Instruction Manual

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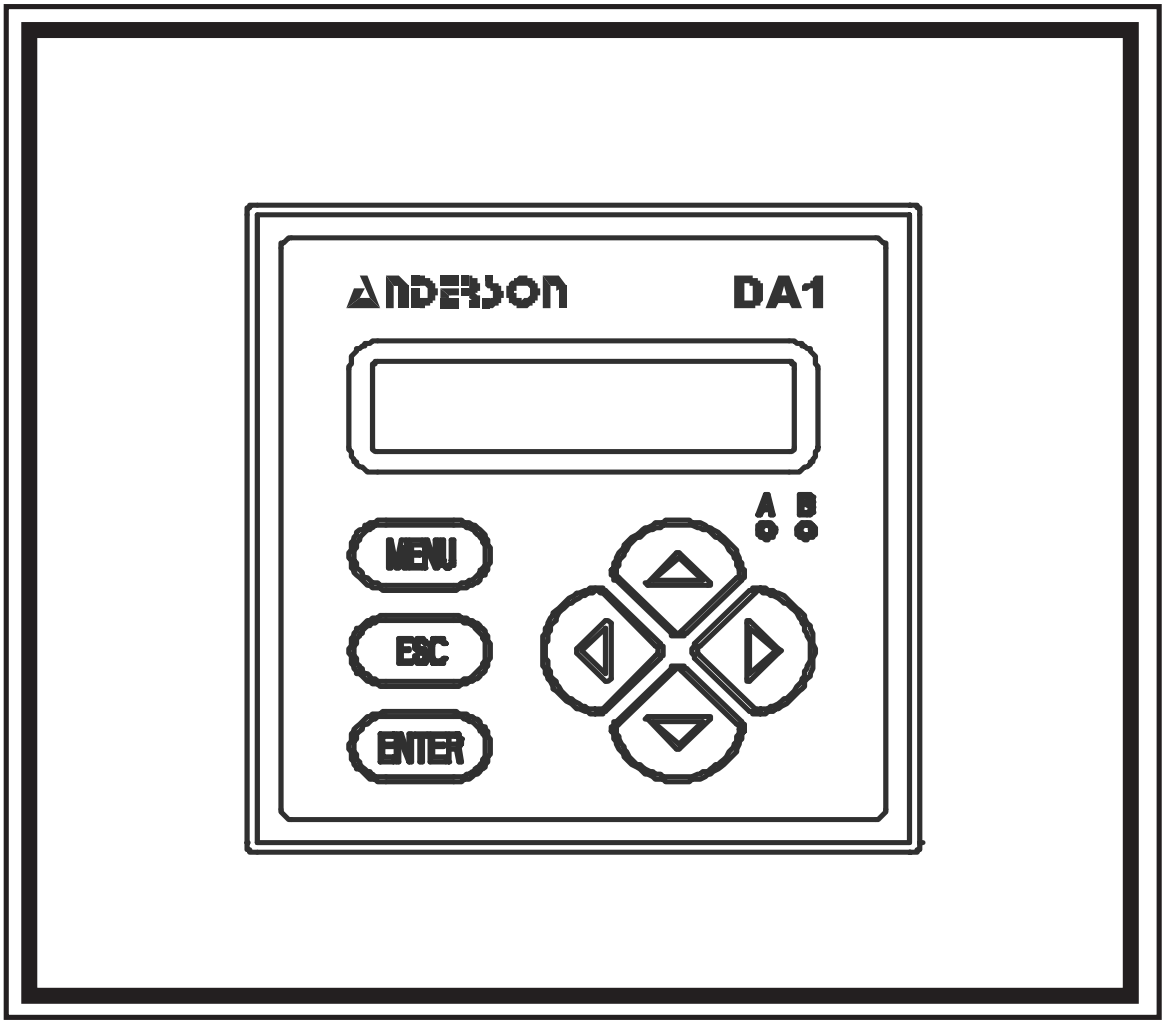
Instrument Model Number _____

Instrument Serial Number _____



MODEL DA1 ELECTRODELESS CONDUCTIVITY ANALYZER

(Panel-mount 1/4 DIN style; selectable for conductivity, % concentration, and TDS)

Form Number AIC2033

Table of Contents

Section 1- General Information

1.1 Capability Highlights

Sensor Input

The analyzer can be used with any HC1 series electrodeless conductivity sensor. These sensors have a built-in Pt 1000 RTD temperature compensator element.

Measure Screen

The MEASURE screen (normal display mode) can provide different readouts of measured data. With the MEASURE screen displayed, press **⇦ or ⇨ key** to show:

- Measured conductivity, % concentration or TDS
- Measured uncompensated conductivity corresponding to above readout
- Measured temperature (°C or °F)
- Measured analog output 1 and 2 values (mA)
- Measured conductivity, % concentration or TDS and temperature

Passcode-protected Access

For security, you can enable a passcode feature to restrict access to configuration and calibration settings to authorized personnel only. See Section 7.6 for details.

Calibration Methods

Each sensor has a unique zero point and span. Therefore, always ZERO the sensor in air if it is being calibrated for the first time (Section 8.2). Specific methods to calibrate for sensor span are available and dependent on the analyzer's configured measurement (conductivity, % concentration or TDS). For calibration details, refer to Section 8.3, 8.4 or 8.5 respectively. The mA values for each analog output can also be calibrated (Section 8.6).

Analog Outputs

The analyzer provides two isolated analog outputs (1 and 2). Each output can be set to be 0-20 mA or 4-20 mA, and assigned to represent one of these measurements:

- Measured conductivity, % concentration or TDS
- Measured temperature

Parameter values can be entered to define the endpoints at which the minimum and maximum analog output values are desired (range expand). For analog output setup details, refer to Section 7.4.

During calibration, both analog outputs can be selected to:

- Hold their present values (HOLD OUTPUTS).
- Transfer to preset values to operate control elements by an amount corresponding to those values (XFER OUTPUTS).
- Remain active to respond to the measured value (ACTIVE OUTPUTS).

Relays

The analyzer has two electromechanical relays with SPDT contacts. Each relay can be set to function as a CONTROL, ALARM, TIMER or STATUS relay. CONTROL and ALARM relays can be assigned to be driven by one of these measurements:

- Measured conductivity, % concentration or TDS
- Measured temperature

NOTE: *Since TIMER and STATUS relays are driven by other criteria, the parameter assigned to these relays is not relevant and, therefore, disregarded.*

Refer to Section 7.5 for relay setup details.

NOTE: *When a relay is set to function as a STATUS relay, it is no longer configurable. Instead, it becomes a dedicated system diagnostic-only alarm relay that automatically energizes when the "WARNING CHECK STATUS" message flashes on the MEASURE screen. This occurs when the analyzer detects a "fail" diagnostic condition. See Section 9.1 for more details.*

Except for STATUS relays, during calibration the relay on/off states are affected in the same way as the analog outputs by the "(HOLD/XFER/ACTIVE) OUTPUTS" screen selection. These relays are also held at their present on/off states, transferred to desired preset on/off states, or remain active to respond to measured values.

1.2 Modular Consturuction

The modular construction of the analyzer provides electrical safety. The front panel keypad assembly uses voltages no greater than 24 VDC, and is completely safe to handle.

Line power must be connected to specifically designated terminals on TB1.

WARNING:
REMOVE LINE POWER BEFORE NEARING THIS AREA TO PREVENT ELECTRICAL SHOCK.

1.3 Retained Configured Values

All user-entered configuration values are retained indefinitely, even if power is lost or turned off. The non-volatile memory of the analyzer does not require battery backup.

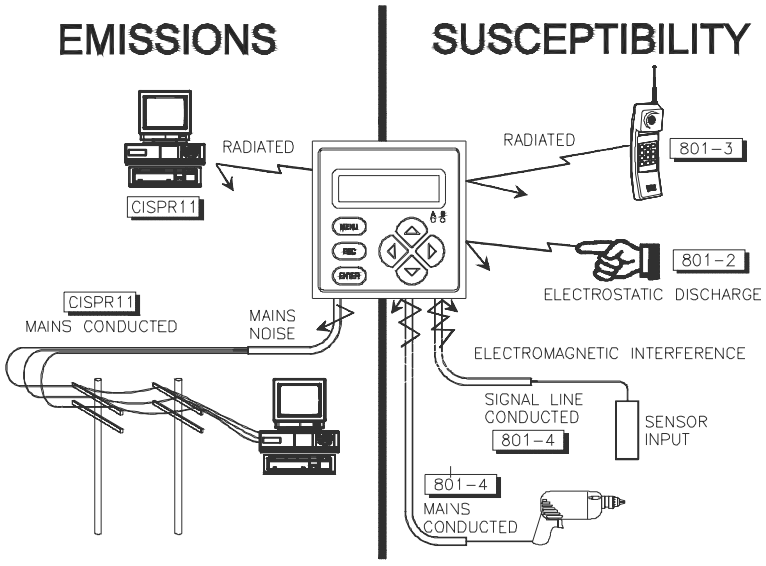
1.4 Analyzer Serial Nmber

A label with the analyzer model number, serial number, build date, and other items is located on top of the enclosure.

1.5 EMI / RFI Immunity

The analyzer is designed to provide protection from most normally encountered electromagnetic interference. This protection exceeds U.S. standards and meets European IEC 801-series testing for electromagnetic and radio frequency emissions and susceptibility. Refer to Figure 1-1 and the specifications in Section 2.1 for more information.

FIGURE 1-1 EMI/RFI Immunity Diagram



Section 2 - Specifications

2.1 Operational

Display	Two-line by 16 character backlit LCD

NOTE: *The measured value (conductivity, % concentration or TDS) or temperature can be displayed separately or shown together on a single screen. Both analog output values can also be shown.*

Measurement	**Selectable Ranges**
Conductivity	µS/cm: 0-200.0 or 0-2000
	mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000
	S/cm: 0-2.000
% Concentration	0-99.99% or 0-200.0%
TDS	0-9999 ppm
Temperature	-4.0 to 392.0°F or -20.0 to +200.0°C
Temperature Compensation	Automatic from 14.0 to 392.0°F (-10.0 to +200.0°C) with selection for Pt 1000 ohm RTD temperature element, or manually fixed at a user-entered temperature

NOTE: *The selected measurement (conductivity, % conc. or TDS) determines which of the following temperature compensation methods are available:*
Linear % per °C slope, built-in natural water temperature properties table, user-entered temperature table, or no compensation

Sensor-to-Analyzer Distance — Maximum cable length is a function of the measuring range and allowable non-linearity. The following schedule is recommended:

Full-scale Range	**Max.Length**
200 to 2000 µS/cm	200 ft. (61 m)
2000 to 2,000,000 µS/cm	300 ft. (91 m)

NOTE: *When measuring % concentration, convert the analyzer full-scale value to conductivity to determine the maximum distance.*

Outputs:

Analog Outputs (1 and 2)	Two isolated 0/4-20 mA outputs; each with 0.004 mA (12-bit) resolution and capability to drive up to 600 ohm loads.

NOTE: *Each output can be assigned to represent the selected measurement (conductivity, % conc. or TDS) or measured temperature. Parameter values can be entered to define the endpoints at which the minimum and maximum mA output values are desired (range expand).*

Relays (A and B)	Two electromechanical relays; SPDT (Form C) contacts; 5A; 115/230 VAC, 5A @ 30 VDC resistive
Relay Operational Mode	Each relay (A and B) can be driven by the selected measurement (conductivity, % conc. or TDS) or measured temperature

PAGE 8

Relay Function Modes:

Control	Settings for high/low phasing, setpoint, deadband, overfeed timer, off delay, and on delay
Alarm	Settings for low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay
Timer	Relay is activated by user-entered interval and time duration values
Status	Not configurable; relay only activates when a sensor or analyzer diagnostic WARNING condition exists.
Relay Indicators	Relay A and B LEDs indicate respective relay status

Calibration Methods:

Sensor ZERO (all measurements)	With the dry sensor in air, press keys to initiate automatic system zeroing.
Conductivity Measurement:	
COND CAL	Enter compensation reference temperature, linear % per °C slope, and one known reference solution value.
SAMPLE CAL	Enter one sample value (determined by laboratory analysis or a comparison reading).
ELECTRONIC CAL	Enter one sample value to match conductivity simulated utilizing a decade resistance box.
Concentration Measurement:	
CONC CAL	Enter one sample value (determined by laboratory analysis or comparison reading).
COND CAL	Enter compensation reference temperature, linear % per °C slope, and one known reference solution value.
TDS Measurement:	
TDS CAL	Enter one sample value (determined by laboratory analysis or comparison reading).
Power Requirements	90-130 VAC, 50/60 Hz. (10 VA max.) or 190-260 VAC, 50/60 Hz. (10 VA max.)
HART Communication: (optional)	Enables configuration and retrieval of measured data for multiple analyzers over a communication link using appropriate hand-held terminal or data system with HART software
Memory Backup (non-volatile)	All settings retained indefinitely in EEPROM

2.2 Performance (Electrical, Analog Outputs)

Accuracy*	0.5% of span
Stability*	0.2% of span per 24 hours, non-cumulative
Repeatability*	0.1% of span or better
Temperature Drift*	Zero and Span: less than 0.02% of span/°C

*These typical performance specifications are:

1. Based on 25°C with conductivity of 500 µS/cm and higher. Consult factory for applications in which conductivities are less than 500 µS/cm.
2. Derated above 100°C to the maximum displayed temperature of 200°C. Consult factory for details.

2.3 Mechanical

Enclosure (Panel Mount)	Polycarbonate ; general purpose; two brackets supplied. 3.70" H x 3.70" W x 6.03" L (94mm L x 94mm W x 153mm L)
Panel Cutout Dimensions:	3.59" W x 3.59" H (91mm W x 91mm H)
Enclosure (Wall Mount)	Fiberglass reinforced polyester, with (3) cable grommets in bottom 7.50" W x 8.75" H x 6.00" D (19mm W x 22mm H x 15mm W)
Net Weight (Panel Mount)	1.7 lbs. (0.8 kg) approximately
Net Weight (Wall Mount)	4.4 lbs. (2.1 kg) approximately
Ambient Conditions:	
Operation	-4 to +140°F (-20 to +60°C); 0-95% relative humidity, non-condensing
Storage	-22 to +158°F (-30 to +70°C); 0-95% relative humidity, non-condensing

Section 3 - Physical Installation

After unpacking, it is recommended to save the shipping carton and packing materials in case the instrument must be stored or re-shipped. Inspect the equipment and packing materials for signs of shipping damage. If there is any evidence of damage, notify the transit carrier immediately.

3.1 Location

1. It is recommended to locate the analyzer as close as possible to the installed sensor. The maximum allowable distance between an installed sensor and the analyzer depends upon the full-scale value you set for the analyzer measuring range:

200-2000 µS/cm Full-scale Value	2000-2,000,000 µS/cm Full-scale Value
200 feet (61 m)	300 feet (91 m)

NOTE: *When measuring % concentration, convert the analyzer full-scale value to conductivity to determine the maximum distance.*

2. Mount the analyzer in a location that is:

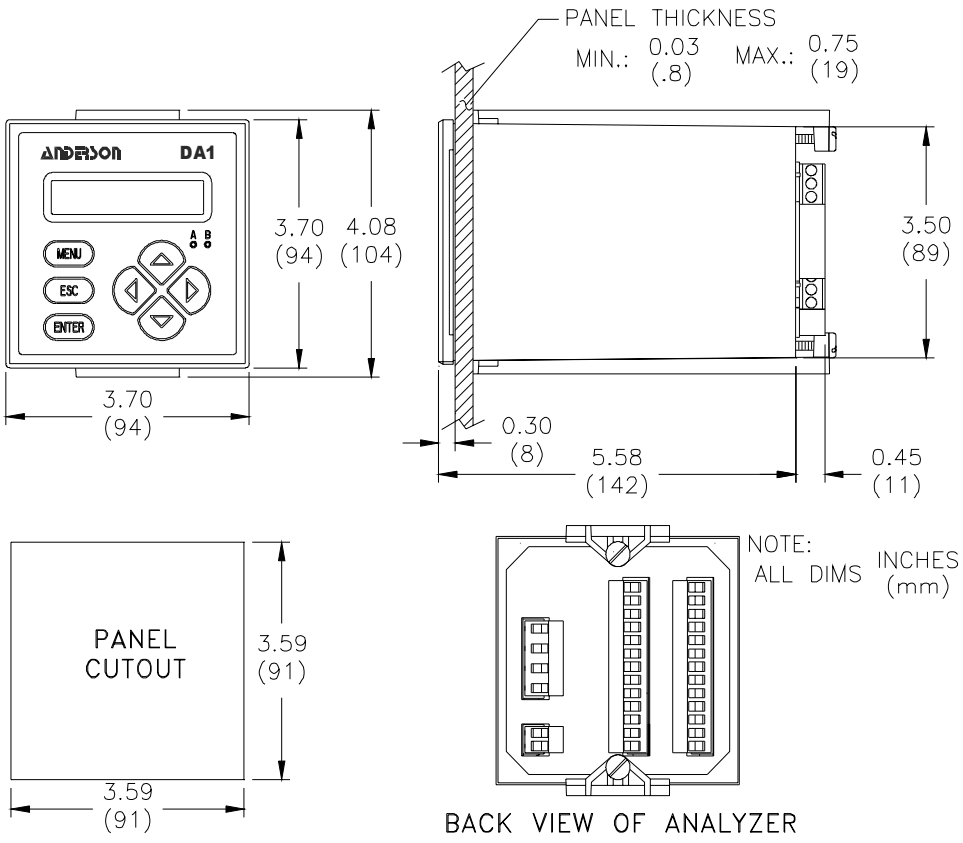
   - Clean and dry where there is little or no vibration.
   - Protected from corrosive fluids.
   - Within ambient temperature limits (-4 to +140°F or -20 to +60°C).

   CAUTION:
   EXPOSING THE ANALYZER TO DIRECT SUNLIGHT MAY INCREASE THE OPERATING TEMPERATURE ABOVE ITS SPECIFIED LIMIT, AND DECREASE DISPLAY VISIBILITY.

3.2 Panel Mounting

Figure 3-1 illustrates the analyzer enclosure dimensions and panel mounting details. Using the two supplied brackets, attach them to the analyzer case as shown to panel mount the analyzer.

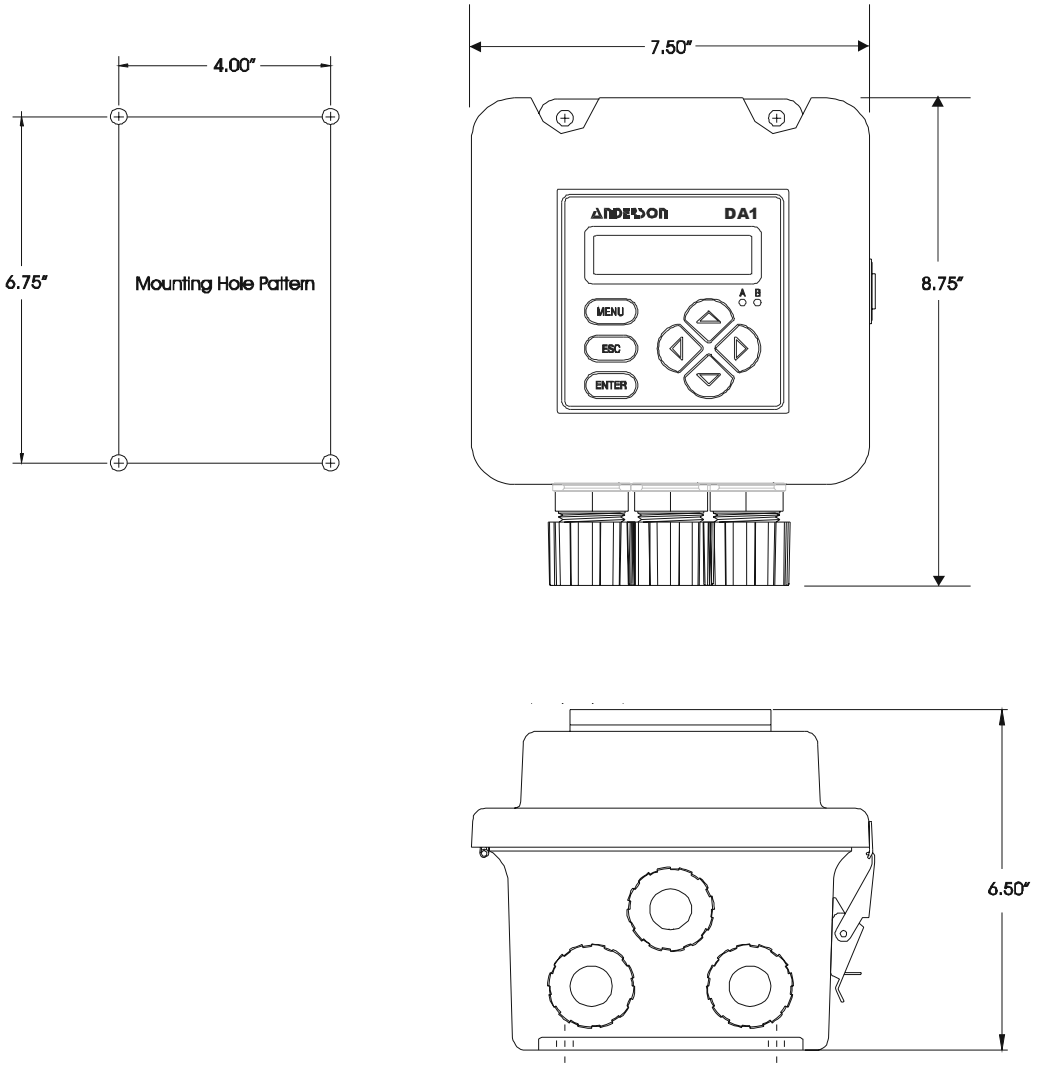
FIGURE 3-1 Panel Mount Dimensions



3.3 Wall Mounting

Figure 3-2 illustrates the anayzer wall mount enclosure and mounting dimensions.

Figure 3-2 Wall Mount Dimensions



Section 4 - Electrical Connections

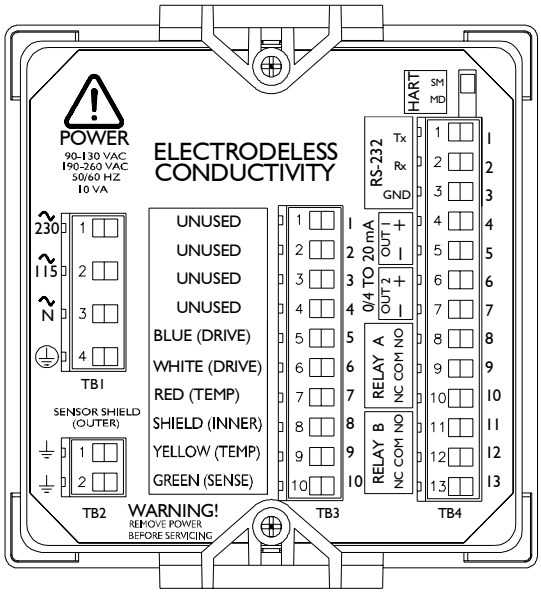
Figure 4-1 shows the terminal arrangement and designations on the back of the analyzer.

NOTE: *For easier wiring, terminal blocks can be unplugged from their mating connectors. All terminals are suitable for single wires up to 14 AWG (2.5 mm²).*

Wiring Tip! Follow these general wiring guidelines:

1. Keep all cable shields as short as possible and connect them to earth ground.
2. Use Steward ferrite 28 B0590-000 or equivalent on:
   - Mains (line power) cable — no turns required.
   - Sensor cable — one turn required.
   - mA analog output cables — two turns required.
   - Relay cables — no turns required.
3. In harsh conducted RF conditions, connect the earth ground of the instrument (Terminal 4 on TB1) to a local, known earth ground source.

FIGURE 4-1 DA1 Analyzer Terminal Designations



4.1 Sensor Wiring

All Anderson Model HC1-series electrodeless conductivity sensors have a built-in Pt 1000 ohm RTD temperature element for automatic temperature compensation and to measure temperature.

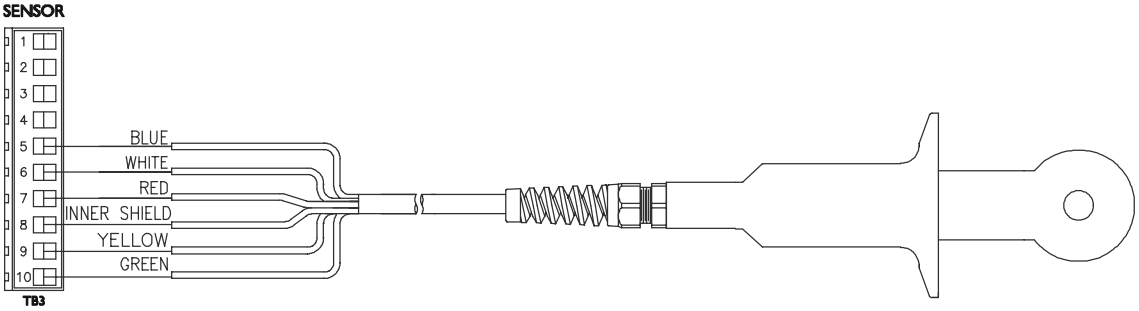
> **Wiring Tip!** Route the sensor cable in 1/2-inch, grounded metal conduit to protect it from moisture, electrical noise, and mechanical damage. For installations where the distance between sensor and analyzer exceeds the sensor cable length, indirectly connect the sensor to the analyzer using a junction box and interconnect cable.

NOTE: *Do not route the sensor cable in any conduit containing AC or DC power wiring ("electrical noise" may interfere with the sensor signal). Also, always re-calibrate the system when the cable length between sensor and analyzer changes.*

Refer to Figure 4-2 and connect the sensor (or interconnect) cable wires to Terminals 5 through 10 on TB3, matching colors as indicated.

NOTE: *For best immunity to electromagnetic interference, connect the sensor cable's <u>outer</u> shield wire (clear with black band — not its clear-only inner shield wire) to a shield terminal on TB2.*

FIGURE 4-2 Connecting HC1 Electrodeless Conductivity Sensor



4.2 Analog Outputs

Two isolated analog outputs (1 and 2) are provided. Each output can be set to be 0-20 mA or 4-20 mA, and assigned to represent one of the following:

- Measured conductivity, % concentration or TDS
- Measured temperature

The outputs are isolated from the inputs and earth ground, but not from each other. For output configuration details, see Section 4.4.

> **Wiring Tip!** Use high quality, shielded instrumentation cable for connecting the analog outputs. To protect the output signal from EMI/RFI, connect cable shields to a shield terminal on TB2.

Each 0/4-20 mA analog output can drive a load of up to 600 ohms.

- **Output 1:** Connect the load to Terminals 4 and 5 on TB4, matching polarity as indicated.
- **Output 2:** Connect the load to Terminals 6 and 7 on TB4, matching polarity as indicated.

4.3 Relay Outputs

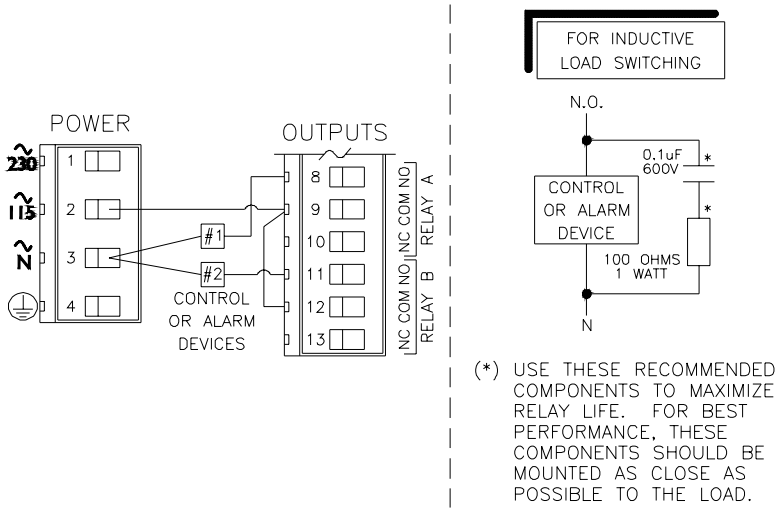
The analyzer is equipped with two electromechanical relays. For relay setup details, see Section 7.5.

CAUTION:
DO NOT EXCEED THE CONTACT RATING FOR EACH RELAY (5A 115/230 VAC). WHEN SWITCHING LARGER CURRENTS, USE AN AUXILIARY RELAY SWITCHED BY THE ANALYZER RELAY TO EXTEND ANALYZER RELAY LIFE. WHEN USING RELAY OUTPUTS, MAKE SURE THAT LINE POWER WIRING CAN ADEQUATELY CONDUCT THE CURRENT DRAW OF THE SWITCHED LOAD(S).

Two sets of SPDT relay outputs (Relays A and B) are provided at Terminals 8 through 13 on TB4. **The relay outputs are not powered.** The line power used to power the analyzer may also be used to power control/alarm devices with these relay contacts. Refer to Figure 4-3 for a general wiring arrangement. Always check control wiring to insure that line power will not be shorted by the relay switching action, and that wiring conforms to local codes.

WARNING:
MAKE SURE LINE POWER IS NOT PRESENT WHILE CONNECTING WIRES TO TB4 RELAY TERMINALS.

FIGURE 4-3 Relay Wiring



4.4 AC Line Power

Refer to Figure 4-4, 4-5 or 4-6 and connect line power to appropriate terminals on TB1 using the standard three-wire connection arrangement. **Use wiring practices which conform to local codes** (example: National Electric Code Handbook in the U.S.A.).

WARNING:
REMOVE LINE POWER WHILE CONNECTING LINE POWER WIRES TO THE TB1 TERMINALS. ALSO, USE ONLY THE STANDARD THREE-WIRE CONNECTION ARRANGEMENT FOR SINGLE-PHASE LINE POWER TO PREVENT AN UNSAFE CONDITION, AND TO ENSURE PROPER ANALYZER OPERATION.

NOTE: *In all cases, connect the line power cable ground wire (usually green) to the "ground symbol" terminal on TB1.*

The "115" and "230" voltage circuits are protected with internal, board-mounted slow-blow fuses.

NOTE: *For 230 volt split phase line power, be sure to conform to local codes with regard to fusing the 115 volt line connected to the "N" terminal*.

FIGURE 4-4 Connecting 115 Volt Single Phase Line Power (90-130 VAC)

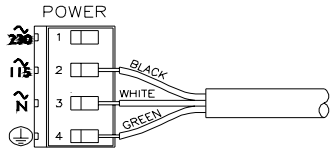


FIGURE 4-5 Connecting 230 Volt Single Phase Line Power (190-260 VAC)

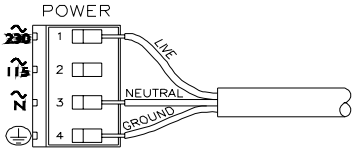
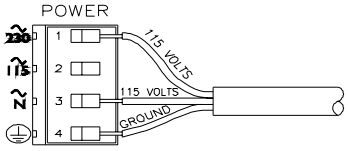


FIGURE 4-6 Connecting 230 Volt Split Phase Line Power (190-260 VAC)



Section 5 - User Interface

The user interface consists of a two-line LCD display and a keypad with **MENU**, **ENTER**, **ESC**, ⇦, ⇨, ⇧, **and ⇩ keys**.

5.1 Display

The backlit, high resolution display is factory-set for optimum viewing contrast under all lighting conditions. By using the keypad, you can display three types of screens:

- **MEASURE Screens:** The normal display mode shows measured values. Pressing the ⇦ **or ⇨ key** sequentially scrolls through the measured value (conductivity, % concentration or TDS), the corresponding uncompensated conductivity, temperature, analog Output 1 and 2 mA values, and the measured value and temperature.

- **MENU Screens:** These top-level and lower-level (submenu) screens within the three main branches of the menu tree are used to access edit/selection screens for configuration. (EXIT screens at the end of each menu branch enable you to move up one level in the menu tree by pressing the **ENTER key**. This is functionally the same as pressing the **ESC key**.)

- **Edit/Selection Screens:** These screens enter values / choices to calibrate, configure, and test the analyzer.

5.2 Relay A and B Indicators

Relay A and B red LED indicators light when their respective relay energizes. (When a relay overfeed timer has "timed out," the respective LED continuously blinks until the overfeed conditionis resolved.)

5.3 Keypad

The keypad enables you to move throughout the analyzer menu tree. The keys and their related functions are:

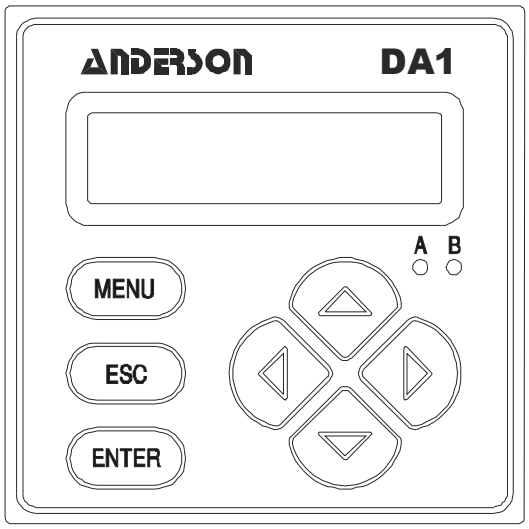
1. **MENU key:** Pressing this key with the MEASURE screen displayed shows the "MAIN MENU ▶ CALIBRATE" screen. To display theCONFIGURE or TEST/MAINT top-level main branch screen, press the ⇩ **key**. Pressing **MENU key** with a menu screen displayed always shows the top-level screen in that branch. (Pressing **MENU key** also "aborts" the procedure to change values or selections.)

2. **ENTER key:** Pressing this key does two things: it displays submenu and edit/selection screens, and it enters (saves) configuration values/selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With any "MAIN MENU" screen displayed, pressing the **ESC key** once takes the display up one level to the MEASURE screen.) This key can also "abort" the procedure to change a value or selection.

4. **⇦ and ⇨ keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: Changes readout (in continuous loop sequence) to show different measurements.
   - Menu Screens: These keys are non-functional.
   - Edit/Selection Screens: “Coarse” adjusts the displayed numerical value.
5. **⇧ and ⇩ keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: These keys are non-functional.
   - Menu Screens: Moves up or down respectively between other same-level menu screens.
   - Edit/Selection Screens: “Fine” adjusts the displayed numerical value (holding key down changes value faster), or moves up or down between choices.

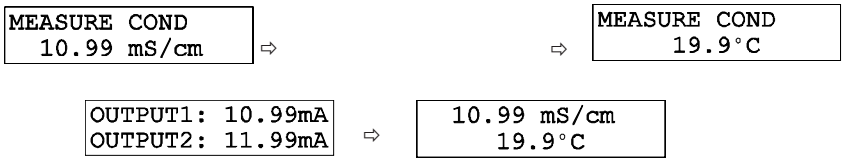
FIGURE 5-1 DA1 Analyzer Keypad



5.4 Measure Screen

The MEASURE screen is normally displayed. Pressing the **MENU key** temporarily replaces the MEASURE screen with the top-level "MAIN MENU ▶ CALIBRATE" branch selection screen. Using the keypad, you can then display other screens to calibrate, configure, or test the analyzer. **If the keypad is not used within 30 minutes, except during calibration or while using specific analyzer test/main-tenance functions, the display will automatically return to the MEASURE screen.** To display the MEASURE screen at any time, press the **MENU key** once and then press the **ESC key** once.

The MEASURE screen can show five different readout versions. To select between them, in continuous loop sequence, press the **⇦ or ⇨ key**. These are examples of the different versions:



NOTE: *When the analyzer returns to its normal MEASURE screen mode, the appearing readout is always the version last selected. Note that two of the MEASURE screen readout examples show the factory-default "COND" notation on their top lines, illustrating the analyzer notation feature. To create your own notation, refer to Section 7.2, subheading "ENTER NOTE (top line of MEASURE screen)."*

When the measured value is beyond the analyzer measuring range, a series of " + " or " - " screen symbols appear, respectively indicating that the value is above or below range.

Section 6 - Menu Structure

The analyzer menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level screens, related lower-level submenu screens and, in many cases, sub-submenu screens.

Each layer contains an EXIT screen to return the display up one level to the previous layer of screens.

> **Menu Structure Tip!** For operating convenience, the layers within each main branch are organized with the most frequently used function screens at their beginning, rather than the function screens used for initial startup.

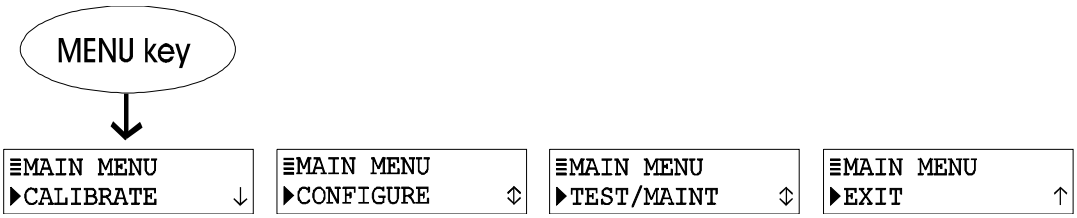
6.1 Displaying Main Branch Selection Screens

1. With the MEASURE screen displayed, pressing the **MENU key** always shows the

   ≡MAIN MENU
   ▶CALIBRATE ↓

   branch selection screen. (Pressing the **MENU key** with any other type of screen displayed always returns the display to the top of that respective menu branch.)

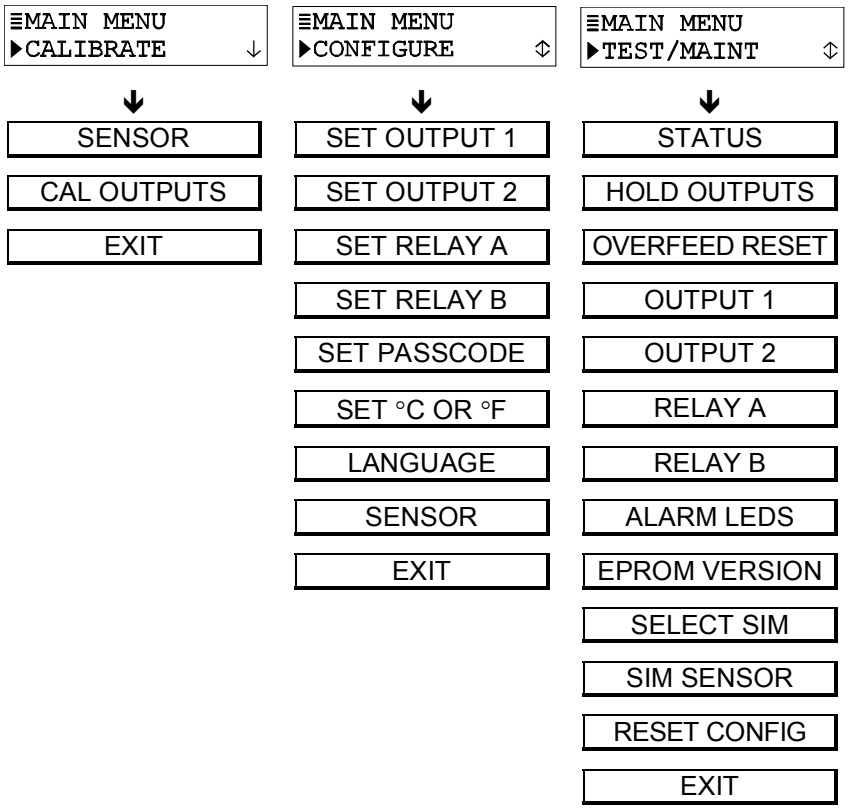
2. Press **⇩ and ⇧ keys** to select between the three MAIN MENU branch selection screens (CALIBRATE, CONFIGURE or TEST/MAINT), or the EXIT screen:



3. With the desired MAIN MENU branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

6.2 Displaying Top-Level Menu Screens

With the first top-level menu screen of the desired main branch displayed, use the **⇩ and ⇧ keys** to scroll through other top-level screens to access a desired screen.
The top-level menu screens for each main branch are:



Menu Structure Tip! A menu screen with a horizontal bar symbol (**|**) at the start of its first line indicates there is a related submenu or edit/selection screen.
A menu screen with a ▶ symbol at the start and a "↓" symbol at the end of its second line indicates that you can select other screens within the same layer by pressing the **⇩ key**. A "⇳" symbol at the end of the second line indicates that you can move up or down between screens by respectively pressing the **⇧ or ⇩ key**. When a "↑" symbol appears, it indicates you have reached the end of the screens in that layer. You can select previous screens using the **⇧ key**.

6.3 Displaying Submenu Screens

After selecting a top-level menu screen, press the **ENTER key** to display a related submenu or edit/selection screen:

- **Submenu Screens** are usually linked to other related same-level screens. Pressing the ⇩ **key** displays these other related submenu screens.

Example: With this submenu screen displayed:

```
≣SET OUTPUT 1
▶SET PARAMETER ↓
```

pressing the ⇩ **key** displays this related, same-level submenu screen:

```
≣SET OUTPUT 1
▶SET 4mA VALUE ↕
```

- **Edit/Selection Screens** always have a first line ending with a "?". Pressing the ⇩ **or** ⇧ **key** changes the value/ choice enclosed by parenthesis (second line on screen).

Example: With this submenu screen displayed:

```
SET °C OR °F?
(°C              )
```

pressing the ⇩ **key** displays another choice:

```
SET °C OR °F?
(°F              )
```

6.4 Adjusting Edit / Selection Screen Values

Use **arrow keys** to edit/change the value/choice enclosed by parenthesis (examples shown above and below).

```
SET PARAMETER?
(SENSOR          )
```

```
SET 4mA VALUE?
(10.22 uS/cm     )
```

A choice can be changed by simply using the⇧ **and** ⇩ **keys**. Numerical values can be adjusted using ⇦ **and** ⇨ **keys** ("coarse adjust)" and ⇧ **and** ⇩ **keys** ("fine" adjust). The longer the key is pressed, the faster the value changes.

6.5 Entering (Storing) Edit / Selection Screen Values / Choices

With the desired value/choice displayed, press the **ENTER key** to enter (store) it into the non-volatile analyzer memory. The previous screen will then re-appear.

NOTE: *You can always press the **ESC key** to abort saving a new setting. The original setting will be retained.*

Section 7 - Analyzer Configuration

NOTE: *When the passcode feature is enabled (Section 7.6), you must successfully enter the passcode before attempting to enter a configuration setting.*

7.1 Selecting LANGUAGE to Operate Analyzer

The analyzer is equipped to display operating screens in various languages such as English, French (Français), German (Deutsche), Spanish (Español), and others. The analyzer is factory-set for English. To change languages:

1. Press **MENU key** to display a "MAIN MENU" screen. If the
```
≣MAIN MENU
▶CONFIGURE          ⇳
```
screen is not showing, use **⇩ or ⇧ key** to display it.

2. Press **ENTER key** to display
```
≣CONFIGURE
▶SET OUTPUT 1    ↓
```
.

3. Press **⇩ key** until
```
≣CONFIGURE
▶LANGUAGE           ⇳
```
screen appears.

4. Press **ENTER key** to display
```
LANGUAGE?
(ENGLISH            )
```
. Use **⇩ and ⇧ keys** to view the language choices.

5. With the desired language displayed, press **ENTER key** to enter this selection.

NOTE: *After a language is selected and entered, all screens will be displayed in that language.*

7.2 Configuring Sensor Characteristics

The analyzer must be configured to define the characteristics of the sensor including its temperature element type, its "T" factor, and other related items such as selecting the measurement and its format, temperature compensation, input signal filtering, pulse suppression, etc.

SELECT MEASURE (conductivity, concentration, or TDS)

1. With the
```
≣CONFIGURE
▶LANGUAGE           ⇳
```
screen displayed, press **⇩ key** once to display
```
≣CONFIGURE
▶SENSOR             ⇳
```
.

2. Press **ENTER key** to display
```
≣SENSOR
▶SELECT MEASURE↓
```
.

3. Press **ENTER key** again to display
```
SELECT MEASURE?
(CONDUCTIVITY    )
```
. Use **⇩ and ⇧ keys** to view the three choices:

- **CONDUCTIVITY:** Selects conductivity measurement.
- **CONCENTRATION:** Selects % concentration measurement. (See "CONFIG CONC" subheading to convert measured conductivity to % concentration by selecting a BUILT-IN chemical concentration table or creating a USER-DEFINED table.)
- **TDS:** Selects total dissolved solids measurement.

WARNING:
CHANGING THE MEASUREMENT AUTOMATICALLY REPLACES ALL USER-ENTERED VALUES WITH FACTORY-DEFAULT VALUES.

4. With the desired choice displayed, press **ENTER key** to enter this selection.

Select DISPLAY FORMAT

After choosing the measurement, select the desired MEASURE screen display format. The selected units and resolution will also appear on all applicable edit/selection menu screens.

1. With the
```
≣SENSOR
▶SELECT MEASURE↓
```
screen displayed, press **⇩ key** once to display
```
≣SENSOR
▶DISPLAY FORMAT↕
```
.

2. Refer to the selected measurement and follow the steps:

CONDUCTIVITY Display Format

Press **ENTER key** to display a screen like
```
DISPLAY FORMAT?
(200.0 uS/cm   )
```
. Use **⇩and⇧keys** to view the choices (200.0 µS/cm, 2000 µS/cm, 2.000 mS/cm, 20.00 mS/cm, 200.0 mS/cm, 2000 mS/cm or 2.000 S/cm). With the desired choice displayed, press **ENTER key** to enter this selection.

CONCENTRATION Display Format

A. Press **ENTER key** to display
```
≣DISPLAY FORMAT
▶CONC FORMAT    ↓
```
.

B. Press **ENTER key** again to display a screen like
```
CONC FORMAT?
(99.99%          )
```
. Use **⇩ and ⇧ keys** to view choices (99.99% or 200.0%). With the desired choice displayed, press **ENTER key** to enter it.

C. After the screen re-appears, press **⇩ key** once to display to format the uncompensated conductivity MEASURE screen readout (and select conductivity range for USER-DEFINED table, if used).

D. Press **ENTER key** to display a screen like . Use **⇩ and ⇧ keys** to view choices (same as conductivity choices previously described). With the desired choice displayed, press **ENTER key** to enter it.

TDS Display Format

Display format configuration for TDS is always 0-9999 ppm. Consequently, there is no display format screen.

PAGE 26

Select Temperature Compensation

Configure the required type of temperature compensation for the selected measurement.

1. With the ≣SENSOR ▶DISPLAY FORMAT⇳ screen displayed, press ⇩**key** once to display ≣SENSOR ▶T-COMPENSATION⇳.

2. Press **ENTER key** to display a screen like T-COMPENSATION? (LINEAR). Use ⇩ **and** ⇧ **keys** to view choices:

   - **LINEAR (recommended for most aqueous solutions)**
   - NATURAL WATER (not shown for TDS measurement; only use this built-in table for special applications — consult factory)
   - TEMP TABLE (user-defined temperature table)
   - NONE (measurement values are not compensated)

3. With the desired choice displayed, press **ENTER key** to enter this selection.

NOTE: *The factory default for temperature compensation is LINEAR with a 2.00% per °C slope and 25.0°C reference temperature. This provides the best results for most aqueous solutions. To enter different slope and reference temperature values for an uncommon solution, refer to subheading "CONFIG LINEAR or CONFIG T-TABLE Temperature Compensation" for details.*

CONFIG CONC or CONFIG TDS Measurement (configuration not needed for conductivity)

Only when CONCENTRATION or TDS is selected must the analyzer be further configured. If CONDUCTIVITY was selected, disregard this subsection — no measurement configuration is needed.

CONCENTRATION Measurement Setup

Configure the analyzer with an appropriate table to convert measured conductivity into displayed % concentration. If one of the analyzer's BUILT-IN chemical concentration tables matches the solution being measured, simply select that table. If not, you must create a USER-DEFINED concentration table for the solution being measured.

Selecting BUILT-IN Chemical Concentration Table

1. With the ≣SENSOR ▶T-COMPENSATION⇳ screen displayed, press ⇩ **key** once to display ≣SENSOR ▶CONFIG CONC ⇳.

2. Press **ENTER key** to display ≣CONFIG CONC ▶SELECT TYPE ↓.

3. Press **ENTER key** again to display SELECT TYPE? (BUILT-IN). Use ⇩ **and** ⇧ **keys** to view the choices (BUILT-IN or USER-DEFINED). "BUILT-IN" configures the analyzer to use one of the built-in chemical concentration tables.

4. With "BUILT-IN" displayed, press **ENTER key**.

5. After the screen re-appears, press ⇩ **key** <u>once</u> to display

```
≣CONFIG CONC
▶SET BUILT-IN  ⇳
```

.

6. Press **ENTER key** to display a chemical table selection screen like

```
SET CHEMICAL?
(NaOH 0-16%    )
```

. Use ⇩ **and** ⇧ **keys** to view the BUILT-IN chemical concentration table choices:

Table A -- BUILT-IN CHEMICALCONCENTRATION TABLES

Solution	Concentration	°C Range	Solution	Concentration	°C Range
NaOH	0-16%	0-100°C	H_2SO_4	40-80%	0-115°C
$CaCl_2$	0-22%	15-55°C	H_2SO_4	93-99%	0-115°C
HNO_3	0-28%	0-50°C	H_3PO_4	0-40%	0-75°C
HNO_3	36-96%	0-50°C	HCl	0-18%	0-65°C
H_2SO_4	0-30%	0-115°C	HCl	22-36%	0-65°C

7. With the desired BUILT-IN chemical table choice displayed, press **ENTER key** to enter this selection.

Creating USER-DEFINED Concentration Table

If the solution being measured does not match any BUILT-IN chemical table, create a USER-DEFINED table to convert measured conductivity into displayed % concentration.

NOTE: *A USER-DEFINED table must contain <u>at least two</u> data points (Pt. 1 and Pt. 2) but can have up to ten points. (More points improve measuring accuracy.) Each point must have a conductivity value coordinate (shown as X) and a corresponding % concentration value coordinate (shown as Y). The conductivity values and range are shown in units selected by the "DISPLAY COND FORMAT" screen. Conductivity values for each successive data point <u>must increase</u>. Concentration values, shown in their selected 99.99% or 200.0% display format, must be different from each other and always entered in either increasing or decreasing order. (The table must be monotonic; that is, as conductivity values increase, concentration values must always increase or decrease.)*

The analyzer default USER-DEFINED concentration table is:

Data Point	*Conductivity Value (X coordinate)*	*% Concentration Value (Y coordinate)*
Pt. 1	*0 µS/cm*	*0.00%*
Pt. 2	*2000 µS/cm*	*99.99%*

To create your own USER-DEFINED table, edit this default table and, if needed, add more points.

PAGE 28

Recommendation: Before entering values, plan ahead and determine the conductivity and corresponding % concentration values for each data point in your table. Use Table B to conveniently organize and note your specific table entry values:

Table B -- VALUES FOR USER-DEFINED CONCENTRATION TABLE

Data Point	Conductivity Value	% Concentration Value	Data Point	Conductivity Value	% Concentration Value
Pt. 1			Pt. 6		
Pt. 2			Pt. 7		
Pt. 3			Pt. 8		
Pt. 4			Pt. 9		
Pt. 5			Pt. 10		

NOTE: After the analyzer has been calibrated, you can use the uncompensated conductivity MEASURE screen to determine corresponding conductivity values.

1. With the
```
≣SENSOR
▶T-COMPENSATION⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶CONFIG CONC    ⇳
```
.

2. Press **ENTER key** to display
```
≣CONFIG CONC
▶SELECT TYPE    ↓
```
.

3. Press **ENTER key** again to display
```
SELECT TYPE?
(BUILT-IN       )
```
. Use ⇩ **and** ⇧ **key** to select "USER-DEFINED," which configures the analyzer to use the special concentration table you create.

4. With "USER-DEFINED" displayed, press **ENTER key**.

5. After the screen re-appears, press ⇩ **key** once to display .

6. Press **ENTER key** to display a screen like
```
POINT 1 X DATA ▶
     0 mS/cm
```
. Using this screen and other similar data point screens, enter data to create your table.

NOTE: *To switch between X and Y coordinate screens for a data point, use the* ⇨ ***and*** ⇦ ***keys**. To move between data points for an X or Y coordinate, use the* ⇩ ***and*** ⇧ ***keys**.*

A. Press **ENTER key** to display a screen like
```
X VALUE?
(    0 mS/cm    )
```
. Use **arrow keys** to adjust the displayed Point 1 conductivity value to the desired value, and press **ENTER key** to enter the value.

B. Press ⇨ **key** once to display
```
POINT 1 Y DATA ◀
      0.00%
```
.

C. Press **ENTER key** to display
```
Y VALUE?
(      0.00%      )
```
. Use **arrow keys** to adjust the displayed Point 1 % concentration value to correspond with the Point 1 conductivity value, and press **ENTER key** to enter the value.

D. Press ⇩ **key** once and ⇦ **key** once to display a screen like
```
POINT 2 X DATA ▶
    2 mS/cm
```
.

E. Repeat steps 6A through 6D to enter the conductivity and corresponding % concentration values for each remaining data point in the table.

F. After all X and Y coordinate values are entered for each data point in the table, press **ESC key** once to display
```
CONFIG CONC
EXIT TABLE?
```
.

G. Press **ENTER key** to display
```
CONFIG CONC
SAVE CHANGES?
```
.

H. Press **ENTER key** again to save the table.

NOTE: *If a table contains unacceptable coordinate values, the display shows a "CONFIRM FAILURE" message. Pressing* ***ENTER Key*** *displays the unacceptable coordinate(s).*

TDS Measurement Setup

Define the conductivity-to-TDS conversion factor:

1. With the
```
≣SENSOR
▶T-COMPENSATION⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶CONFIG TDS     ⇳
```
.

2. Press **ENTER key** to display
```
≣CONFIG TDS
▶SELECT FACTOR ↓
```
.

3. Press **ENTER key** again to display
```
SELECT FACTOR?
(NaCl           )
```
. Use **⇩ and ⇧ keys** to view both choices:

   - **NaCL:** Analyzer uses the built-in NaCl conductivity-to-TDS conversion factor.
   - **USER DEFINED:** Analyzer uses a user-entered conductivity-to-TDS conversion factor.

4. With the desired choice displayed, press **ENTER key** to enter this selection. If the "NaCl" conversion factor was selected, TDS measurement configuration is complete. If you selected "USER DEFINED," you must enter a conductivity-to-TDS conversion factor:

   A. With the
```
≣CONFIG TDS
▶SELECT FACTOR ↓
```
screen displayed, press ⇩ **key** once to

display ≣CONFIG TDS / ▶SET FACTOR ⇳ .

B. Press **ENTER key** to display a screen like SET FACTOR? / (0.49 ppm/uS) . Use **arrow keys** to adjust the displayed value to the desired conductivity-to-TDS conversion factor, and press **ENTER key** to enter the value.

C. After the ≣CONFIG TDS / ▶SET FACTOR ⇳ screen re-appears, press **ESC key** once to return to the ≣SENSOR / ▶CONFIG TDS ⇳ screen.

CONFIG LINEAR or CONFIG T-TABLE Temperature Compensation (configuration not needed for other compensation methods)

Only when LINEAR or TEMP TABLE is the selected temperature compensation, must the analyzer be further configured. If the built-in NATURAL WATER properties table or NONE was selected, disregard this subsection — no compensation configuration is needed.

LINEAR Compensation Setup

LINEAR compensation factory defaults are 2.00%/°C slope and 25.0°C reference temperature. **These values are appropriate for most aqueous solutions.** Use chemical handbook tables to find values for uncommon solutions. To enter different values, do the following:

1. With the ≣SENSOR / ▶T-COMPENSATION ⇳ or ≣SENSOR / ▶CONFIG TDS ⇳ screen displayed, press ⇩ **key** until ≣SENSOR / ▶CONFIG LINEAR ⇳ screen appears.

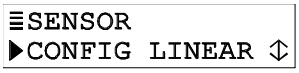
2. Press **ENTER key** to display ≣CONFIG LINEAR / ▶SET SLOPE ↓ .

3. Press **ENTER key** again to display a screen like SET SLOPE? / (2.00 %/°C) . Use **arrow keys** to adjust the displayed value to the desired % per °C slope, and press **ENTER key** to enter the value.

4. After the screen re-appears, press ⇩ **key** once to display .

5. Press **ENTER key** to display a screen like SET REF TEMP? / (25.0°C) . Use **arrow keys** to adjust the displayed value to the desired reference temperature, and press **ENTER key** to enter the value.

6. After the ≣CONFIG LINEAR / ▶SET REF TEMP ⇳ screen re-appears, press **ESC key** once to return

to the 

screen.

TEMP TABLE Compensation Setup

When special temperature compensation is required, you can create your own temperature table to define the temperature compensation curve.

NOTE: *The TEMP TABLE must contain at least two data points (Pt. 1 and Pt. 2) but can have up to ten points. (More points improve compensation accuracy.) Each point must have a temperature value coordinate (shown as X) and a corresponding ratio coordinate (shown as Y). Temperature values must be between 0.0 and 200.0°C (or 32.0 and 392.0°F). Each entered temperature value must be different from all others. Ratio values, which can be the same, are unit-less and must be between 0.00 and 99.99.*

Use this equation to calculate the ratio value for each corresponding temperature value:

$$\text{Ratio Value (for each corresponding temperature)} = \frac{\text{Cond. Value at Ref. Temp.}}{\text{Cond. Value at Noted Temp.}}$$

Example: Suppose the uncompensated or raw conductivity values are 100 mS/cm at a 25°C reference temperature, 120 mS/cm at 50°C, and 70 mS/cm at 15°C. Using this equation, ratio values for each of the corresponding temperatures are:

For 25°C, ratio value = 100 / 100 or 1.00

For 50°C, ratio value = 100 / 120 or 0.83

For 15°C, ratio value = 100 / 70 or 1.43

The default TEMP TABLE is:

Data Point	*Temperature Value (X coordinate)*	*Corresponding Ratio Value (Y coordinate)*
Pt. 1	*0.0°C*	*1.00*
Pt. 2	*100.0°C*	*1.00*

To create your own TEMP TABLE, edit this default table and, if needed, add more data points.

Recommendation: Before entering values, plan ahead and determine the temperature and ratio values for each data point in your table. Use Table C to conveniently organize and note your specific table entry values:

Table C -- VALUES FOR TEMP TABLE

Data Point	°C Temp. (X)	Raw Cond. Value	Ratio Value (Y)	Data Point	°C Temp. (X)	Raw Cond. Value	Ratio Value (Y)
Pt. 1				Pt. 6			
Pt. 2				Pt. 7			
Pt. 3				Pt. 8			
Pt. 4				Pt. 9			
Pt. 5				Pt. 10			

PAGE 32

1. With the ≣SENSOR ▶T-COMPENSATION⇳ or ≣SENSOR ▶CONFIG TDS ⇳ screen displayed, press ⇩ **key** until ≣SENSOR ▶CONFIG T-TABLE⇳ screen appears.

2. Press **ENTER key** to display POINT 1 X DATA ▶ 0.0°C .

   Using this screen and other similar data point screens, enter data to create your table:

NOTE: *To switch between X and Y coordinate screens for a data point, use the* ***⇨ and ⇦ keys****. To move between data points for an X or Y coordinate, use the* ***⇩ and ⇧ keys****.*

A. Press **ENTER key** to display X VALUE? (0.0°C) . Use **arrow keys** to adjust the displayed Point 1 temperature value to the desired value, and press **ENTER key** to enter the value.

B. Press ⇨ **key** once to display POINT 1 Y DATA ◀ 1.00 .

C. Press **ENTER key** to display Y VALUE? (1.00) . Use **arrow keys** to adjust the displayed Point 1 ratio value to the desired value, and press **ENTER key** to enter the value.

D. Press ⇩ **key** once and ⇦ **key** once to display POINT 2 X DATA ▶ 100.0°C .

E. Repeat steps 2A through 2D to enter the temperature and corresponding ratio values for each remaining data point in the table.

F. After all X and Y coordinate values are entered for each data point in the table, press **ESC key** once to display CONFIG T-TABLE EXIT TABLE? .

G. Press **ENTER key** to display CONFIG T-TABLE SAVE CHANGES? .

H. Press **ENTER key** again to save the table.

NOTE: *If a table contains unacceptable coordinate values, the display shows a "CONFIRM FAILURE" message. Pressing* ***ENTER key*** *displays the unacceptable coordinate(s).*

SET FILTER Time

A time constant (in seconds) can be set to filter or "smooth out" the sensor signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what sensor signal filter time to use is a compromise. The higher the filter time, the longer the sensor signal response time will be to a change in the actual process value.

1. With the
```
≣SENSOR
▶CONFIG LINEAR ⇳
```
or
```
≣SENSOR
▶CONFIG T-TABLE⇳
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≣SENSOR
▶SET FILTER    ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS     )
```
. Use **arrow keys** to adjust the displayed value to the desired filter time, and press **ENTER key** to enter the value.

Select PULSE SUPPRESS (on/off)

Sometimes an external interference may occasionally cause the measurement system to provide unstable readings. Common causes include entrained gas bubbles in the process, and electromagnetic interference (EMI or "electrical noise" pulses). The analyzer has a pulse suppression feature to counteract this condition and stabilize readings. <u>Example</u>: Suppose the analyzer reading is steadily showing 1880 mS/cm, then suddenly jumps to 1950 mS/cm for a few seconds, and returns to 1880 mS/cm. By turning on this feature, the analyzer will perceive this as a temporary upset, "suppressing" most of this pulse change and providing a smoother measurement reading.

1. With the
```
≣SENSOR
▶SET FILTER    ⇳
```
screen displayed, press the ⇩ key <u>once</u> to display
```
≣SENSOR
▶PULSE SUPPRESS⇳
```
.

2. Press **ENTER key** to display
```
PULSE SUPPRESS?
(OFF           )
```
. Use **⇩ and ⇧ keys** to view both choices (OFF or ON). With the desired choice displayed, press **ENTER key** to enter this selection.

PAGE 34

ENTER NOTE (top line of MEASURE screen)

The top line of the MEASURE screen readouts that separately show the measurement and temperature values are factory set to read “COND.” This notation can be changed, for example, to “BASIN 1” to tailor the analyzer MEASURE screen to the application. The top line would then be “MEASURE BASIN 1.” The notation is limited to eight characters which can be a combination of capital letters A through Z, numbers 0 through 9, and spaces.

1. With the
```
≣SENSOR
▶PULSE SUPPRESS⇳
```
screen displayed, press ⇩**key** once to display
```
≣SENSOR
▶ENTER NOTE    ⇳
```
.

2. Press **ENTER key** to display
```
ENTER NOTE?
([C]OND        )
```
. Create the desired notation on the second line:

   A. Starting with extreme left character position, use⇧ **and** ⇩ **keys** to select the desired first character.

   B. Press ⇨ **key** once to select the next character, and use⇧ **and** ⇩ **keys** to select its desired character.

   C. Repeat this procedure until the desired notation is displayed.

3. Press **ENTER key** to enter the displayed notation.

Select TEMP ELEMENT Type

Configure the analyzer for either automatic temperature compensation (uses Pt 1000 ohm RTD built into sensor), or fixed MANUAL temperature compensation. When usingMANUAL, you must determine and enter a specific temperature value.

NOTE: *When a temperature element type has been selected but the element is not connected to the analyzer, a “WARNING: CHECK STATUS” message will appear. To prevent or clear the message, connect the element or select “MANUAL.”*

1. With the
```
≣SENSOR
▶ENTER NOTE    ⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶TEMP ELEMENT  ⇳
```
.

2. Press **ENTER key** to display
```
≣TEMP ELEMENT
▶SELECT TYPE   ↓
```
.

3. Press **ENTER key** again to display
```
SELECT TYPE?
(PT1000        )
```
. Use⇩ **and** ⇧ **keys** to view both choices:

   - **PT1000:** Configures analyzer for use with a Pt 1000 RTD temperature element (used in all Anderson HC1-series electrodeless conductivity sensors).

   - **MANUAL:** Configures analyzer for fixed manual temperature compensation when not using a temperature element.

4. With the desired choice displayed, press **ENTER key** to enter this selection. When "MANUAL?" is selected, you must set the specific manual temperature compensation value:

   A. With the ≣TEMP ELEMENT / ▶SELECT TYPE ↓ screen displayed, press ⇩ **key** once to display ≣TEMP ELEMENT / ▶SET MANUAL ⇳.

   B. Press **ENTER key** to display a screen like SET MANUAL? / (25.0°C). Use **arrow keys** to adjust the displayed value to the desired fixed temperature, and press **ENTER key** to enter the value.

SET T FACTOR (sensor's factory-certified "T" factor)

Each sensor is tested to provide a unique, certified temperature T FACTOR because:

- Temperature greatly affects conductivity measurement accuracy.
- The inherent ohm value of the Pt 1000 RTD temperature element varies slightly from sensor to sensor, affecting temperature measurement accuracy.

By entering the sensor's unique T FACTOR, the analyzer will provide the highest possible measuring accuracy for both temperature and conductivity.

1. With the ≣TEMP ELEMENT / ▶SELECT TYPE ↓ screen displayed, press ⇩ **key** once to display ≣TEMP ELEMENT / ▶SET T FACTOR ⇳.

2. Press **ENTER key** to display a screen like SET T FACTOR? / (1000.0 OHMS). Use **arrow keys** to adjust the displayed value to exactly match the sensor's factory-certified T FACTOR, and press **ENTER key** to enter the value.

SPECIAL CASE - ALTERED SENSOR CABLE LENGTH

Changing the standard 20 ft. (6 m) sensor cable length, by shortening it or adding an interconnect cable, affects temperature measuring accuracy. The factory-certified T factor is based on standard cable length. To compensate for altered cable length measuring error, change the certified T factor entry:

· Shortened Sensor Cable: To increase the analyzer Temperature reading to match the known solution Temperature, decrease the T factor by 3.85 ohms for each °C difference.

· Added Interconnect Cable: To decrease the analyzer temperature reading to match the known solution temperature, increase the T factor by 3.85 ohms for each °C difference.

Example: *Suppose the known solution temperature is 50°C and the analyzer reads 53°C due to interconnect cable resistance. Multiply the 3°C difference by 3.85 ohms to get 11.55. Then increase the sensor T factor by adding 11.55 to it and entering that value. If, due to a shortened sensor cable, the analyzer was reading 3°C less than the known solution temperature you would decrease the sensor T factor by subtracting 11.55 from it.*

3. After the ≣TEMP ELEMENT / ▶SET T FACTOR ⇳ screen re-appears, press **ESC key** twice to return to the ≣CONFIGURE / ▶SENSOR ⇳ screen.

7.3 SET °C OR °F (temperature display format)

The MEASURE screen can be set to display temperature values in °C or °F. In either case, the display resolution for measured temperature is always "XX.X."

1. With the ≣CONFIGURE / ▶SENSOR ⇳ screen displayed, press ⇧ **key** — not ⇩ **key** — twice to display ≣CONFIGURE / ▶SET °C OR °F ⇳ .

2. Press **ENTER key** to display a screen like SET °C OR °F? / (°C) . Use ⇩ **and** ⇧ **keys** to view both choices (°C or °F). With the desired choice displayed, press **ENTER key** to enter this selection.

7.4 Configuring Analog Outputs (1 and 2)

The analyzer provides two isolated analog outputs (1 and 2). During calibration, the analog outputs can be held, transferred to a preset mA value, or remain active. During normal measurement operation, both analog outputs can be held at their last measured values:

- For up to 30 minutes by selecting the "HOLD OUTPUTS" line in the TEST/MAINT menu and pressing the **ENTER key**.
- By an activated TIMER relay for its entered DURATION and OFF DELAY time periods (1-999 seconds each).

The output state selected during calibration (HOLD, XFER or ACTIVE) always takes precedence over an applied TIMER relay hold. From the moment output hold is initiated (during calibration or from TEST/MAINT menu), the elapsed time INTERVAL or DURATION countdown for a TIMER relay is temporarily suspended. Also, any TIMER relay counting down DURATION time is turned off. When output hold is released, a TIMER relay resumes its INTERVAL or DURATION countdown from the suspended time. When a TIMER relay is counting down DURATION time, both outputs are temporarily held until after the preset DURATION time (and OFF DELAY time, if used) elapses.

These instructions configure Output 1. Configure Output 2 in the same way using its respective menu screens.

SET PARAMETER (representation)

Each output can be assigned to represent the SENSOR (measured conductivity, % concentration or TDS) or measured TEMPERATURE.

1. With the ≣CONFIGURE ▶SET °C OR °F ⇳ screen displayed, press ⇧ **key** — not ⇩ **key** — until ≣CONFIGURE ▶SET OUTPUT 1 ↓ appears.

2. Press **ENTER key** to display ≣SET OUTPUT 1 ▶SET PARAMETER ↓.

3. Press **ENTER key** again to display SET PARAMETER? (SENSOR). Use ⇩ **and** ⇧ **keys** to view both choices. With the desired choice displayed, press **ENTER key** to enter this selection.

SET 0/4 mA and 20 mA VALUES (range expand)

Parameter values can be set to define the endpoints at which the minimum and maximum output values are desired.

1. With the ≣SET OUTPUT 1 ▶SET PARAMETER ↓ screen displayed, press ⇩ **key** once to display ≣SET OUTPUT 1 ▶SET 4mA VALUE ⇳.

2. Press **ENTER key** to display a screen like SET 4mA VALUE? (10.22 mS/cm). Use **arrow keys** to set the displayed value at which 0/4 mA is desired, and press **ENTER key** to enter the value.

3. After the ≣SET OUTPUT 1 ▶SET 4mA VALUE ⇳ screen re-appears, press ⇩ **key** once to display ≣SET OUTPUT 1 ▶SET 20mA VALUE⇳

4. Press **ENTER key** to display a screen like SET 20mA VALUE? (19.99 mS/cm). Use **arrow keys** to set the displayed value at which 20 mA is desired, and press **ENTER key** to enter the value.

NOTE: *If the same values are set for 0/4 mA and 20 mA, the output automatically goes to, and remains at, 20 mA.*

SET TRANSFER Value (mA)

Each analog output is normally active, responding to the measured value of its assigned parameter. However, during calibration you can transfer (XFER) each output to a preset value to operate a control element by an amount corresponding to that value.

To set a mA transfer value for an analog output to suit your application:

1. With the ≣SET OUTPUT 1 ▶SET 20mA VALUE⇳ screen displayed, press ⇩ **key** once to display ≣SET OUTPUT 1 ▶SET TRANSFER ⇳.

2. Press **ENTER key** to display a screen like
```
SET TRANSFER?
(20.00 mA      )
```
. Use **arrow keys** to set the displayed value to the desired mA transfer value, and press **ENTER key** to enter the value.

SET FILTER Time

A time constant (in seconds) can be set to filter or "smooth out" the output signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what output filter time to use is a compromise. The higher the filter time, the longer the output signal response time will be to a change in the measured value.

1. With the
```
≣SET OUTPUT 1
▶SET TRANSFER  ⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SET OUTPUT 1
▶SET FILTER    ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS     )
```
. Use **arrow keys** to adjust the displayed value to the desired filter time, and press **ENTER key** to enter the value.

Select SCALE 0 mA/ 4 mA (low endpoint)

Each output can be set to be 0-20 mA or 4-20 mA.

1. With the
```
≣SET OUTPUT 1
▶SET FILTER    ⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SET OUTPUT 1
▶SCALE 0mA/4mA ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SCALE 0mA/4mA?
(4mA           )
```
. Use ⇩ **and ⇧ keys** to view both choices (0 mA or 4 mA). With the desired choice displayed, press **ENTER** to enter this selection.

7.5 Configuring Relays (A and B)

The analyzer is equipped with two electromechanical relays (A and B). Each relay can be set to function as a CONTROL, ALARM, TIMER or STATUS relay. For details on each relay function, see subsection "SET FUNCTION Mode."

During calibration, CONTROL and ALARM relays can be held, transferred to present on/off states, or remain active. During normal measurement operation, CONTROL and ALARM relays can be held in their present on/off states for up to 30 minutes by selecting the "HOLD OUTPUTS" line in the TEST/MAINT menu and pressing the **ENTER key**.

NOTE: *TIMER relays operate differently than CONTROL or ALARM relays, and are affected differently. See the TIMER relay description in the "SET FUNCTION Mode" subsection for details.*

These instructions configure Relay A. Configure Relay B in the same way using its respective menu screens.

SET PARAMETER (representation)

Each CONTROL or ALARM relay can be assigned to be driven by the SENSOR (measured conductivity, % concentration or TDS) or measured TEMPERATURE .

NOTE: *Since TIMER and STATUS relays are driven by other criteria, the parameter assigned to these relays is not relevant and, therefore, disregarded.*

1. With the ≣SET OUTPUT 1 / ▶SCALE 0mA/4mA ⇳ screen displayed, press **ESC key** once to display ≣CONFIGURE / ▶SET OUTPUT 1 ↓.

2. Press ⇩ **key** twice to display ≣CONFIGURE / ▶SET RELAY A ⇳.

3. Press **ENTER key** to display ≣SET RELAY A / ▶SET PARAMETER ↓.

4. Press **ENTER key** again to display SET PARAMETER? / (SENSOR). Use **⇩ and ⇧ keys** to view both choices. With the desired choice displayed, press **ENTER key** to enter this selection.

SET FUNCTION Mode (alarm, control, status or timer)

Each relay can be selected to function as a:

- **ALARM** relay (with separate high and low alarm points and deadbands) that operates in response to the selected measured value.
- **CONTROL** relay (with phasing, setpoint, deadband, and overfeed timer) that operates in response to the selected measured value.
- **STATUS** relay that is not configurable. It is a dedicated system diagnostic-only alarm relay that automatically energizes when the “WARNING CHECK STATUS” message flashes on the MEASURE screen. This occurs when a sensor or analyzer “ FAIL” diagnostic condition is detected (see Section 9.1 for details).
- **TIMER** relay that is intended to control a device on a timed basis. A TIMER relay activates after an entered INTERVAL time (up to 999.9 minutes) expires. The TIMER relay remains on for the entered DURATION time (up to 999 seconds).

NOTE: *When a TIMER relay is counting down DURATION time, both analog outputs and all ALARM and CONTROL relays are automatically “held” to ensure that connected devices are not disrupted by any upset condition the TIMER relay operation may cause. An OFF DELAY time (1-999 seconds) can be entered to define how long after the TIMER relay turns off that the outputs and relays will remain held, providing time for any upset condition to stabilize.*

From the moment output hold is initiated (during calibration or from TEST/MAINT menu), the elapsed time INTERVAL or DURATION countdown for a TIMER relay is temporarily suspended. Also, any TIMER relay counting down DURATION time is turned off. When output hold is released, a TIMER relay resumes its INTERVAL or DURATION countdown from the suspended time. When a TIMER relay is counting down DURATION time, both analog outputs are temporarily held until after the preset DURATION time (and OFF DELAY time, if used)

elapses.

1. With the ≣SET RELAY A / ▶SET PARAMETER ↓ screen displayed, press ⇩ **key** <u>once</u> to display ≣SET RELAY A / ▶SET FUNCTION ⇳ .

2. Press **ENTER key** to display SET FUNCTION? / (ALARM). Use ⇩ **and** ⇧ **keys** to view the choices (ALARM, CONTROL, STATUS or TIMER). With the desired choice displayed, press **ENTER key** to enter this selection.

SET TRANSFER Mode (relay on or off)

Normally, each CONTROL or ALARM relay is active, responding to the measured value of its assigned parameter. During calibration, however, you can transfer (XFER) each relay to a preset on/off state to suit your application requirements:

1. With the ≣SET RELAY A / ▶SET FUNCTION ⇳ screen displayed, press ⇩ **key** <u>once</u> to display ≣SET RELAY A / ▶SET TRANSFER ⇳ .

2. Press **ENTER key** to display a screen like SET TRANSFER? / (DE-ENERGIZED). Use ⇩**and** ⇧ **keys** to view both choices (DE-ENERGIZED or ENERGIZED). With the desired choice displayed, press **ENTER** to enter this selection.

ACTIVATION (configuration values)

The group of configuration settings available to a relay is dependent on its selected function mode (ALARM, CONTROL or TIMER). **Relays set for STATUS function are not configurable.** Table D describes all relay configuration settings, categorized by relay function mode:

Table D -- RELAY CONFIGURATION SETTINGS

Setting	Description
For ALARM Relay	
Low Alarm	Sets the value at which the relay will turn on in response to decreasing measured value.
High Alarm	Sets the value at which the relay will turn on in response to increasing measured value.
Low Deadband	Sets the range in which the relay remains on after the measured value increases above the low alarm value.
High Deadband	Sets the range in which the relay remains on after the measured value decreases below the high alarm value.
Off Delay	Sets a time (0-300 seconds) to delay the relay from normally turning off.
On Delay	Sets a time (0-300 seconds) to delay the relay from normally turning on.
For CONTROL Relay	
Phase	A “high” phase assigns the relay setpoint to respond to increasing measured value; conversely, a “low” phase assigns the relay setpoint to respond to decreasing measured value.
Setpoint	Sets the value at which the relay will turn on.
Deadband	Sets the range in which the relay remains on after the measured value decreases below the setpoint value (high phase relay) or increases above the setpoint value (low phase relay).
Overfeed Timer	Sets the time (0-999.9 min.) to limit how long the relay can remain “on.” For more details on overfeed timer operation, see Section 10.
Off Delay	Sets a time (0-300 seconds) to delay the relay from normally turning off.
On Delay	Sets a time (0-300 seconds) to delay the relay from normally turning on.
For TIMER Relay	
Interval	Sets a time (0-999.9 min.) to establish how long the timer relay remains “off” before it turns on.
Duration	Sets the time (0-999 seconds) to limit how long the timer relay remains “on.”
Off Delay	Sets a time (0-999 seconds) to establish how long after the timer relay turns “off” that the analog outputs and alarm and control relays remain “held.”
For STATUS Relay	
No settings available -- status relay cannot be configured.	

7.5 Configuring Relays (continued)

NOTE: *It is possible to enter values that always keep a relay active or inactive. To avoid this, be sure that "low" values are lower than "high" values.When a relay is set for STATUS function, the ▷ symbol at the start of the "ACTIVATION" line indicates that this menu item is not available.*

The "off delay" and "on delay" settings, available to CONTROL or ALARM relays, may be beneficial in eliminating process "overshoot" when there are long process pipe runs or delays in mixing.

To set relay configuration values (ACTIVATION):

1. With the


screen displayed, press ⇩ **key** <u>once</u> to display


.

2. Press **ENTER key** to display the first respective relay function "ACTIVATION" screen setting.

3. Use the same basic keypad operations described in previous setup procedures to enter the desired value for the displayed relay activation setting.

4. Repeat this procedure for each relay activation setting.

7.6 SET PASSCODE (feature enabled or disabled)

The analyzer has a passcode feature to restrict access to configuration and calibration settings to only authorized personnel.

- **DISABLED:** With passcode feature disabled, all configuration settings can be displayed and changed, and the analyzer can be calibrated.

- **ENABLED:** With passcode feature enabled, all configuration settings can be displayed — but they cannot be changed, and the CALIBRATE and TEST/MAINT menus cannot be accessed without the passcode. When you attempt to change a setting in the CONFIGURE menu by pressing the **ENTER key**, a displayed notification requests passcode entry. A valid passcode entry saves the changed setting and returns the display to the "MAIN MENU" branch selection screen. An incorrect passcode entry causes the display to momentarily show an error notification before returning to the "MAIN MENU" branch selection screen. There is no limit on attempts to enter a valid passcode.

The passcode is factory set to "**3 4 5 6**." It cannot be changed.

To enable or disable the passcode feature:

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use **⇩ or ⇧ key** to display it.

2. Press **ENTER key** to display 

.

3. Press **⇩ key** until 

screen appears.

4. Press **ENTER key** to display 

. Use **⇩ and ⇧ keys** to view both choices (DISABLED or ENABLED). With the desired choice displayed, press **ENTER key** to enter this selection.

7.7 Configuration Setting Summary

Table E lists all configuration settings and their entry ranges/ choices and factory defaults, categorized by basic functions

Table E -- ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS)			
Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
LANGUAGE Setting			
LANGUAGE?	ENGLISH, FRENCH, GERMAN, SPANISH, etc.	ENGLISH	
SENSOR Settings			
SELECT MEASURE?	CONDUCTIVITY, CONCENTRATION or TDS	CONDUCTIVITY	
DISPLAY FORMAT? (full scale value)	CONDUCTIVITY: µS/cm: 200.0, or 2000 mS/cm: 2.000, 20.00, 200.0 or 2000 S/cm: 2.000 CONCENTRATION: 99.99% or 200.0% TDS: 9999 ppm	CONDUCTIVITY: 2000 µS/cm CONCENTRATION: 99.99% TDS: 9999 ppm	
T-COMPENSATION?	LINEAR, NATURAL WATER, TEMP TABLE or NONE	LINEAR at 2.00% per °C with 25.0°C reference temperature	
CONFIG CONC: SELECT TYPE?	BUILT-IN or USER-DEFINED	BUILT-IN	
CONFIG CONC: SET CHEMICAL?	NaOH 0-16%, $CaCl_2$ 0-22%, HNO_3 0-28%, HNO_3 36-96%, H_2SO_4 0-30%, H_2SO_4 40-80%, H_2SO_4 93-99%, H_3PO_4 0-40%, HCl 0-18% or HCl 23-36%	Built-in NaOH 0-16% chemical concentration table	
CONFIG CONC: USER DEFINED?	Edit default table by entering up to 10 data points with conductivity X coordinates and corresponding concentration Y coordinates	Two point default conc. table: Pt. 1: X = 0 µS/cm; Y = 0.00% Pt. 2: X = 2000 µS/cm; Y = 99.99%	
CONFIG TDS: SELECT FACTOR?	NaCl or USER DEFINED	NaCl	
CONFIG TDS: SET FACTOR?	0.01-99.99 ppm/µS	0.49 ppm/µS	
CONFIG LINEAR: SET SLOPE?	0-4.00% per °C	2.00% per °C	
CONFIG LINEAR: SET REF TEMP?	0-200.0°C or 32-392.0°F	25.0°C or 77°F	
SENSOR: CONFIG T-TABLE	Edit default table by entering up to 10 data points with temperature X coordinates and corresponding ratio Y coordinates (0-99.99)	Two point default temp. table: Pt. 1: X = 0.0°C; Y = 1.00 Pt. 2: X = 100.0°C; Y = 1.00	
SENSOR: SET FILTER?	0-60 seconds	0 seconds	
PULSE SUPPRESS?	OFF or ON	OFF	
SENSOR: ENTER NOTE?	Enter up to eight characters to replace COND	COND	
TEMP ELE: SELECT TYPE?	PT1000 or MANUAL	PT1000	
TEMP ELE: SET T FACTOR?	950-1050 ohms	1000 OHMS	
TEMP ELE: SET MANUAL?	0-200.0°C	25.0°C	
Temperature Display Setting			
SET °C OR °F?	°C or °F	°C	

Table E -- ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS -- continued)			
Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
OUTPUT Settings			
SET PARAMETER?	SENSOR or TEMPERATURE	Output 1: SENSOR Output 2: TEMPERATURE	
SET 4mA VALUE?	CONDUCTIVITY: µS/cm: 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 0 mS/cm: 0 S/cm: 0 CONC: 0.00% or 0.0% TDS: 0 ppm TEMP: 0.0°C or 32.0°F	
SET 20mA VALUE?	CONDUCTIVITY: µS/cm: 0-200.0 or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 200.0 or 2000 mS/cm: 2.000, 20.00, 200.0 or 2000 S/cm: 2.000 CONC: 99.99% or 200.0% TDS: 9999 ppm TEMP: 100.0°C or 212.0°F	
SET TRANSFER?	0-20 mA or 4-20 mA	All Outputs: 20 mA	
SET FILTER?	0-60 seconds	All Outputs: 0 seconds	
SCALE 0mA/4mA?	0 mA or 4 mA	All Outputs: 4 mA	
RELAY Settings			
Settings Common to ALARM and CONTROL Relays:			
SET PARAMETER?	SENSOR or TEMPERATURE	Relay A: SENSOR Relay B: TEMPERATURE	
SET FUNCTION?	ALARM, CONTROL, STATUS or TIMER	All Relays: ALARM	
SET TRANSFER?	DE-ENERGIZED or ENERGIZED	All Relays: DE-ENERGIZED	
OFF DELAY?	0-300 seconds	0 seconds	
ON DELAY?	0-300 seconds	0 seconds	
Settings for only ALARM Relays:			
LOW ALARM?	CONDUCTIVITY: µS/cm: 0-200.0 or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 0 mS/cm: 0 S/cm: 0 CONC: 0.00% or 0.0% TDS: 0 ppm TEMP: 0.0°C or 32.0°F	
HIGH ALARM?	CONDUCTIVITY: µS/cm: 0-200.0 or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 200.0 or 2000 mS/cm: 2.000, 20.00, 200.0 or 2000 S/cm: 2.000 CONC: 99.99% or 200.0% TDS: 9999 ppm TEMP: 100.0°C or 212.0°F	

Table E -- ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS -- continued)			
Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
Settings for only ALARM Relays (continued):			
LOW DEADBAND?	CONDUCTIVITY: 0-10% of range CONCENTRATION: 0-10% of range TDS: 0-10% of range TEMPERATURE: 0-10% of range	COND: 0 µS/cm, mS/cm or S/cm CONC: 0.00% or 0.0% TDS: 0 ppm TEMP: 0.0°C or 0.0°F	
HIGH DEADBAND?	CONDUCTIVITY: 0-10% of range CONCENTRATION: 0-10% of range TDS: 0-10% of range TEMPERATURE: 0-10% of range	COND: 0 µS/cm, mS/cm or S/cm CONC: 0.00% or 0.0% TDS: 0 ppm TEMP: 0.0°C or 0.0°F	
Settings for only CONTROL Relays:			
PHASE?	HIGH or LOW	Relays A and B: HIGH	
SET SETPOINT?	CONDUCTIVITY: µS/cm: 0-200.0 or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 200.0 or 2000 mS/cm: 2.000, 20.00, 200.0 or 2000 S/cm: 2.000 CONC: 99.99% or 200.0% TDS: 9999 ppm TEMP: 100.0°C or 212.0°F	
DEADBAND?	CONDUCTIVITY: 0-10% of range CONCENTRATION: 0-10% of range TDS: 0-10% of range TEMPERATURE: 0-10% of range	COND: 0 µS/cm, mS/cm or S/cm CONC: 0.00% or 0.0% TDS: 0 ppm TEMP: 0.0°C or 0.0°F	
OVERFEED TIMER?	0-999.9 minutes	0 minutes	
Settings for only TIMER Relays:			
INTERVAL?	0-999.9 minutes	5 minutes	
DURATION?	0-999 seconds	5 seconds	
OFF DELAY?	0-999 seconds	1 second	
PASSCODE Setting			
SET PASSCODE?	DISABLED or ENABLED	DISABLED	
TEST/MAINT Simulation Function Settings			
SELECT SIM?	SENSOR or TEMPERATURE	SENSOR	
SIM SENSOR?	CONDUCTIVITY: µS/cm: 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	Present measured value of sensor's selected parameter	

Section 8 - Analyzer Calibration

8.1 Important Information

Each electrodeless conductivity sensor has a unique zero point and span. Consequently, **always zero the sensor when calibrating it <u>for the first time</u>** (Section 8.2). Zeroing provides the best possible measuring accuracy. Then calibrate for sensor span using one of the available methods, and periodically thereafter to maintain best measurement accuracy. Over time, some processes such as heavy slurries may plug the sensor hole, causing minor measurement errors. The time between calibrations, and the rate of measurement drift can vary considerably with each application and its specific conditions.

Calibration Tip! Establish a maintenance program to keep the sensor relatively clean and the measuring system calibrated. The weekly or monthly intervals between performing maintenance will be influenced by the characteristics of the process solution, and can only be determined by operating experience.

Since the inherent ohm value of each sensor's Pt 1000 RTD temperature element varies slightly, each element is tested to provide a unique, factory-certified temperature T FACTOR shown etched on the sensor housing. If this factor was not previously entered during configuration in Section 7.2, subheading "SET T FACTOR," **<u>enter it now before zeroing or calibrating</u>** to provide best possible measuring accuracy.

NOTE: *When the passcode feature is enabled (Section 7.6), you must successfully enter the passcode before attempting to calibrate the analyzer.*

An in-progress calibration can always be aborted by pressing the ESC key. After the "ABORT: YES?" screen appears, do <u>one</u> of the following:

- Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog outputs <u>and</u> relays to their active states (MEASURE screen appears).
- Press **⇧ or ⇩ key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.

In addition to zeroing and calibrating for sensor span, you also can calibrate the analyzer analog output (1 and 2) mA values. Refer to Section 8.6 for details.

Zeroing/Calibration Tip! If a "CONFIRM FAILURE?" screen appears during zeroing or calibration, press **ENTER key** to confirm. Then, use **⇧ or ⇩ key** to select between "CAL: EXIT" or "CAL: REPEAT" and do <u>one</u> of the following:

- With "(CAL: EXIT)" screen selected, press **ENTER key**. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return analog outputs <u>and</u> relays to their active states (MEASURE screen appears).
- With "(CAL: REPEAT)" screen selected, press **ENTER key** to repeat zeroing or calibration.

8.2 ZERO Procedure (first-time sensor calibration only)

Zero the sensor if it is being calibrated for the first time. If not, disregard this subsection and proceed with sensor span calibration (Section 8.3, 8.4 or 8.5).

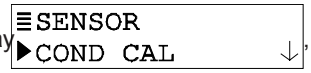
1. Make sure that the sensor is dry before zeroing.

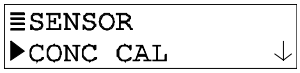
2. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use **⇩ or ⇧ key** to display it.

3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display 

, 

or 

(displayed screen depends on selected measurement).

5. Press **⇩ key** twice to display 

.

6. Press **ENTER key** to display 

. Use **⇧ and ⇩ keys** to view the three states that the analog outputs (and relays) can be in during zeroing:

   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

   With the desired choice displayed, press **ENTER key** to enter this selection.

7. With the dry sensor held in air and the "ZERO: IN DRY AIR?" screen displayed, press **ENTER key** to confirm this and start automatic zeroing.

8. After the "ZERO: CONFIRM ZERO OK?" screen appears, press **ENTER key** to end zeroing.

9. After the "ZERO: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes zeroing the sensor.

8.3 Conductivity Calibraton

After zeroing the sensor (first-time sensor calibration only), calibrate for sensor span using one of these methods:

- **COND CAL Method:** This method requires removing the sensor from the process, immersing it into a conductivity reference solution, and entering a reference for temperature compensation, and the known linear % per °C slope and conductivity value of the reference solution.

- **SAMPLE CAL Method:** This method allows keeping the sensor installed in the process, but requires you to obtain a process sample, determine its value by laboratory analysis or comparison reading, and enter that value.

- **ELECTRONIC CAL Method:** This method requires that the sensor be removed from the process and utilizes a decade resistance box to simulate conductivity rather than an actual solution.

COND CAL Method

1. Prepare the conductivity reference solution using your normal method. Its value should be near the typical measured process value for best accuracy. When the value is relatively low (between 200 and 100,000 microSiemens/cm), you may want to use the data in Table F to prepare the reference solution. Add the listed grams of pure, dried NaCl to one liter of high purity, de-ionized, CO_2-free water that is 25°C to obtain the listed conductivity. Solution conductivity can be decreased by dilution with de-ionized water.

Table F -- CONDUCTIVITY REFERENCE SOLUTIONS

Desired Solution Value			Grams NaCl
µS/cm	mS/cm	ppm (NaCl)*	To Be Added
200	0.20	100	0.10
500	0.50	250	0.25
1000	1.00	500	0.50
2000	2.00	1010	1.01
3000	3.00	1530	1.53
4000	4.00	2060	2.06
5000	5.00	2610	2.61
8000	8.00	4340	4.34
10,000	10.00	5560	5.56
20,000	20.00	11,590	11.59
50,000	50.00	31,950	31.95
100,000	100.00	72,710	72.71

** When using ppm measuring scale for compounds other than NaCl, refer to appropriate chemistry handbook for reference solution formulation.*

2. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

NOTE: *Suspend the sensor to prevent it from touching the container. Simply laying it into the container will produce calibration error. If the sensor is tee-mounted, use a smaller container. Ideally, convert a tee of the same size and material as the mounting tee into a calibration container by sealing two of its ends.*

3. Press **MENU key** to display a "MAIN MENU" screen. If the
```
≣MAIN MENU
▶CALIBRATE          ↓
```
screen is not showing, use **⇩ or ⇧ key** to display it.

4. Press **ENTER key** to display
```
≣CALIBRATE
▶SENSOR             ↓
```
.

5. Press **ENTER key** again to display
```
≣SENSOR
▶COND CAL           ↓
```
.

6. Press **ENTER key** again to display
```
COND CAL?
(HOLD OUTPUTS    )
```
. Use **⇧ or ⇩key** to view the three states that the analog outputs (and relays) can be in during calibration:

- **HOLD OUTPUTS:** Holds their present values.
- **XFER OUTPUTS:** Transfers to preset values.
- **ACTIVE OUTPUTS:** Responds to measured values.

With the desired choice displayed, press **ENTER key** to enter this selection.

7. With the
```
ENTER REF TEMP?
(25.0°C          )
```
screen displayed, use **arrow keys** to adjust the displayed temperature to match the desired reference solution temperature, if other than 25°C, and press **ENTER key** to enter the value.

8. After a screen like this
```
ENTER SLOPE?
(2.00 %/°C       )
```
appears, use **arrow keys** to adjust the displayed % per °C value to match the known slope of the reference solution, and press **ENTER key** to enter the value.

NOTE: *Measured values are normally compensated using the configured temperature compensation method. While using the "COND CAL" method to calibrate, the measured reference solution is linearly compensated by these entered reference temperature and slope values.*

9. With the sensor in solution and the
```
COND CAL:
SAMPLE READY?
```
screen displayed, press **ENTER key** to confirm. This active
```
XXXX uS/cm
READING STABLE?
```
screen appears showing the measured reference solution value.

10. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static
```
COND CAL?
(XXXX uS/cm      )
```
screen appears showing the "last measured" value.

11. Use **arrow keys** to adjust the displayed value to exactly match the known value of the reference solution.

12. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

13. Re-install the sensor into the process.

14. Press **ENTER key** to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes the "COND CAL" method of calibration.

SAMPLE CAL Method

The "SAMPLE CAL" method enables the sensor to remain installed in the process.

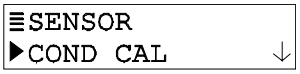
1. Obtain a sample of the process solution and determine its value using laboratory analysis or a calibrated portable meter.

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

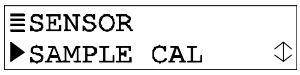
screen is not showing, use **⇩ or ⇧ key** to display it.

3. Press **ENTER key** to display 

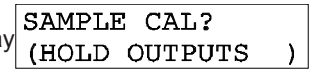
.

4. Press **ENTER key** again to display 

.

5. Press **⇩ key** once to display 

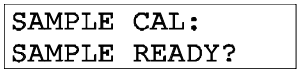
.

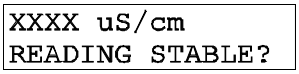
6. Press **ENTER key** to display 

. Use **⇧ or ⇩ key** to view the three states that the analog outputs (and relays) can be in during calibration:

   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

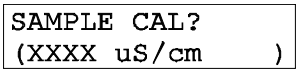
   With the desired choice displayed, press **ENTER key** to enter this selection.

7. With the sensor in the process and the 

screen displayed, press **ENTER key** to confirm. This active 

screen appears showing the measurement reading.

8. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the

reading has stabilized, this static 

screen appears showing the "last measured" value.

9. Use **arrow keys** to adjust the displayed value to exactly match the known value of the process sample.

10. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

11. Press **ENTER key** again to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes the "SAMPLE CAL" method of calibration.

ELECTRONIC CAL Method (only to be used after consulting with the factory)

The "ELECTRONIC CAL" method requires that the sensor be removed from the process and utilizes a decade resistance box to simulate conductivity rather than an actual solution.

1. Determine the typical conductivity in µS/cm for the application.

2. Calculate the required loop resistance by dividing 470 million by the desired conductivity in µS/cm (or 470 divided by the desired conductivity in S/cm)

3. Wrap (9) nine loops of wire (18-22 AWG) around and through the center of the sensor.

4. Connect this wire to a 1% or better decade resistance box (the decade box forms a 10th loop). Set the decade box to the value calculated above.

5. Press **MENU key** to display a "MAIN MENU" screen. If the 

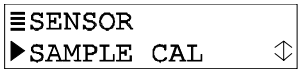
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

6. Press **ENTER key** to display 

.

7. Press **ENTER key** again to display 

.

8. Press ⇩ **key** once to display 

.

9. Press **ENTER key** to display 

. Use ⇧ **or** ⇩ **key** to view the three states that the analog outputs (and relays) can be in during calibration:

- **HOLD OUTPUTS:** Holds their present values.
- **XFER OUTPUTS:** Transfers to preset values.
- **ACTIVE OUTPUTS:** Responds to measured values.

With the desired choice displayed, press **ENTER key** to enter this selection.

10. Press **ENTER key** to display
```
SAMPLE CAL:
SAMPLE READY?
```
. With the decade box connected, press **ENTER key** again to confirm. This active
```
XXXX uS/cm
READING STABLE?
```
screen appears showing the measurement reading.

11. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static
```
SAMPLE CAL?
(XXXX uS/cm     )
```
screen appears showing the "last measured" value.

12. Use **arrow keys** to adjust the displayed value to exactly match the desired conductivity value used in the calculation..

13. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

14. Press **ENTER key** again to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes ELECTRONIC CAL calibration.

8.4 % Concentration Calibration

After zeroing the sensor (first-time sensor calibration), calibrate for sensor span using one of these methods:

- **CONC CAL Method:** This method requires you to immerse the sensor into a prepared % concentration reference solution of known value, or to keep the sensor installed in the process while obtaining a process sample. When keeping the sensor installed, determine the process value by laboratory analysis or comparison reading. In either case, enter the known reference solution or sample % concentration value.

- **COND CAL Method:** This method requires you to remove the sensor from the process, immerse it into a conductivity reference solution, and enter a temperature compensation reference temperature, linear % per °C slope, and known reference solution value. The conductivity reference solution should have an equivalent, uncompensated value that corresponds with the normal % concentration value of the process.

CONC CAL Method

1. Depending on the situation, do one of the following:

   - When Keeping Sensor Installed:

     Obtain a sample of the process solution and determine its value using laboratory analysis or a recently calibrated portable meter.

   - When Using a Reference Solution:

     A. Prepare a % concentration reference solution using your normal method. **To achieve accurate calibration, the reference solution must have the same chemical composition as the process.** Also, its value should be near the typical measured process value.

     B. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

     NOTE: *Suspend the sensor to prevent it from touching the container. Simply laying it into the container will produce calibration error. If the sensor is tee-mounted, use a smaller container. Ideally, convert a tee of the same size and material as the mounting tee into a calibration container by sealing two of its ends.*

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use **⇩ or ⇧ key** to display it.

3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display

```
≡SENSOR
▶CONC CAL                ↓
```

.

5. Press **ENTER key** again to display

```
CONC CAL?
(HOLD OUTPUTS    )
```

. Use **⇧ or ⇩ key** to view the three states that the analog outputs (and relays) can be in during calibration:

   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

   With the desired choice displayed, press **ENTER key** to enter this selection.

6. With the sensor in the process (or reference solution) and the

```
CONC CAL:
SAMPLE READY?
```

   screen displayed, press **ENTER key** to confirm. This active

```
XX.XX%
READING STABLE?
```

   screen appears showing the measurement reading.

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static

```
CONC CAL?
(XX.XX%          )
```

   screen appears showing the "last measured" value.

8. Use **arrow keys** to adjust the displayed value to exactly match the known value of the process sample (or reference solution).

9. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

10. If the sensor was immersed in a reference solution, re-install the sensor into the process.

11. Press **ENTER key** to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes the "CONC CAL" method of calibration.

COND CAL Method

When the analyzer is set to measure % concentration but you want to calibrate using a conductivity reference solution, please refer to Section 8.3, subsection "COND CAL Method" and follow steps 1 through 14

8.5 TDS Calibration

When the analyzer is set to measure TDS, only the "TDS CAL" method is available for sensor span calibration. This method requires you to immerse the sensor into a prepared TDS reference solution of known ppm value, or to keep the sensor installed in the process while obtaining a process sample. In either case, enter the known reference solution or sample ppm value.

1. Depending on the situation, do one of the following:

   - When Keeping Sensor Installed:

     Obtain a sample of the process solution and determine its value using laboratory analysis or a recently calibrated portable meter.

   - When Using a Reference Solution:

   A. Prepare a TDS reference solution using your normal method. **To achieve accurate calibration, the reference solution must have the same chemical composition as the process.** Also, its value should be near the typical measured process value. When the value is relatively low (between 100 and 72,710 ppm NaCl), you can prepare the reference solution using the information from step 1 and Table F in Section 8.3, subsection "COND CAL Method."

   B. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

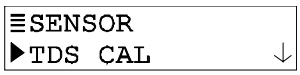
   NOTE: *Suspend the sensor to prevent it from touching the container. Simply laying it into the container will produce calibration error. If the sensor is tee-mounted, use a smaller container. Ideally, convert a tee of the same size and material as the mounting tee into a calibration container by sealing two of its ends.*

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

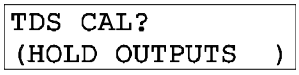
screen is not showing, use **⇩or ⇧key** to display it.

3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display 

.

5. Press **ENTER key** again to display 

. Use **⇧ or ⇩ key** to view the three states that the analog outputs (and relays) can be in during calibration:

   - **HOLD OUTPUTS:** Holds their present values.
   - **XFER OUTPUTS:** Transfers to preset values.
   - **ACTIVE OUTPUTS:** Responds to measured values.

   With the desired choice displayed, press **ENTER key** to enter this selection.

6. With the sensor in the process (or reference solution) and the

TDS CAL: SAMPLE READY?

screen displayed, press **ENTER key** to confirm. This active

XXXX ppm READING STABLE?

screen appears showing the measurement reading.

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static

TDS CAL? (XXXX ppm)

screen appears showing the "last measured" value.

8. Use **arrow keys** to adjust the displayed value to exactly match the known value of the process sample (or reference solution).

9. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

10. If the sensor was immersed in a reference solution, re-install the sensor into the process.

11. Press **ENTER key** to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog outputs and relays to their active states (MEASURE screen appears).

This completes the "TDS CAL" method of calibration.

8.6 Analog Outputs (1 and 2) Calibration

The analyzer analog outputs are factory-calibrated. However, they can be re-calibrated at any time if desired. **These instructions calibrate Output 1. Calibrate Output 2 in the same way using its respective menu screens.**

NOTE: *When the passcode feature is enabled (Section 7.6), you must successfully enter the passcode before attempting to calibrate the analog outputs.*
When an output is configured to be 0-20 mA, the analyzer will calibrate the 4 mA and 20 mA values (not the 0 mA value). Also, the analyzer adjustment range for output values during calibration is ± 2 mA.

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

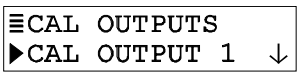
screen is not showing, use **⇩ or ⇧ key** to display it.

2. Press **ENTER key** to display 

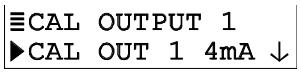
.

3. Press **⇩ key** once to display 

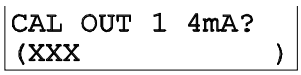
.

4. Press **ENTER key** to display 

.

5. Press **ENTER key** again to display 

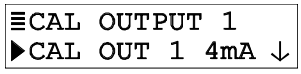
.

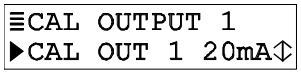
6. Press **ENTER key** again to display a screen like 

. The displayed value is "counts" — not mA — that dynamically change when the output is adjusted.

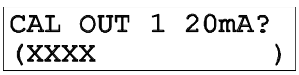
7. Use a calibrated digital multimeter to measure Output 1's actual minimum value provided at Terminals 4 and 5 on TB4.

8. Use **arrow keys** to adjust Output 1's minimum value to read exactly "4.00 mA" on the digital multimeter — not the analyzer display, and press **ENTER key** to complete calibration of the minimum endpoint value.

9. After the 

screen re-appears, press **⇩ key** once to display 

.

10. Press **ENTER key** to display a screen like 

. Once again, the displayed value is "counts" — not mA — that dynamically change when the output is adjusted.

11. Use a calibrated digital multimeter to measure Output 1's actual maximum value.

12. Use **arrow keys** to adjust Output 1's maximum value to read exactly "20.00 mA" on the digital multimeter — not the analyzer display, and press **ENTER key** to complete calibration of the maximum endpoint value.

This completes Output 1 calibration.

Section 9 - Test / Maintenance

The analyzer has TEST/MAINT menu screens to:

- Check system status of analyzer, sensor, and relays, including TIMER relay countdown.
- Hold analog outputs at their last measured values.
- Manually reset all relay overfeed timers at once.
- Provide analog output test signals to confirm operation of connected devices.
- Test relay operation (energize or de-energize).
- Test front panel alarm LED operation (on or off).
- Identify analyzer EPROM version.
- Simulate a measurement or temperature signal to exercise the measurement loop.
- Reset all configuration values to factory-set defaults.

9.1 STATUS CHECKING (Analyzer, Sensor and Relays)

The system diagnostic capabilities of the analyzer enable you to check the operating status of the analyzer, sensor (measurement and temperature signals), and relays. The MEASURE screen will flash the "WARNING CHECK STATUS" message when a sensor or analyzer "FAIL" diagnostic condition has been detected. To determine the condition causing the warning, display the "STATUS" screens.

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use **⇩ or ⇧ key** to display it.

2. Press **ENTER key** to display 

.

3. Press **ENTER key** again to display "STATUS: ANALYZER OK" screen. This screen confirms that the analyzer is operating properly. If "FAIL" appears, it may mean:
   - EPROM failure (data is not valid).
   - Scaling card not present or not recognized.
   - Analog-to-digital converter not responding.
   - RAM failure.
   - Internal serial communications failure.

4. Press the **ENTER key** again to view the "STATUS: SENSOR OK" screen. If "FAIL" appears, it indicates that the sensor cable wires or terminals are shorted.

5. Press the **ENTER key** again to view the "STATUS: TEMP OK" screen. If "FAIL" appears, it indicates that the Pt1000 RTD temperature element in the sensor is inoperative, disconnected or incorrectly wired.

6. With the "STATUS: TEMP OK" screen displayed, press **ENTER key** once to view the "STATUS: RLY A" screen. Press the **ENTER key** again to view the "STATUS: RLY B" screen. Status indications can be:

Status Indication	Meaning
ACTIVE (Relay energized; LED is on.)	Control Relay: Measured value exceeds setpoint. Alarm Relay: Measured value exceeds low or high alarm point. Status Relay: Existing system diagnostic condition has been detected.
INACTIVE (Relay not energized; LED is off.)	Control Relay: Measured value does not exceed setpoint. Alarm Relay: Measured value does not exceed low or high alarm point. Status Relay: Analyzer has not detected system diagnostic condition.
TIMEOUT (Relay not energized; LED is blinking.)	Control Relay: Overfeed timer has timed out; manually reset it. **NOTE:** TIMEOUT only applies to control relays.
COUNTING (Relay energized; LED is on.)	Control Relay: Overfeed timer is counting, but has not timed out. **NOTE:** COUNTING only applies to control relays.
TIME ON (Relay energized; LED is on.)	Timer Relay: Timer relay is on and counting down duration time before turning off. **NOTE:** TIME ON only applies to timer relays.
TIME OFF (Relay not energized; LED is off.)	Timer Relay: Timer relay is off and counting down interval time before turning on. **NOTE:** TIME OFF only applies to timer relays.

7. To end status checking, press **ESC key** or **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

9.2 HOLD OUTPUTS

The analyzer has a convenient feature to hold the analog outputs at their last measured values for up to 30 minutes, suspending operation of any connected devices.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩**key** once to display ≣TEST/MAINT ▶HOLD OUTPUTS ⇳.

2. Press **ENTER key** to immediately hold the analog outputs ("HOLD OUTPUTS: ENTER TO RELEASE" screen appears, acknowledging hold is applied).

   NOTE: *If the keypad is not used within 30 minutes, the analog outputs will automatically change back to their active states and the display will return to the MEASURE screen.*

3. To release the hold at any time and return analog outputs back to their "active" states, press **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

9.3 OVERFEED RESET (relay timers)

When a relay overfeed timer "times out," as indicated by its blinking LED, the timer must be manually reset using TEST/ MAINT menu screens. The relay LED stops blinking after reset. **All overfeed timers are manually reset at once.**

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶OVERFEED RESET⇳ screen appears.

2. Press **ENTER key** to display "OVERFEED RESET: DONE" screen, acknowledging all relay overfeed timers have been reset.

3. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

9.4 OUTPUT (1 AND 2) Analog Test Signals

The analyzer can provide analog output test signals of a desired mA value to confirm operation of connected devices. **These instructions provide an Output 1 test signal. Provide an Output 2 test signal in the same way using its respective menu screens.**

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶OUTPUT 1 ⇳ screen appears.

2. Press **ENTER key** to display a screen like OUTPUT 1? (XX.XXmA) .

   NOTE: *The mA test signal for Output 1 is now active. Its value is shown on this screen.*

3. Use **arrow keys** to adjust the displayed value to obtain the desired mA test signal at Output 1 terminals.

4. To remove the output test signal and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

9.5 RELAY (A and B) Operating Test

Relays A and B can be tested to confirm their operation. **These instructions test Relay A. Test Relay B in the same way using its respective menu screens.**

NOTE: *The front panel relay LEDs will not operate during this test.*

1. With the
```
≣TEST/MAINT
▶STATUS                ↓
```
screen displayed, press **⇩ key** until
```
≣TEST/MAINT
▶RELAY A               ⇳
```
screen appears.

2. Press **ENTER key** to display
```
RELAY A?
(ENERGIZE          )
```
. Relay A should be energized. Confirm this by checking its NO and NC relay output terminals with a continuity meter.

3. Press **⇧ or ⇩ key** once to display
```
RELAY A?
(DE-ENERGIZE       )
```
. Relay A should now be de-energized. Confirm this by checking its NO and NC relay output terminals with a continuity meter.

4. To end this test and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

9.6 ALARM LEDS Operating Test

Both front panel relay LEDs can be simultaneously tested.

1. With the
```
≣TEST/MAINT
▶STATUS                ↓
```
screen displayed, press **⇩ key** until
```
≣TEST/MAINT
▶ALARM LEDS            ⇳
```
screen appears.

2. Press **ENTER key** to display
```
ALARM LEDS:
ALTERNATE ON/OFF
```
. Both front panel LEDs should continuously blink on and off.

3. To end this test and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

9.7 EPROM VERSION Checking

You can check the version of EPROM used in the analyzer.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶EPROM VERSION ⇳ screen appears.

2. Press **ENTER key** to view the EPROM version screen.

3. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

9.8 SELECT SIM Measurement

You can simulate a measured value to make the relays and analog outputs respond accordingly. First, select the type of simulated value using this subsection. Then, set the desired simulation value following the steps in subsection 9.9.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶SELECT SIM ⇳ screen appears.

2. Press **ENTER key** to display a screen like SELECT SIM? (SENSOR). Use ⇩ **and** ⇧ **keys** to view choices:
   - **SENSOR:** Depending on the configured measurement, selects the simulated value to be a conductivity, % concentration or TDS value.
   - **TEMPERATURE:** Selects the simulated value to be a temperature value.

3. With the desired choice displayed, press **ENTER key** to enter this selection.

9.9 SIM Setting

After selecting the type of simulated measurement (subsection 9.8), set the desired simulation value.

1. With the ≣TEST/MAINT ▶SELECT SIM ⇳ screen displayed, press ⇩ **key** once to display ≣TEST/MAINT ▶SIM SENSOR ⇳.

2. Press **ENTER key** to display a screen like SIM SENSOR? (XXXX mS/cm).

NOTE: *Both analog output signals are now active. They have a mA value that corresponds to the measurement value shown on this screen. (The relays, depending on their configured settings, may also respond to this simulation value.)*

3. Use **arrow keys** to adjust the displayed simulation value to the desired value.

4. To remove the simulated ouput and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

9.10 RESET CONFIG Values to Factory Defaults

You can conveniently reset all stored configuration and calibration settings simultaneously to factory-set defaults (see Table E).

1. With the


screen displayed, press ⇩ **key** until


screen appears.

2. Press **ENTER key** to display the “RESET CONFIG: ARE YOU SURE?” screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)

3. Press **ENTER key** to reset all stored configuration and calibration settings to factory defaults. The “RESET CONFIG: DONE” screen appears, acknowledging that reset has occurred.

4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

Section 10 - Relay Overfeed Timer Feature

The useful relay overfeed timer feature, **only available to a CONTROL relay**, is described in more detail in this section.

10.1 Why Use an Overfeed Timer

Suppose that you configure a CONTROL relay with a high phase to operate in response to increasing measured value. The CONTROL relay will then turn on whenever the measured value exceeds its preset setpoint. When the measured value decreases below the setpoint by an amount you preset (the deadband setting), the relay will turn off. But what if a damaged sensor or a process upset condition keeps the measured value above the setpoint or deadband setting? The control element (valve, pump, etc.) switched by that relay would then continue to operate. Depending on the application control scheme, this may excessively dispense costly chemical additives or overly drain or divert the process. Also, the control element itself could be damaged due to excessive continuous or unusual operation such as a pump that is running dry. The useful overfeed timer prevents undesirable conditions like these from happening. It restricts how long the relay and its connected control element will remain on regardless of conditions.

10.2 Configuring Relay Overfeed Timers

To set a relay overfeed timer, use its respective configuration menu screen. The time you set to restrict how long the relay stays on (0-999.9 minutes) should be just enough to provide acceptable results. An excessive setting may waste chemicals or the process itself. Initially, set this time as an estimate. Then, by experimenting and observing the response, periodically “fine tune” to optimize the setting.

10.3 Overfeed Timer "Timout" Operation

When a CONTROL relay is on and its overfeed timer “times out,” its LED indicator will blink. This indicates that the relay is now off and will remain off until you manually reset the overfeed timer. After reset, the relay LED stops blinking. (Both relay overfeed timers are reset simultaneously.)

10.4 Resetting Overfeed Timers

To manually reset both relay overfeed timers, please refer to Section 9.3.

10.5 Interations with Other Analyzer Functions

A relay overfeed timer can, and often will, interact with other analyzer functions while those functions are in use. Table G on the next page explains common overfeed timer interactions.

Table G -- RELAY OVERFEED TIMER INTERACTIONS WITH OTHER ANALYZER FUNCTIONS		
Function Conditions		Resulting Action of Overfeed Timer
Manually Holding Relay Operation (when outputs are held at start of calibration)		
Off relay held in "off"	Overfeed timer was off	Overfeed timer remains off. After you change back to ACTIVE from the HOLD mode, the overfeed timer will remain off until the measured value (or a value you simulate) causes the relay to turn on.
On relay held in "on"	Overfeed timer was counting	Overfeed timer continues its "count down" until it turns the relay off. If you release HOLD before the timer "times out," the timer continues its "count down" until it turns the relay off or the timer automatically resets when the measured value (or a value you simulate) causes the relay to turn off. If you release HOLD after the timer has "timed out," it must be manually reset (PART THREE, Section 5.3).
On relay held in "on"	Overfeed timer was timed out	Overfeed timer remains off which keeps the relay turned off. You must manually reset the timer (PART THREE, Section 5.3).
Manually Transferring Relay Operation (when outputs are transferred at start of calibration)		
Off relay is transferred to "on"	Overfeed timer was off	Overfeed timer starts its "count down" until it turns the relay off. After you change the "on" relay back to "off," the overfeed timer automatically resets.
On relay is transferred to "off"	Overfeed timer was counting	Overfeed timer automatically resets. After you change the "off" relay back to "on," the overfeed timer starts its "count down" until it turns the relay off, or the timer automatically resets again when the measured value (or a value you simulate) causes the relay to turn off.
On relay is transferred to "off"	Overfeed timer was timed out	
Manually Testing Relay Operation (using TEST/MAINT menu screens)		
Off relay is changed to "on"	Overfeed timer was off	Overfeed timer starts its "count down" until it turns the relay off. After you change the "on" relay back to "off," the overfeed timer automatically resets.
On relay is changed to "off"	Overfeed timer was counting	Overfeed timer automatically resets. After you change the "off" relay back to "on," the overfeed timer starts its "count down" until it turns the relay off, or the timer automatically resets again when the measured value (or a value you simulate) causes the relay to turn off.
On relay is changed to "off"	Overfeed timer was timed out	
Operating a Relay By Simulating a Value (using TEST/MAINT menu screens)		
Off relay is turned "on" by simulated value	Overfeed timer was off	Overfeed timer starts its "count down" until it turns the relay off. After you change the "on" relay back to "off," the overfeed timer automatically resets.
On relay is turned "off" by simulated value	Overfeed timer was counting	Overfeed timer automatically resets. After you change the "off" relay back to "on," the overfeed timer starts its "count down" until it turns the relay off, or the timer automatically resets again when the measured value (or a value you simulate) causes the relay to turn off.
On relay is turned "off" by simulation value	Overfeed timer was timed out	

Section 11 - Service and Troubleshooting

When experiencing problems, try to determine the primary measurement system component causing the problem (sensor, analyzer or interconnect cable, if used).

11.1 Inspecting Sensor Cable

If a measurement problem exists and you suspect the sensor cable, inspect it for physical damage. If an interconnect cable is used, disconnect the cable at both ends (sensor and analyzer) and, using an ohmmeter, check its wires for continuity and internal shorts.

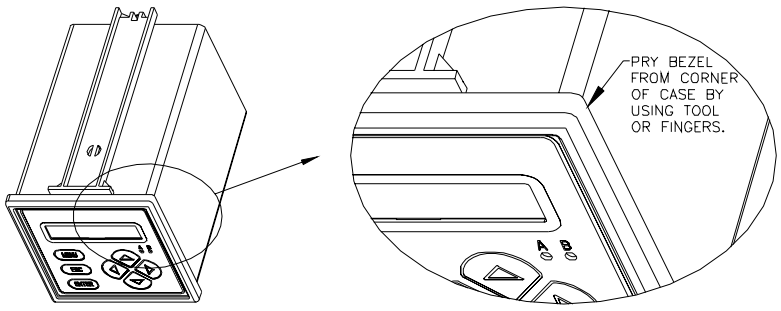
11.2 Replacing Internal Fuse(s)

The analyzer is equipped with two internal, board-mounted fuses (80 and 100 mA; type T slow-blow; 5 mm x 20 mm). The fuses protect the 115 and 230 volt line power circuits.

> WARNING:
> DISCONNECT LINE POWER TO AVOID THE POSSIBILITY OF ELECTRICAL SHOCK.

1. After disconnecting line power, unplug all terminal connectors from their terminal strips.
2. Using a flat bladed knife or screwdriver, remove the bezel. Start by prying the bezel from one of the front panel corners as shown in Figure 11-1. **(If the bezel breaks do not be concerned.** A new bezel is supplied in the fuse kit.)
3. Slowly pull the analyzer (front panel and all connected circuit boards) out of the case.
4. Locate the board-mounted fuses on the left circuit board. Remove the blown fuse and replace it with an Anderson fuse (or equivalent). A fuse kit (53433-A0001) includes 80 mA and 100 mA fuses, and replacement bezel.
5. Re-assemble the analyzer. Then plug all terminal connectors back into their terminal strips.

FIGURE 11-1 Removing Analyzer Bezel



11.3 Replacing Relays

The analyzer relays are soldered into a complex, multi-layered circuit board. To avoid the possibility of damaging this board while attempting to replace a relay, simply return the complete analyzer to the factory for relay replacement.

11.4 Keeping Sensor Clean

To maintain measurement accuracy, periodically clean the sensor. Operating experience will help you determine when to clean the sensor (typically once a month). Use the recommended cleaning procedure described in the electrodeless conductivity sensor operating manual.

11.5 Keeping Analyzer Calibrated

Depending on application circumstances, periodically calibrate the analyzer to maintain measurement accuracy.

> **Maintenance Tip!** Upon startup, frequently check the system until operating experience can determine the optimum time between calibrations that provides acceptable measurement results.

Calibrate the analyzer using a method described in Section 8.3, 8.4 or 8.5. Calibrating with old, contaminated or diluted reference solution may cause measurehment errors. **Do not reuse a reference solution — always discard it.** Note that the value of a reference solution changes as its temperature changes. Therefore, always allow the temperatures of the sensor and reference solution to equalize while calibrating.

11.6 Avoiding Electrical Interference

> **Recommendation:** Do not run the sensor cable (and interconnect cable, if used) in the same conduit with AC or DC power wiring. Also, connect cable shielding as recommended (Section 4).

> **Maintenance Tip!** Excess cable should not be coiled near motors or other equipment that may generate electrical or magnetic fields. Cut cables to proper length during installation to avoid unnecessary inductive pickup ("electrical noise" may interfere with sensor signal).

11.7 Checking Electrical Connections

1. Verify that line power exists at the appropriate analyzer TB1 terminals.
2. Check all analyzer cable connections to ensure they are properly connected.

11.8 Verifying Sensor Operation

To verify sensor operation, refer to the procedure in the troubleshooting section of the sensor operating manual.

11.9 Verifying Analyzer Operation

> WARNING:
> DISCONNECT LINE POWER TO AVOID THE POSSIBILITY OF ELECTRICAL SHOCK.

1. After disconnecting line power and the sensor from the analyzer, connect a 1000 ohm resistor between Terminals 7 (red) and 9 (yellow) on TB3.
2. Connect a 100,000 ohm resistor between Terminals 6 (white) and 10 (green) on TB3.
3. Reconnect line power to the analyzer.

WARNING:
LINE POWER IS PRESENT. BE CAREFUL TO AVOID ELECTRICAL SHOCK.

4. Verify that the analyzer conductivity reading is between 5.00 and 50.00 mS/cm. Also, verify that the analyzer temperature reading is between -10 and +10°C.

11.10 Verifying Interconnect Cable Integrity

If above readings are achieved, the analyzer is operating properly, but the interconnect cable (if used) may be faulty.

WARNING:
DISCONNECT LINE POWER TO AVOID THE POSSIBILITY OF ELECTRICAL SHOCK.

1. After disconnecting line power, reconnect the sensor directly to the analyzer (purposely bypassing the interconnect cable and junction box, if used).
2. Place the sensor in a container of saturated salt water that is at room temperature (approximately 25°C).
3. Reconnect line power to the analyzer.

WARNING:
LINE POWER IS PRESENT. BE CAREFUL TO AVOID ELECTRICAL SHOCK.

4. Verify that the analyzer conductivity reading is between 150 mS/cm and 350 mS/cm. If the reading is achieved, the interconnect cable and/or junction box connections are probably faulty. Use a digital multimeter to check the interconnect cable for shorted or open wires.

Section 12 - Ordering Matrix

OUTPUT
A Standard

ENCLOSURE
0 No enclosure
1 Watertight fiberglass enclosure with liquid-tight connectors

ACCESSORIES
53433A0001 Fuse Kit - Includes two (2) replacement fuses and a bezel