: 2 ppm – 20,700 ppm  
pH Range: 4 – 8 pH  
Temperature Range: 0° – 80°C  
Pressure Range: 50 psig

### 7.6.13 POTASSIUM ELECTRODE

Part#: 2005034 (2005334 SENTINEL)  
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° - 80°C  
Pressure Range: 150 psig

#### 7.6.14 SILVER ELECTRODE

Part#: 2005016 (2005316 SENTINEL)  
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

#### 7.6.15 SODIUM ELECTRODE

Part#: 2005031 (2005331 SENTINEL)  
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

#### 7.6.16 SULFIDE ELECTRODE

Part#: 2005122 (2005322 SENTINEL)  
ISE sensor: solid state AgS membrane  
Construction: PEEK body  
Reference Electrode: double porous Teflon junction  
Measurement range: 0.01 – 32,000 ppm  
pH Range: 2 – 14 pH (pH must be 3 units higher than pNa)  
Temperature Range: 0° - 80°C  
Pressure Range: 150 psig

#### 7.6.17 TRITON® DO82

Measurement Range: 0 -20 mg/l (0 – 20 ppm)  
0 – 200 % Saturation  
0 – 400 mbar (0 – 6 psi)  
Pressure Range: Maximum Pressure 10 bar (159 psi)  
Temperature Range: -5° - 50°C (20° - 120°F) Measuring  
-20° - 60°C (0° - 140°F) Ambient  
Response Time: T90 = 60 sec  
Accuracy: Max. Error < 2 % of measured range  
Repeatability: ±0.5 % of measured range  
Resolution: 0.01 ppm or 0.01 % Saturation  
Operating Lifetime of Sensor Cap: Up to 2 years in recommended service, typically > 1 year  
Wetted Materials: 316 SS, POM, PVC, Silicone  
Sensor Cable: Shielded 7 core cable, 7 meter (23 ft.) or 15 meter (49 ft.) lengths  
Process Connection: G1 Thread (3/4" FNPT adapter available)  
Maximum Cable Length: 100 m maximum from C-22 controller  
Dimensions: Length 8.7" (220 mm), Diameter 1.6" (40 mm)  
Weights: Cable length 7 m (23 ft.): 0.7 kg (1.5 lbs.)  
Cable length 15 m (49 ft.): 1.1 kg (2.4 lbs.)

### 7.6.18 TRITON® TR80/TR82

**Measuring principle:**

Particle caused back scattering of 850 nm near infrared light with sunlight rejection filter

**Measuring Range:**

-0 Sensor

0 - 1000 NTU, FNU

-2 Sensor

0 - 4000 NTU, FNU

-4 Sensor

<40 NTU, FNU

**Accuracy:**

2% of reading or 0.5 NTU, whichever is larger

**Process Temperature Range:**

-5 ... 50°C

**Temperature Compensation:**

Internal Temperature Compensation

**Process pressure range:**

50 psi maximum in Flow Cell

500 meter submersion depth (50 bar, 725 psi)

Vacuum operation is not permitted

**Drift:**

< 1% / month

**Wetted Materials**

Sensor Body: stainless steel AISI 316 Ti

Sensing end: epoxy

**Process Connection:**

1" NPT Nylon compression fitting

**Electrical connection**

Waterproof 5-wire measuring cable or

Water Resistant 5-wire measuring cable (Standard)

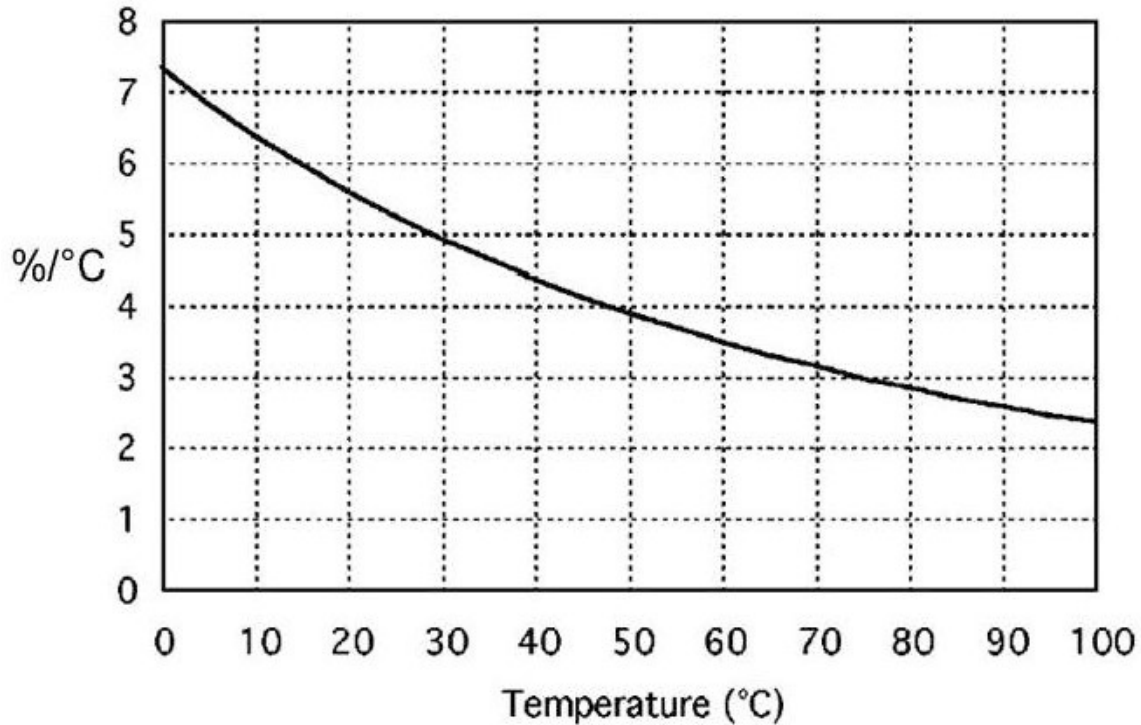
**Cable Length:**

10 ft (3.0 m), 20 ft (6.1 m), 30 ft (9.1 m) cables

## Appendix A    Resistivity Temperature Compensation

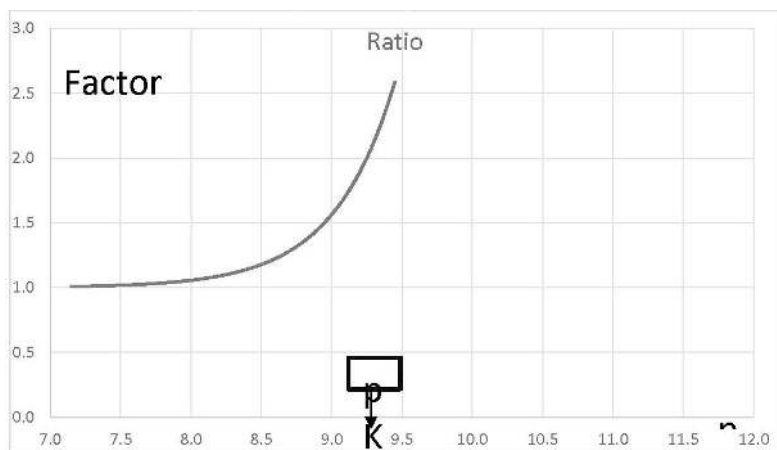
The temperature coefficient of pure water changes with concentration and temperature. The graph below shows the % change per °C for 18.2 MΩ water. For the range of 20° - 40°C the mean value is -5% per °C, this is the default value set in the Model LQ800. The temperature coefficient of 10 MΩ water drops to a mean value of -2.6%. The standard Resistivity temperature coefficient of -2.0%/°C is valid for all values below 1.0 MΩ water.

The Temperature Coefficient is set in CONFIG → SENSOR→ T COMP→ -5.00



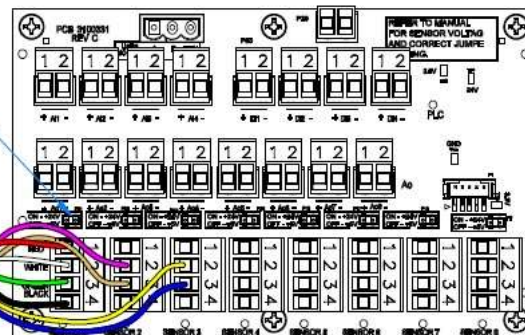
## Appendix B    Hydra-DS pH Compensation and Wiring Diagram

| pH   | Ratio | pH          | Ratio        | pH    | Ratio | pH    | Ratio |
|------|-------|-------------|--------------|-------|-------|-------|-------|
| 7.15 | 1.008 | 8.35        | 1.126        | 9.55  | 2.995 | 10.75 | 32.62 |
| 7.25 | 1.010 | 8.45        | 1.158        | 9.65  | 3.512 | 10.85 | 40.81 |
| 7.35 | 1.013 | 8.55        | 1.200        | 9.75  | 4.162 | 10.95 | 51.12 |
| 7.45 | 1.016 | 8.65        | 1.251        | 9.85  | 4.981 | 11.05 | 64.10 |
| 7.55 | 1.020 | 8.75        | 1.316        | 9.95  | 6.012 | 11.15 | 80.43 |
| 7.65 | 1.025 | 8.85        | 1.398        | 10.05 | 7.310 | 11.25 | 101.0 |
| 7.75 | 1.032 | 8.95        | 1.501        | 10.15 | 8.943 | 11.35 | 126.9 |
| 7.85 | 1.040 | 9.05        | 1.631        | 10.25 | 11.00 | 11.45 | 159.5 |
| 7.95 | 1.050 | 9.15        | 1.794        | 10.35 | 13.59 | 11.55 | 200.5 |
| 8.05 | 1.063 | <b>9.25</b> | <b>2.000</b> | 10.45 | 16.85 | 11.65 | 252.2 |
| 8.15 | 1.079 | 9.35        | 2.259        | 10.55 | 20.95 | 11.75 | 317.2 |
| 8.25 | 1.100 | 9.45        | 2.585        | 10.65 | 26.12 | 11.85 | 399.1 |



The diagram illustrates the HYDRA-DIGITAL SENSOR assembly. It features a sensor head with a threaded body and a flange. A cable is connected to the sensor head, and a connector is attached to the cable. The connector has a label that reads: "MODEL HYDRA-DIGITAL SENSOR", "TYPE 0000000000", "SERIAL 0000000000", "MANUFACTURER 000000", and "KROHNE".

| COLOR  | DESC.  | LQ800 LOC.  |
|--------|--------|-------------|
| RED    | 24VDC  | SENSOR #1-1 |
| WHITE  | DAT_A1 | SENSOR #1-2 |
| GREEN  | DAT_B1 | SENSOR #1-3 |
| BLACK  | RTN    | SENSOR #1-4 |
| PURPLE | DAT_A2 | SENSOR #2-2 |
| BROWN  | DAT_B2 | SENSOR #2-3 |
| YELLOW | DAT_A3 | SENSOR #3-2 |
| BLUE   | DAT_B3 | SENSOR #3-3 |





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