1 YEAR WARRANTY

MADE IN USA

CE

User's Guide

CDCN684
Conductivity Analyzer

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IMPORTANT SAFETY INFORMATION

This analyzer is compliant with safety standards as outlined in:

FMRC Class Numbers 3600, 3611, and 3810 (U.S.A.)
CSA C22.2 No. 142 and C22.2 No. 213 (Canada)
EN 61010-1 (European Community)

Please read and observe the following:

- Line voltage may be present at terminals on TB1 at the back of the analyzer enclosure. This may be hazardous. Always remove line power before going near this area of the analyzer. The front bezel assembly of the analyzer, however, contains only low voltage and is completely safe to handle.
- Wiring or repairs should only be performed by qualified personnel and only to an unpowered analyzer.
- Whenever it appears that analyzer safety is questionable, disable the analyzer to ensure against any unintended operation. For example, an unsafe condition is likely when:
  1) The analyzer appears visibly damaged.
  2) The analyzer fails to operate properly or provide the intended measurements.
  3) The analyzer has been stored for long periods at temperatures above 158°F (70°C).
- This analyzer must be installed by specially trained personnel in accordance with relevant local codes and instructions contained in this operating instruction manual. Observe the analyzer's technical specifications and input ratings. If one line of the line power mains is not neutral, use a double-pole mains switch to disconnect the analyzer.

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

WARNING:

A WARNING LOOKS LIKE THIS. ITS PURPOSE IS TO WARN YOU OF THE POTENTIAL FOR PERSONAL INJURY.

CAUTION:

A CAUTION LOOKS LIKE THIS. ITS PURPOSE IS TO ALERT YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. Its purpose is to alert you to important, useful operating information.*

Definition of Equipment Symbols

This symbol **means CAUTION** and alerts you to possible danger or instrument malfunction. Refer to this manual before proceeding.

This symbol, which appears on the analyzer POWER terminal block (shown in Figure 2-2), **means that this is a protective ground terminal** and alerts you to connect an earth ground to it.

This symbol **means that there is alternating current present** and alerts you to be careful.

CONDENSED OPERATING INSTRUCTIONS

This manual contains details for all operating aspects of the instrument. The following condensed instructions are provided to assist you in getting the instrument started up and operating as quickly as possible. **These condensed instructions only pertain to basic conductivity measurement operation.** To measure resistivity, TDS, or a calculated Sensor A and B measurement, or to use specific features of the instrument, refer to the appropriate sections in this manual for instructions.

A. CONNECTING SENSOR(S)/CONFIGURING TEMPERATURE ELEMENT(S)

1. After the analyzer is properly mounted (Part Two, Section 2), connect the Omega's CDE680 Series contacting conductivity sensor(s), matching wire colors to terminals as indicated:

Sensor A Wire Colors	Connect To
Red	Terminal #1 on TB3
Black	Terminal #2 on TB3
Clear (inner shield wire)	Terminal #3 on TB3
White	Terminal #4 on TB3
Blue	Terminal #5 on TB3
Clear w/black (outer shield)	Terminal #1 on TB2

Sensor B Wire Colors	Connect To
Red	Terminal #6 on TB3
Black	Terminal #7 on TB3
Clear (inner shield wire)	Terminal #8 on TB3
White	Terminal #9 on TB3
Blue	Terminal #10 on TB3
Clear w/black (outer shield)	Terminal #2 on TB2

NOTE: *For best immunity to electromagnetic interference, connect the sensor cable's outer shield wire (clear with black band -- not its clear only inner shield wire) to a "SENSOR SHIELD (OUTER)" terminal on TB2.*

2. The analyzer is supplied factory-set for automatic temperature compensation using the Pt 1000 ohm temperature element built into Omega's CDE680 Series contacting conductivity sensors. When using a sensor with a different temperature element, or if you want fixed MANUAL temperature compensation, you must change the temperature element type (see Part Three, Section 3.2, subheading "Selecting Temperature Element Type").

NOTE: *When using only one sensor, select "MANUAL" for the unused sensor input element type to prevent a "WARNING: CHECK STATUS" message due to analyzer detecting no element.*

B. CONNECTING LINE POWER

Important: Follow the instructions in Part Two, Section 3.4 to connect line power to the analyzer.

C. CALIBRATING THE ANALYZER

The analyzer must be calibrated so that measured values will correspond to actual process values. It can be traditionally "wet" calibrated. However, since measured conductivity is greatly affected by small changes in temperature, OMEGA strongly recommends using its DRY method for highest measuring accuracy of conductivity and temperature. Besides, the DRY method is actually a normal part of configuring the sensor characteristics during initial startup, and **eliminates the need for conductivity reference solutions.** This method also automatically sets the analyzer measuring range to match the inherent range of the sensor's cell constant. For more details about the benefits of DRY, refer to the "Calibration Tip!" in Part Three, Section 4.1.

NOTE: *DRY method eliminates the need for periodic re-calibration! The only requirement, depending on the application, may be to periodically clean the sensor. Only when the sensor is replaced is it necessary to perform a new DRY calibration.*

Calibration Tip! Each contacting conductivity sensor has a unique zero point and offset. Consequently, when calibrating a sensor for the first time, always zero it according to step 1. Zeroing provides the best possible measuring accuracy, and eliminates any discrepancy between Sensor A and B measurement channels.

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CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER -- (continued)

DRY calibration, routinely attained while configuring the analyzer for sensor characteristics, requires entry of the sensor's OMEGA-certified "K" value and temperature "T factor" which are unique to each sensor. When using two sensors, enter each unique set of values using the respective sensor menu screens.

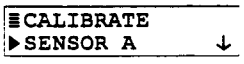
1. Zero the sensor if it is being calibrated for the first time. If not, disregard this step and perform steps 2 through 17.

> **Zeroing Tip!** If at any time during zeroing, the "ZERO: CONFIRM FAILURE?" screen appears, press **ENTER key** to confirm. Then, use the ⇧ or ⇩ **key** to select between "CAL REPEAT?" or "CAL EXIT?" and do one of the following:
>
> - With the "ZERO: CAL REPEAT?" screen selected, press **ENTER key** to repeat zeroing.
> - With the "ZERO: CAL: EXIT?" screen selected, press **ENTER key**. After the "ZERO: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog outputs and relays to their active states (MEASURE screen appears).

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

   B. Press **MENU key** to display 

.

   C. Press **ENTER key** to display 

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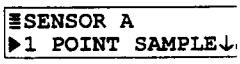
   D. Press **ENTER key** again to display 

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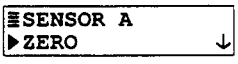
   E. Press ⇩ **key** once to display 

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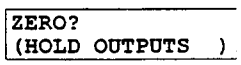
   F. Press **ENTER key** to display 

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   G. Press **ENTER key** again to "hold" the analog outputs and relays at their present states during zeroing. (Outputs can also be transferred to preset values or allowed to remain active.)

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

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

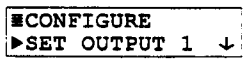
   J. After the "ZERO: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog outputs and relays to their active states (MEASURE screen appears).

2. Press **MENU key** to display 

.

3. Press ⇩ **key** once to display 

.

4. Press **ENTER key** to display 

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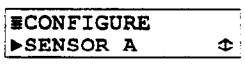
5. Press ⇩ **key** until you display 

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CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER – (continued)

6. Press **ENTER key** to display [≡SENSOR A / ▶SELECT MEASURE↓].
7. Press ⇩ **key** until you display [≡SENSOR A / ▶CELL CONSTANT ⇕].
8. Press **ENTER key** to display [≡CELL CONSTANT / ▶SELECT CELL K ↓].
9. Press **ENTER key** again to display a cell category selection screen like [SELECT CELL K? / (0.0500)]. Use ⇧ **and** ⇩ **keys** to select the nominal cell category that corresponds to the sensor's OMEGA-certified "K" value shown on a label attached to the sensor cable or to the inside cover of its optional junction box. Then press **ENTER key** to enter the selection.
10. After the [≡CELL CONSTANT / ▶SELECT CELL K ↓] screen re-appears, press ⇩ **key** once to display [≡CELL CONSTANT / ▶SET CELL K ⇕].
11. Press **ENTER key** to display a cell "K" value screen like [SET CELL K? / (0.0500)]. Use ⇨ **and** ⇦ **keys** to coarse adjust, and ⇧ **and** ⇩ **keys** to fine adjust the displayed value to exactly match the sensor's OMEGA-certified "K" value. Then press **ENTER key** to enter the value.
12. After the [≡CELL CONSTANT / ▶SET CELL K ⇕] screen re-appears, press **ESC key** once to display [≡SENSOR A / ▶CELL CONSTANT ⇕].
13. Press ⇩ **key** until you display [≡SENSOR A / ▶TEMP ELEMENT ⇕].
14. Press **ENTER key** to display [≡TEMP ELEMENT / ▶SELECT TYPE ↓].
15. Press ⇩ **key** once to display [≡TEMP ELEMENT / ▶SET T FACTOR ⇕].
16. Press **ENTER key** to display a "T" factor value screen like [SET T FACTOR? / (1000.0 OHMS)]. Use ⇨ **and** ⇦ **keys** to coarse adjust, and ⇧ **and** ⇩ **keys** to fine adjust the displayed value to exactly match the sensor's OMEGA-certified "T" factor. Then press **ENTER key** to enter the value.
17. After the [≡TEMP ELEMENT / ▶SET T FACTOR ⇕] screen re-appears, press **MENU key** once and then **ESC key** once to display the MEASURE screen.

This completes OMEGA's DRY calibration. The analyzer is now ready to measure conductivity.

To change the display format of the MEASURE screen, for example, from 0-2000 µS/cm to 0.000-2.000 mS/cm, see Part Three, Section 3.2 under the subheading "Selecting Measurement Display Format."

NOTE: *If the values you intend to measure are above the analyzer's set measuring range (not its selected display format), use a different sensor that has the appropriate nominal cell constant. For a listing of sensor cell constants and their inherent measuring ranges, see Table A in Part Three, Section 3.2 under the subheading "Selecting Measurement Display Format."*

D. COMPLETING ANALYZER CONFIGURATION

To further configure the analyzer to your application requirements, use the appropriate CONFIGURE screens to make selections and "key in" values. Refer to Part Three, Section 3 for complete configuration details.

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PART ONE - INTRODUCTION

SECTION 1

GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The analyzer has two independent sensor inputs for monitoring two measurement points. Each input accepts OMEGA CDE680 series enhanced performance contacting conductivity sensors.

MEASURE Screen

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

1. Measured Sensor A conductivity (or resistivity or TDS).
2. Measured Sensor A temperature (°C or °F).
3. Measured Sensor B conductivity (or resistivity or TDS).
4. Measured Sensor B temperature (°C or °F).
5. Analog Output # 1 and #2 values (mA).
6. Measured Sensor A and B values and temperatures.
7. *Calculated Sensor A and B measurement (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

*The calculated measurement can only be displayed when two sensors are used and the analyzer has been correctly configured for CALCULATION.

Passcode-protected Access

For security, you can enable a passcode feature to restrict access to configuration and calibration settings to authorized personnel only. See Part Three, Section 3.7 for details.

Calibration Methods

It is highly recommended to calibrate the analyzer using the DRY method. However, the analyzer can be traditionally "wet" calibrated. For calibration details, refer to Part Three, Sections 4.2 or 4.3 respectively. The mA values for each analog output can also be calibrated (Section 4.4).

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 the following:

- Measured Sensor A conductivity, resistivity, or TDS.
- Measured Sensor A temperature.
- Measured Sensor B conductivity, resistivity, or TDS.
- Measured Sensor B temperature.
- *Calculated Sensor A and B measurement (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

*An analog output can only represent the calculated measurement when two sensors are used and the analyzer has been correctly configured for CALCULATION.

Parameter values (or calculated measurement values) can be entered to define the endpoints at which the minimum and maximum analog output values are desired.

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).

For analog output transfer setup details, refer to Part Three, Section 3.5 under the subheading "Setting Transfer Value."

Relays

The analyzer has two electromechanical relays with SPDT contacts. Each relay can be set to function as a control relay, a dual-alarm relay, or a status relay. A control or alarm relay can be assigned to be driven by one of the following:

- Measured Sensor A conductivity, resistivity, or TDS.
- Measured Sensor A temperature.
- Measured Sensor B conductivity, resistivity, or TDS.
- Measured Sensor B temperature.
- *Calculated Sensor A and B measurement (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

*A relay can only be driven by the calculated measurement when two sensors are used and the analyzer has been correctly configured for CALCULATION.

Refer to Part Three, Section 3.6 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 diagnostic condition. See Part Three, Section 5.1 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. For relay transfer setup details, see Part Three, Section 3.6, under the subheading "Selecting Transfer Mode."

1.2 Modular Construction

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 Configuration Values

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

1.4 Analyzer Serial Number

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.

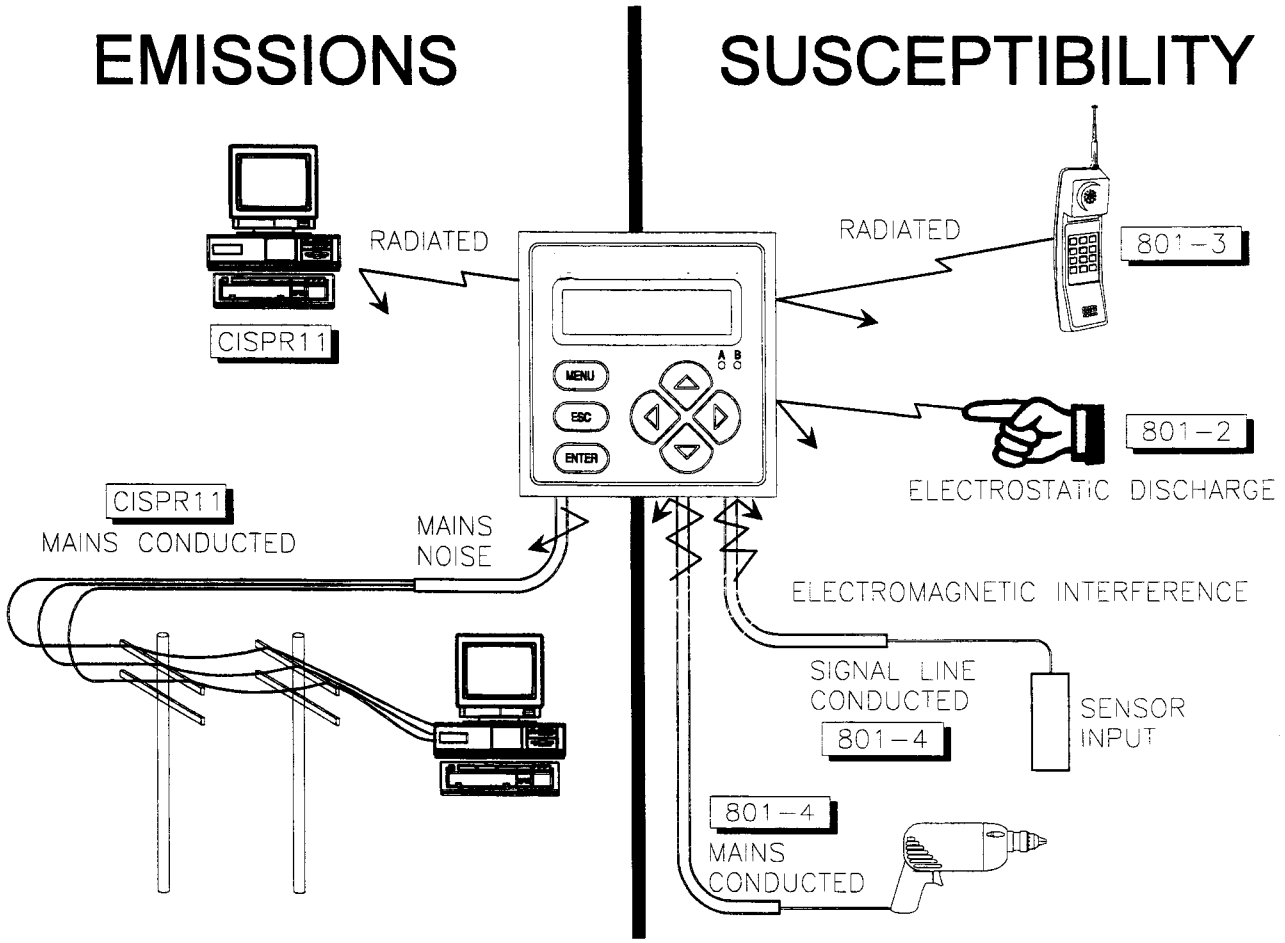


FIGURE 1-1 EMI/RFI Immunity Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

Display ..... Two-line by 16 character backlit LCD

NOTE: *Sensor A or B's measured values or temperatures can be shown separately, or all four measurements can be displayed together. A calculated Sensor A and B measurement can also be displayed.*

Measurement	Selectable Ranges
Conductivity	µS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000
Resistivity	0-19.99 MΩ • cm or 0-999.9 KΩ • cm
TDS	0-9999 ppm or 0-9999 ppb
Calculated Sensor A and B Measurement:	
% Rejection	0-100%
% Passage	0-100%
Ratio A/B or B/A	0-9.999, 0-99.99, 0-999.9, or 9999
Difference A-B or B-A	Same ranges as those listed above for conductivity, resistivity, and TDS
Temperature	-4.0 to +392.0°F or -20.0 to +200.0°C
mA Outputs (#1 and #2)	0.00-20.00 mA or 4.00-20.00 mA

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

Relays:
- Types/Outputs ..... Two electromechanical relays; SPDT (Form C) contacts; U.L. rated 5A 115/230 VAC, 5A @ 30 VDC resistive
- Operational Mode ..... Each relay (A and B) can be assigned to be driven by the:
  - Sensor A or B measurement (conductivity, resistivity, TDS)
  - Sensor A or B temperature
  - Calculated Sensor A and B measurement (% rejection, % passage, ratio A/B, ratio B/A, difference A-B, or difference B-A)
- 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
  - Status ..... Not configurable; relay only activates when a sensor or analyzer diagnostic WARNING condition exists
- Indicators ..... Relay A and B LEDs indicate respective relay status

Temperature Compensation ..... Automatic or manual, -4.0 to +392.0°F (-20.0 to +200.0°C), with selection for temperature element (Pt 1000 ohm RTD or Pt 100 ohm RTD) or a manually entered value

NOTE: *Depending on Sensor A or B's selected measurement (conductivity, resistivity, or TDS) not all of the following temperature compensation methods are available:*

Linear % per °C slope, built-in ammonia temp. properties table, built-in natural water temp. properties table, or no compensation

Sensor-to-Analyzer Distance ..... 300 ft. (91 m) maximum

Power Requirements ..... 90-130 VAC, 50/60 Hz. (10 VA max.) or 190-260 VAC, 50/60 Hz. (10 VA max.)

Calibration Methods:

DRY ..... Enter OMEGA-certified cell constant "K" value and temperature "T" factor of the sensor.

1-POINT SAMPLE ..... Enter one reference solution value or one sample value (determined by laboratory analysis or a comparison reading).

ZERO ..... With the dry sensor in air, press keys to initiate automatic system zeroing.

Analog Outputs ..... 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 Sensor A or B's selected measurement (conductivity, resistivity, or TDS), Sensor A or B's temperature, or a calculated Sensor A and B measurement (% rejection, % passage, ratio A/B, ratio B/A, difference A-B, or difference B-A). Parameter values (or calculated measurement values) can be entered to define the endpoints at which the minimum and maximum mA output values are desired. During calibration, both outputs can be selected to hold their present values, transfer to preset values to operate control elements by an amount corresponding to those values, or remain active to respond to the measured value.*

Communication: RS-232 ..... For factory configuration only

Memory Backup (non-volatile) ..... All user settings are retained indefinitely in memory (EEPROM)

EMI/RFI Conformance ..... Exceeds US and meets European standards for conducted and radiated emissions and immunity; certified CE compliant for applications as specified by EN 50081-2 for emissions and EN 50082-2 for immunity

Electrical Certifications:

General Purpose (pending) ..... UL, C-UL, FM, and CENELEC

Division 2 (pending) ..... UL, C-UL, and FM: Groups A, B, C, D, F, and G

Zone 2 (pending) ..... CENELEC: Group IIC

2.2 Analyzer Performance (Electrical, Analog Outputs)

Accuracy ..... 0.1% of span

Stability ..... 0.05% of span per 24 hours, non-cumulative

Repeatability ..... 0.1% of span or better

Temperature Drift ..... Zero and Span: less than 0.03% of span/°C

2.3 Mechanical

Enclosure ..... Polycarbonate with NEMA 4X front panel; general purpose; two zinc-plated steel brackets for panel mounting

Mounting Configuration ..... Panel mounting

Net Weight ..... 1.7 lbs. (0.8 kg) approximately

PART TWO - INSTALLATION

SECTION 1
UNPACKING

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.

SECTION 2
MECHANICAL REQUIREMENTS

2.1 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 is 300 ft. (91 m).

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.

2.2 Mounting

Figure 2-1 illustrates the analyzer enclosure dimensions and panel mounting details. Use the two supplied brackets to panel mount the analyzer. The brackets may be attached to the top and bottom of the analyzer case, or to each of its sides.

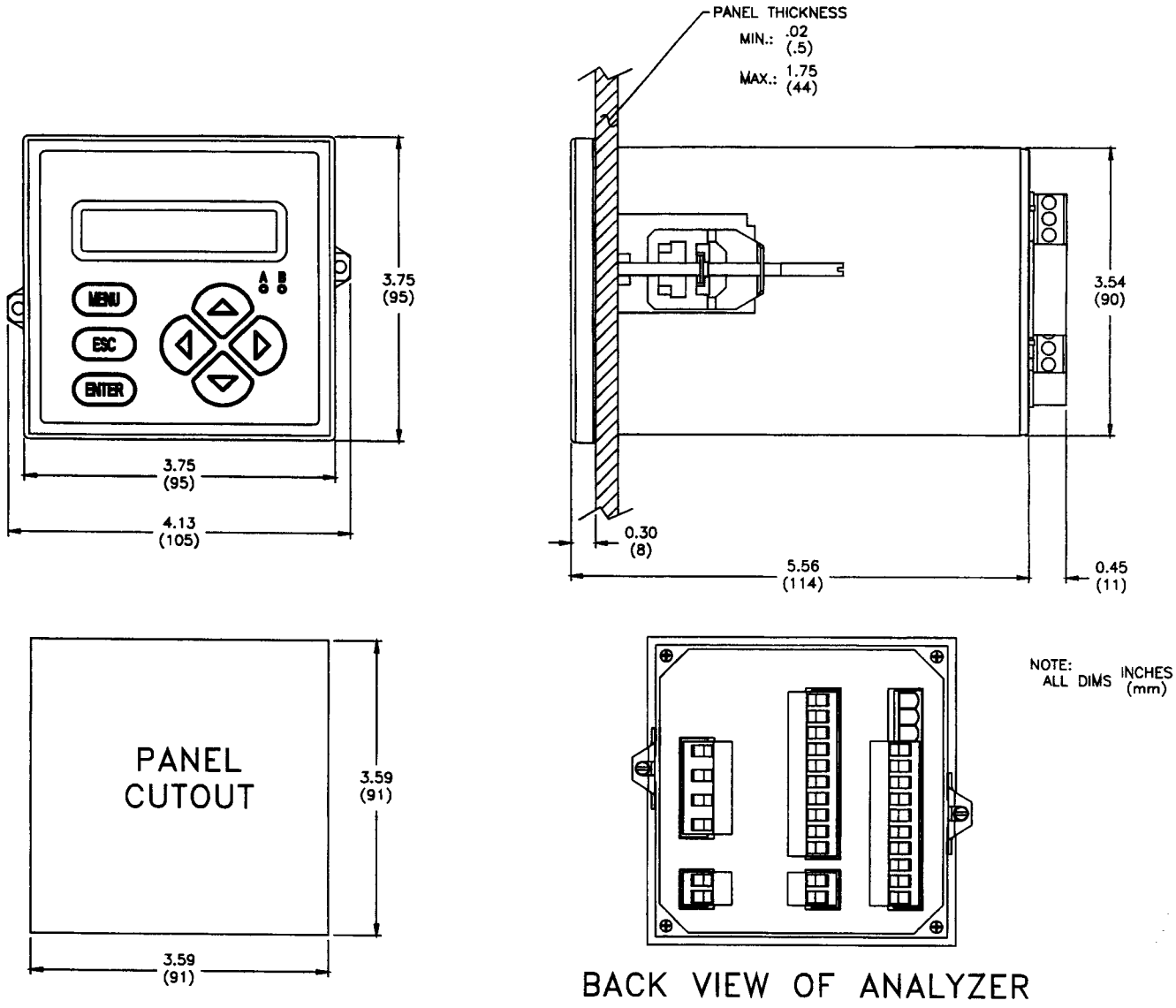


FIGURE 2-1 Analyzer Enclosure Dimensions and Panel Mounting Details

SECTION 3
ELECTRICAL CONNECTIONS

Figure 2-2 shows the terminal block arrangement and terminal designations on the back of the analyzer case.

☞ ***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 mm^2).*

☞ **Wiring Tip!** To comply with European Community (CE) electromagnetic compatibility requirements, 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 analyzer (Terminal 4 on TB1) to a local, known earth ground source.

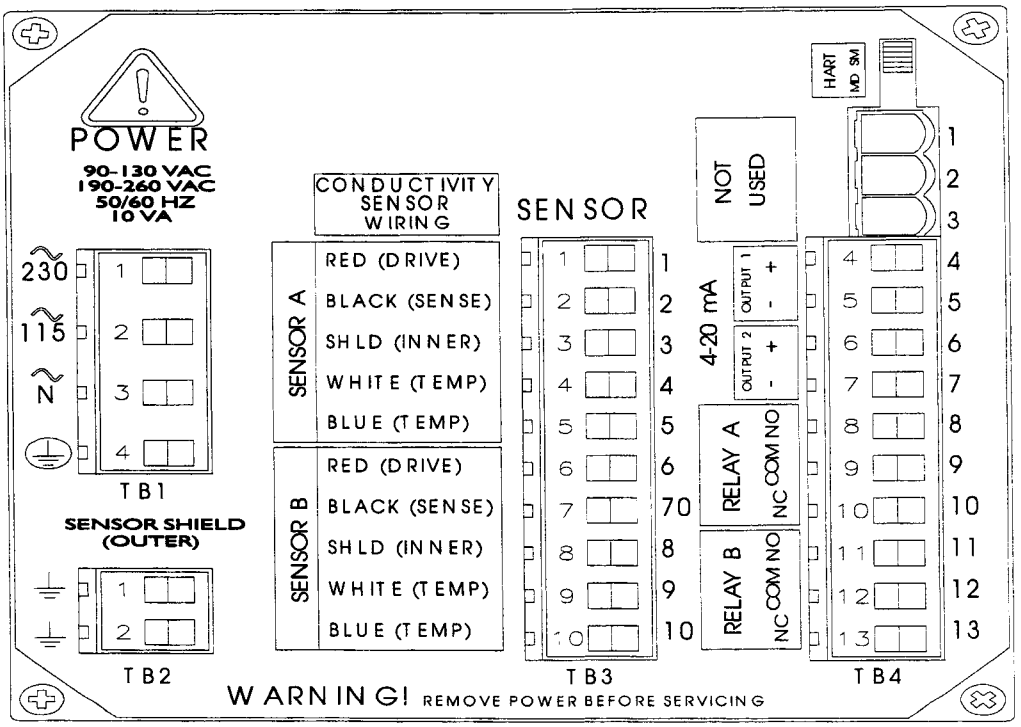


FIGURE 2-2 Analyzer Terminal Block Designations

3.1 Omega's CDE680 Series Contacting Conductivity Sensor(s)

All OMEGA Model CDE680 series contacting conductivity sensors have a built-in Pt 1000 ohm RTD temperature element for automatic temperature compensation and for measuring process 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 power wiring ("electrical noise" may interfere with the sensor signal).*

The analyzer can be used with one or two conductivity sensors. Refer to Figure 2-3 and connect Sensor A's cable (or interconnect) wires to SENSOR Terminals 1 through 5 on TB3, matching colors as indicated. If using a second sensor, connect Sensor B's cable to Terminals 6 through 10.

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 "SENSOR SHIELD (OUTER)" terminal on TB2.*

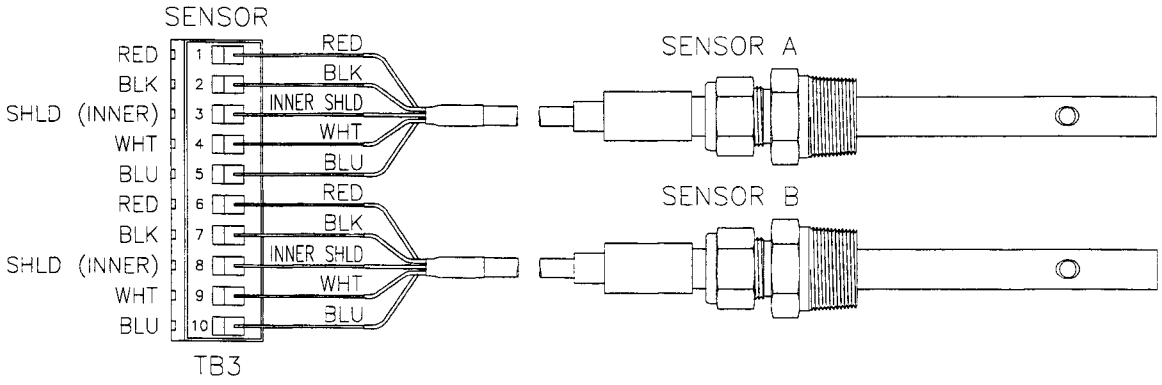


FIGURE 2-3 Connecting Omega's CDE680 Series Contacting Conductivity Sensor(s)

3.2 Analog Outputs

Two analog outputs (#1 and #2) are provided. Each output can be set to be 0/4-20 mA. These outputs are isolated from the inputs and earth ground, but not from each other. Each output can be assigned to represent one of the following:

- Measured Sensor A conductivity, resistivity, or TDS.
- Measured Sensor A temperature.
- Measured Sensor B conductivity, resistivity, or TDS.
- Measured Sensor B temperature.
- *Calculated Sensor A and B measurement (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

*An analog output can only represent the calculated measurement when two sensors are used and the analyzer has been correctly configured for CALCULATION.

For details on configuring the outputs, refer to Part Three, Section 3.5.

Wiring Tip! Use high quality, shielded instrumentation cable for connecting the analog outputs.

Each 0/4-20 mA 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.

3.3 Relay Outputs

The analyzer is equipped with two electromechanical relays. For relay setup details, see Part Three, Section 3.6.

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 2-4 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 TB5 RELAY TERMINALS.

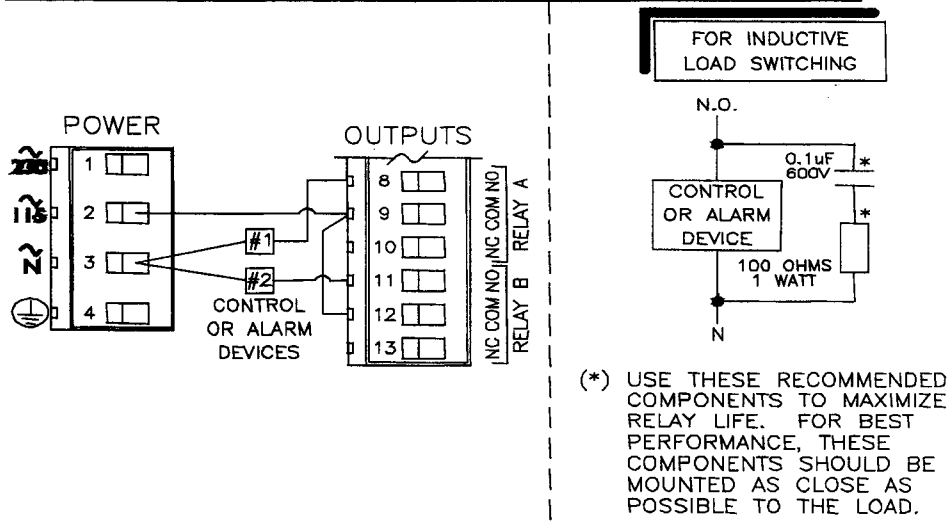


FIGURE 2-4 Connecting Control/Alarm Device(s) to Electromechanical Relay(s)

3.4 Line Power

Refer to Figure 2-5, 2-6 or 2-7 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.*

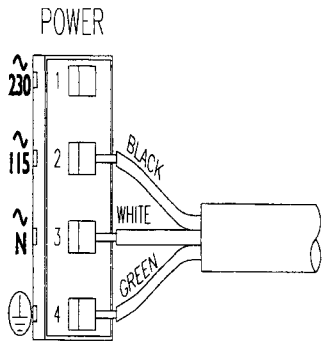


FIGURE 2-5
Connecting 115 Volt
Single Phase Line Power
(90-130 VAC)

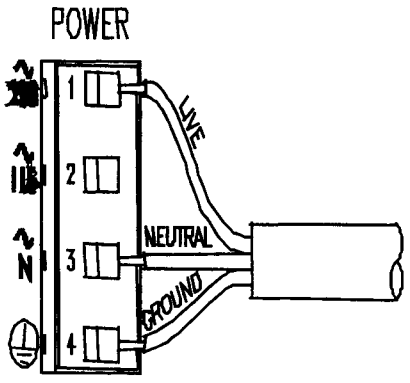


FIGURE 2-6
Connecting 230 Volt
Single Phase Line Power
(190-260 VAC)

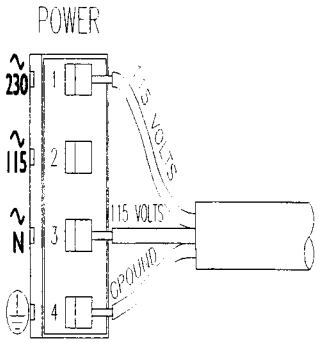


FIGURE 2-7
Connecting 230 Volt
Split Phase Line Power
(190-260 VAC)

PART THREE - OPERATION

SECTION 1
USER INTERFACE

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

1.1 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 screen** to sequentially show, by pressing the ⇦ **or** ⇨ **key**, the measured Sensor A value, Sensor A temperature, Sensor B value, Sensor B temperature, analog Output #1 and #2 mA values, Sensor A and B values with their measured temperatures, and a calculated Sensor A and B measurement (% reject, % pass, ratio A/B or B/A, or difference A-B or B-A).
- **MENU screens** to move within the three main branches of the analyzer menu tree, enabling access to edit/selection screens. (EXIT screens indicate the end of a menu branch and enable you, by pressing the **ENTER key**, to move up one level in the menu tree. This is functionally the same as pressing the **ESC key**.)
- **Edit/Selection screens** to enter values/choices to calibrate, configure, and test the analyzer.

1.2 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 indicator blinks continuously until the overfeed condition is resolved.)

1.3 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 always displays the top of the menu tree ("MAIN MENU ► CALIBRATE" screen). To display the CONFIGURE and TEST/MAINT main branches of the menu tree, press the ⇩ **key**. The **MENU key** can also be used to "abort" the procedure to change values or selections.

2. **ENTER key:** Pressing this key displays an available submenu or edit/selection screen, or enters (saves) values/selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With the "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 the 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.

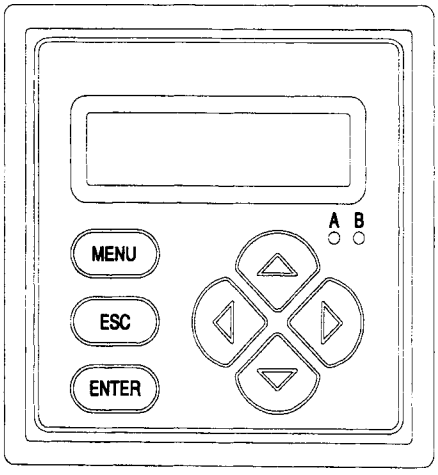
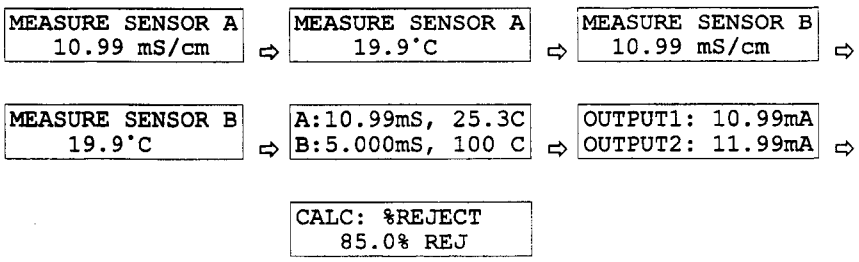


FIGURE 3-1 Analyzer Keypad

1.4 MEASURE Screen (normal display mode)

The MEASURE screen is normally displayed. Pressing the **MENU key** temporarily replaces the MEASURE screen with various screens to calibrate, configure, or test the analyzer. If the keypad is not used within 30 minutes, except during calibration and while using specific analyzer test/maintenance functions, the display automatically returns to the MEASURE screen. To display the MEASURE screen at any time, press the **MENU key** once and then the **ESC key** once.

The MEASURE screen can be viewed in one of seven different readout versions. To select between them, in continuous loop sequence, press the ⇦ **or** ⇨ **key**:



NOTE: *When the analyzer returns to its normal MEASURE screen mode, the appearing MEASURE screen readout is always the version last selected. Note that the first four MEASURE screen readout examples show "SENSOR A" and "SENSOR B" notations on their top lines, illustrating the analyzer notation feature. To create your own notation, refer to Part Three, Section 3.2, under the subheading "Changing Top Line Notation on MEASURE Screen."*

Also, the "CALC: % REJECT" readout is an example of a calculated Sensor A and B measurement. The analyzer can also calculate and display other measurements. Refer to Part Three, Section 3.3 for details.

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 2
MENU STRUCTURE

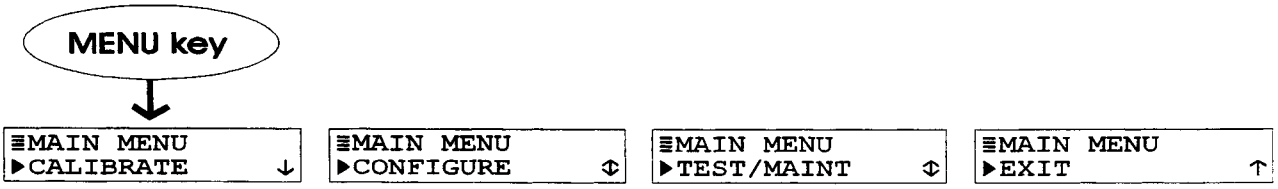
The analyzer menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level screens, related lower level submenu screens and, in many cases, sub-submenu screens.

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.

2.1 Displaying Main Branch Selection Screens

1. Press **MENU key** to always display the start of the analyzer menu tree (CALIBRATE branch selection screen).
2. Press ⇩ **and** ⇧ **keys** to select between the three main branch selection screens or the EXIT screen:

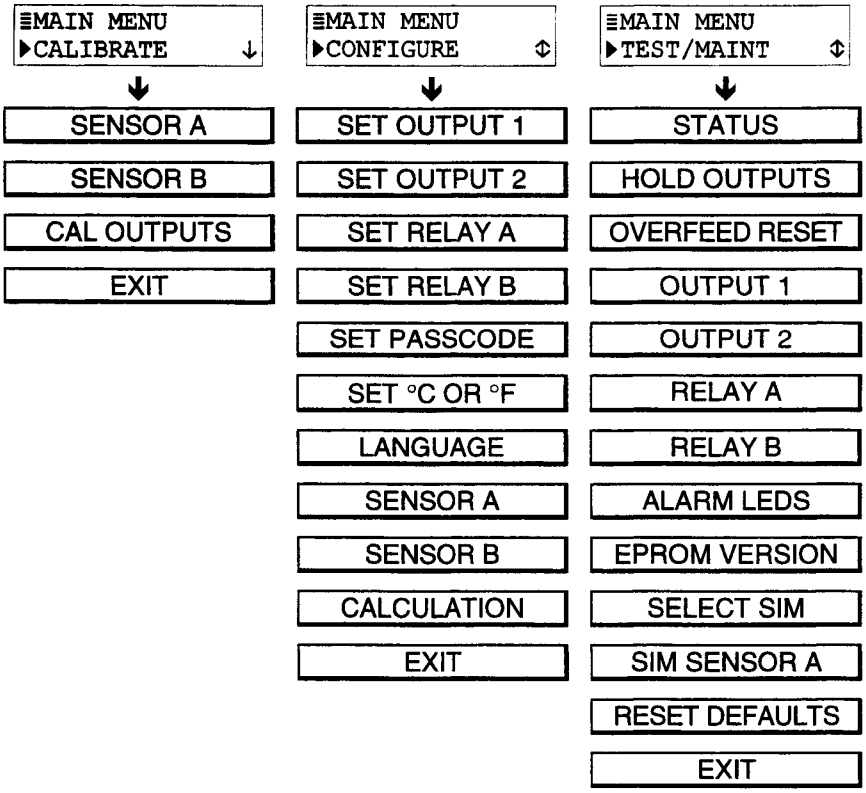


3. With the desired branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

2.2 Displaying Top-level Menu Screens

With the first top-level menu screen within 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**.

2.3 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** always have a first line starting with a horizontal bar symbol. Pressing the ⇩ **key** displays one or more related menu screens within this same level.

  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 this related choice:

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

2.4 Adjusting Edit/Selection Screen Values

Edit/selection screens always contain a second line enclosed by parenthesis -- see examples shown above and below. The enclosed value/choice can be edited/changed by using the ⇧ **and** ⇩ **keys**. Pressing the **ENTER key** saves the change.

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

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

Use the ⇦ **and** ⇨ **keys** to "coarse" adjust numerical values. The ⇧ **and** ⇩ **keys** "fine" adjust numerical values up or down respectively. The longer the key is pressed, the faster the number changes.

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

After the desired value/choice is 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 3
CONFIGURING THE ANALYZER

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.7), you must successfully enter the passcode before attempting to enter a configuration setting.*

3.1 Selecting Language to Operate Analyzer

The analyzer can display screens in various languages including 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 `≡MAIN MENU ▶CALIBRATE ↓`.
2. Press ⇩ **key** <u>once</u> to display `≡MAIN MENU ▶CONFIGURE ↕`.
3. Press **ENTER key** to display `≡CONFIGURE ▶SET OUTPUT 1 ↓`.
4. Press ⇩ **key** <u>six</u> <u>times</u> to display `≡CONFIGURE ▶LANGUAGE ↕`.
5. Press **ENTER key** to display `LANGUAGE? (ENGLISH )`. Use ⇩ **and** ⇧ **keys** to view the language choices.
6. With the desired language displayed, press **ENTER key** to enter this selection.

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

3.2 Configuring Sensor (A and B) Characteristics

The analyzer can be used with one or two sensors, providing up to two separate measurement channels. Each sensor can be independently selected to measure a different parameter. Also, each sensor can have a different nominal cell constant.

The analyzer must be configured to define the characteristics of each sensor including its "K" value, temperature element type, "T" factor, and other related items such as temperature compensation, input signal filtering, pulse suppression, etc. **When using two sensors, configure them in the same way using their respective menu screens.**

☞ ***NOTE:*** *For calculated Sensor A and B measurements (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A), both sensors must be configured for the same measurement (conductivity, resistivity, or TDS). However, each sensor may be set for a different display format and a different cell constant.*

Selecting Measurement (CONDUCTIVITY, RESISTIVITY, or TDS)

1. With the `≡CONFIGURE ▶LANGUAGE ⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡CONFIGURE ▶SENSOR A ⇕`.

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

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

   - **CONDUCTIVITY:** Selects system to measure conductivity.
   - **RESISTIVITY:** Selects system to measure resistivity.
   - **TDS:** Selects system to measure total dissolved solids.

   WARNING:

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

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

Selecting Measurement 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.

The nominal cell constant of a sensor determines the sensor's inherent measuring range. Table A lists cell constants and their respective measuring ranges. When configuring the measuring units and display resolution for your application, make sure they are within the sensor's inherent listed range. If not, choose a sensor with the appropriate constant.

Table A – SENSOR CELL CONSTANTS and MEASURING RANGES			
Sensor Cell Constant	Inherent Measuring Range		
	Conductivity (in µS/cm)	Resistivity (in MΩ • cm)	TDS (in ppm)
0.05	0-100	0.002-20	See Note below
0.5	0-1000	0.001-20	See Note below
1	0-2000	not applicable	See Note below
5	0-10,000	not applicable	See Note below
10	0-200,000	not applicable	See Note below

☞ ***NOTE:*** *To determine which cell constant to use, convert the full-scale TDS value to its equivalent conductivity value at 25°C. Do this by multiplying the TDS value by "2." Then find the range in the Conductivity column corresponding to the calculated value. The cell constant to use is in that row.*

1. With the ≡SENSOR A / ▶SELECT MEASURE↓ screen displayed, press ⇩ **key** <u>once</u> to display ≡SENSOR A / ▶DISPLAY FORMAT↕.

2. Press **ENTER key** to display DISPLAY FORMAT? / (200.0 uS/cm). Use ⇩ **and** ⇧ **keys** to view all choices. Depending on the sensor's selected measurement, the choices are:

For CONDUCTIVITY		For RESISTIVITY
2.000 µS/cm	2.000 mS/cm	XX.XX MΩ • cm
20.00 µS/cm	20.00 mS/cm	XXX.X KΩ • cm
200.0 µS/cm	200.0 mS/cm	
2000 µS/cm	2000 mS/cm	For TDS
		XXXX ppm
		XXXX ppb

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

Selecting Temperature Compensation

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

1. With the ≡SENSOR A / ▶DISPLAY FORMAT↕ screen displayed, press ⇩ **key** <u>once</u> to display ≡SENSOR A / ▶T-COMPENSATION↕.

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

   - **LINEAR (recommended for most aqueous solutions)**
   - AMMONIA (not shown for TDS measurement; only use this built-in temperature properties table for specific applications -- consult factory)
   - NATURAL WATER (not shown for TDS measurement; only use this built-in temperature properties table for specific applications -- consult factory)
   - OPTIONAL TABLE* (user-specified temperature table)
   - NONE (measurement values are not compensated)

   * Only select OPTIONAL TABLE choice when the analyzer is equipped with a customer-specified, factory-configured temperature compensation table.

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 "Configuring Selected Temp. Compensation" for details.*

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

Configuring TDS Measurement (not needed for other measurements)

Only when TDS is selected must the measurement be further configured by defining a conductivity-to-TDS conversion factor. If CONDUCTIVITY or RESISTIVITY was selected, disregard this subsection -- no measurement configuration is needed.

1. With the `≡SENSOR A ▶T-COMPENSATION⇕` screen displayed, press ⇩ **key** once to display `≡SENSOR A ▶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:** Configures analyzer to use the built-in NaCl conductivity-to-TDS conversion factor.
   - **USER DEFINED:** Configures analyzer to use 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** <u>once</u> to display `≡CONFIG TDS ▶SET FACTOR ⇕`.

   B. Press **ENTER key** to display `SET FACTOR? (0.492 ppm/uS )`.

   C. Adjust the displayed value to the desired conductivity-to-TDS conversion factor, and press **ENTER key** to enter the value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

   D. After the `≡CONFIG TDS ▶SET FACTOR ⇕` screen re-appears, press **ESC key** <u>once</u> to return to the `≡SENSOR A ▶CONFIG TDS ⇕` screen.

Configuring LINEAR Temperature Compensation (not needed for other compensation methods)

Only when LINEAR is the selected temperature compensation, determine if it should be further configured by entering a slope, in % per °C, and a reference temperature. If the built-in AMMONIA or NATURAL WATER properties table or NONE was selected, disregard this subsection -- no compensation configuration is needed.

☞ ***NOTE:*** *If "OPTIONAL TABLE" compensation was selected, the analyzer must be equipped with a customer-specified, factory-configured temperature compensation table.*

LINEAR compensation factory defaults are 2.00%/°C slope and 25.0° 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 A
▶T-COMPENSATION⇕
```
screen displayed, press ⇩ **key** twice.

   (If the
```
≡SENSOR A
▶CONFIG TDS    ⇕
```
screen is displayed, press ⇩ **key** just once.)

   In either case, the
```
≡SENSOR A
▶CONFIG LINEAR ⇕
```
screen appears.

2. Press **ENTER key** to display
```
≡CONFIG LINEAR
▶SET SLOPE     ↓
```
.

3. Press **ENTER key** again to display
```
SET SLOPE?
(2.00 %/°C     )
```
.

4. Adjust the displayed value to the desired % per °C slope, and press **ENTER key** to enter the value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

5. After the
```
≡CONFIG LINEAR
▶SET SLOPE     ↓
```
screen re-appears, press ⇩ **key** once to display
```
≡CONFIG LINEAR
▶SET REF TEMP  ⇕
```
.

6. Press **ENTER key** to display
```
SET REF TEMP?
(25.0°C      )
```
.

7. Adjust the displayed value to the desired reference temperature, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

8. After the
```
≡CONFIG LINEAR
▶SET REF TEMP  ⇕
```
screen re-appears, press **ESC key** once to return to the
```
≡SENSOR A
▶CONFIG LINEAR ⇕
```
screen.

Entering Sensor's OMEGA-certified "K" Value

Each OMEGA sensor has a unique, certified "K" value shown on a label attached to the sensor cable or to the inside cover of its optional junction box head. By entering this "K" value, calibration (including zeroing) is only necessary when this sensor is replaced. This also sets the analyzer measuring range to match the inherent range of the sensor's cell constant.

1. With the ≡SENSOR A / ▶T-COMPENSATION ⇕ screen displayed, press ⇩ **key** three times.

   (If the ≡SENSOR A / ▶CONFIG LINEAR ⇕ screen is displayed, press ⇩ **key** once.)

   In either case, the ≡SENSOR A / ▶CELL CONSTANT ⇕ screen appears.

2. Press **ENTER key** to display ≡CELL CONSTANT / ▶SELECT CELL K ↓.

3. Press **ENTER key** again to display SELECT CELL K? / (0.0500).

4. Use ⇩ **and** ⇧ **keys** to select the nominal cell category that corresponds to the sensor's OMEGA-certified "K" value, and press **ENTER key** to enter this selection.

5. After the ≡CELL CONSTANT / ▶SELECT CELL K ↓ screen re-appears, press ⇩ **key** once to display ≡CELL CONSTANT / ▶SET CELL K ⇕.

6. Press **ENTER key** to display SET CELL K? / (0.0500).

7. Adjust the displayed value to exactly match the sensor's OMEGA-certified "K" value, and press **ENTER key** to enter the value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

8. After the ≡CELL CONSTANT / ▶SET CELL K ⇕ screen re-appears, press **ESC key** once to return to the ≡SENSOR A / ▶CELL CONSTANT ⇕ screen.

Setting Sensor Signal 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 A
▶CELL CONSTANT ⇕
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≡SENSOR A
▶SET FILTER    ⇕
```
.

2. Press **ENTER key** to display
```
SET FILTER?
(0 SECONDS      )
```
.

3. Adjust the displayed value to the desired filter time, and press **ENTER key** to enter this value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Selecting Pulse Suppression (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 µS/cm, then suddenly jumps to 1950 µS/cm for a few seconds, and returns to 1880 µS/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 A
▶SET FILTER    ⇕
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≡SENSOR A
▶PULSE SUPPRESS⇕
```
.

2. Press **ENTER key** to display
```
PULSE SUPPRESS?
(OFF            )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (OFF or ON).

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

Changing Top Line Notation on MEASURE Screen (only COND A and B readouts)

The top line of the four MEASURE screen readouts that separately show measurement and temperature values are factory set to read "COND A" and "COND B." These notations can be changed, for example, to "BASIN 1" and "BASIN 2" to tailor the analyzer MEASURE screen to the application. The respective top lines would then be "MEASURE BASIN 1" and "MEASURE BASIN 2." Each 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 A
▶PULSE SUPPRESS⇕
```
screen displayed, press ⇩ **key** once to display
```
≡SENSOR A
▶ENTER NOTE    ⇕
```
.

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

   A. Starting with the extreme left character position, use ⇧ **and** ⇩ **keys** to select the desired first character.
   B. Press ⇨ **key** to access the second character position. Use ⇧ **and** ⇩ **keys** to select the desired second character.

   C. Repeat procedure until desired notation is displayed.

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

Selecting Temperature Element Type

Configure the analyzer to define the temperature element being used for temperature compensation.
It is recommended that the CDCN684 is used with the CDE680 series sensors only which have PT 1000 temperature compensation.

NOTE: *When not using a temperature element, select "MANUAL" for the element type and enter a temperature for fixed temperature compensation. Also, when using only one sensor, select "MANUAL" for the unused sensor input element type. In either case, this prevents (or clears) a "WARNING: CHECK STATUS" message due to the analyzer detecting no temperature element.*

1. With the ≣SENSOR A / ▶ENTER NOTE ⇳ screen displayed, press ⇩ **key** once to display ≣SENSOR A / ▶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 the three choices:
   - **PT1000:** Configures analyzer for use with a Pt 1000 RTD temperature element (used in all OMEGA Model 3400-series contacting conductivity sensors).
   - **PT100:** Configures analyzer for use with a Pt 100 RTD temperature element.
   - **MANUAL:** Configures analyzer for fixed manual temp. compensation when not using a temperature element.

4. With the desired choice displayed, press **ENTER key** to enter this selection. If "MANUAL" was selected, set a desired fixed 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 SET MANUAL? / (25.0°C)

   C. Adjust displayed value to the desired fixed temperature, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Entering Sensor's OMEGA-certified "T" Factor

OMEGA tests each sensor 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, you enable the analyzer to provide the highest possible measuring accuracy for both temperature and conductivity.

. With the
```
≡TEMP ELEMENT
▶SELECT TYPE    ↓
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≡TEMP ELEMENT
▶SET T FACTOR   ⇕
```
.

2. Press **ENTER key** to display
```
SET T FACTOR?
(1000.0 OHMS    )
```
.

3. Use ⇧ **and** ⇩ **keys** to adjust the displayed value to <u>exactly</u> <u>match</u> the sensor's OMEGA-certified "T" factor, and press **ENTER key** to enter the value.

SPECIAL CASE -- ALTERED SENSOR CABLE LENGTH
(only for sensors with PT 1000 temperature elements*)

Changing the standard 20 ft. (6 m) sensor cable length, by shortening it or adding an interconnect cable, will affect temperature measuring accuracy. The OMEGA-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 <u>increase</u> the analyzer temperature reading to match the known solution temperature, <u>decrease</u> the "T" factor by 3.85 ohms for each °C difference.
- Added Interconnect Cable: To <u>decrease</u> the analyzer temperature reading to match the known solution temperature, <u>increase</u> 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.

*Sensors with PT100 temperature elements provide inherently less accurate temperature readings and are not recommended.

4. After the
```
≡TEMP ELEMENT
▶SET T FACTOR   ⇕
```
screen re-appears, press **ESC key** <u>twice</u> to return to the
```
≡CONFIGURE
▶SENSOR A       ⇕
```
screen:

3.3 Configuring Calculated Sensor A and B Measurement

The analyzer can provide a calculated measurement by using the measured Sensor A and Sensor B values. The calculated measurement can be displayed, and an analog output and/or relay can be assigned to represent it.

NOTE: *For a calculated measurement, both sensors must be:*

- *Connected and used.*
- *Configured for the same measurement (conductivity, resistivity, or TDS).*
- *Set for the same measurement units. However, each sensor can have a different cell constant providing an inherently different measuring range.*

Selecting Calculated Measurement (none, % reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A)

1. With the
```
≡CONFIGURE
▶SENSOR A          ↕
```
screen displayed, press ⇩ **key** <u>twice</u> to display
```
≡CONFIGURE
▶CALCULATION       ↕
```
.

2. Press **ENTER key** to display
```
≡CALCULATION
▶SELECT MEASURE↓
```
.

3. Press **ENTER key** again to display
```
SELECT MEASURE?
(NONE              )
```
. Use ⇩ **and** ⇧ **keys** to view the choices (NONE, % REJECT, % PASS, RATIO A/B, RATIO B/A, DIFF A-B, or DIFF B-A).

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

Selecting Calculated RATIO A/B or RATIO B/A Measurement Display Format (not needed for other calculated measurements)

Only when RATIO A/B or RATIO B/A is the selected calculated measurement must its display format be further configured. If % REJECT or % PASS was selected, disregard this subsection -- no display format configuration is needed. If DIFF A-B or DIFF B-A was selected, the display format is automatically set by the Sensor A and B display format selections -- no format configuration is needed.

1. With the
```
≡CALCULATION
▶SELECT MEASURE↓
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≡CALCULATION
▶DISPLAY FORMAT↕
```
.

2. Press **ENTER key** to display `DISPLAY FORMAT? (XXXX )`. Use ⇩ **and** ⇧ **keys** to view the four choices (XXXX, XXX.X, XX.XX or X.XXX).

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

4. After the `≡CALCULATION ▶DISPLAY FORMAT↕` screen re-appears, press **ESC key** once to return to `≡CONFIGURE ▶CALCULATION ↕` screen:

3.4 Selecting Temperature Display Format (°C or °F)

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 A ↕` screen displayed, press ⇧ **key** -- not ⇩ **key** -- twice.

   (If the `≡CONFIGURE ▶CALCULATION ↕` screen is displayed, press ⇧ **key** -- not ⇩ **key** -- four times.)

   In either case, the `≡CONFIGURE ▶SET °C OR °F ↕` screen appears.

2. Press **ENTER key** to display `SET °C OR °F? (°C )`. Use ⇩ **and** ⇧ **keys** to view both choices (°C or °F).

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

3.5 Configuring Outputs (1 and 2)

The analyzer provides two isolated analog outputs (#1 and #2). **Configure both outputs in the same way using their respective menu screens.**

Assigning Representative Parameter

Depending on the system setup, each output can be assigned to represent one of the following:

- Measured Sensor A conductivity, resistivity, or TDS.
- Measured Sensor A temperature.
- Measured Sensor B conductivity, resistivity, or TDS.
- Measured Sensor B temperature.
- *Calculated Sensor A and B measurement (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

*An analog output can only represent the calculated measurement when two sensors are used and the analyzer has been correctly configured for CALCULATION.

1. With the
```
≡CONFIGURE
▶SET °C OR °F    ⇕
```
screen displayed, press ⇧ **key** -- not ⇩ **key** -- five times to display
```
≡CONFIGURE
▶SET OUTPUT 1    ↓
```
.

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

3. Press **ENTER key** again to display
```
SET PARAMETER?
(SENSOR A        )
```
. Use ⇩ **and** ⇧ **keys** to view the choices.

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

Setting Parameter Values for 0/4 mA and 20 mA

You can set the parameter (or calculated measurement) values 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 uS/cm     )
```
.

3. Set the displayed value at which 0/4 mA is desired, and press **ENTER key** to enter the value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

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

5. Press **ENTER key** to display
```
SET 20mA VALUE?
(19.99 uS/cm    )
```
.

6. 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.*

Setting Transfer Value (mA)

Normally, each analog output is active, responding to the measured value of its assigned parameter. During calibration, however, 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 milliamp 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
```
SET TRANSFER?
(20.00 mA       )
```
.

3. Set the displayed value to the desired transfer value, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Setting Output 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
```
SET FILTER?
(0 SECONDS      )
```
.

3. Adjust the displayed value to the desired filter time, and press **ENTER key** to enter it. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)

Setting Output Scale Low Endpoint (0/4 mA)

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
```
SCALE 0mA/4mA?
(4mA            )
```
. Use ⇩ **and** ⇧ **keys** to view both choices (0mA or 4mA).

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

3.6 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, or status relay. Only a control or alarm relay operates in response to the measured value. For details on each relay function, see subsection "Selecting Function Mode."

Configure both relays in the same way using their respective menu screens.

During calibration, control and alarm relays can be held, transferred to preset on/off states, or remain active. During normal measurement operation, these relays can be held in their present on/off states for up to 30 minutes by using the "HOLD OUTPUTS" function in the TEST/MAINT menu.

Assigning Representative Parameter

Depending on the system setup, each control or alarm relay can be assigned to use one of the following for its operation:

- Measured Sensor A conductivity, resistivity, or TDS.
- Measured Sensor A temperature.
- Measured Sensor B conductivity, resistivity, or TDS.
- Measured Sensor B temperature.
- *Calculated Sensor A and B measurement (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

*A relay can only use the calculated measurement for its operation when two sensors are used and the analyzer has been correctly configured for CALCULATION.

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 A). Use ⇩ **and** ⇧ **keys** to view the choices.

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

Selecting Function Mode (alarm, control, or status)

Each relay can be selected to function as a:

- **Dual-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 the analyzer detects a sensor or analyzer "FAIL" diagnostic condition (see Part Three, Section 5.1 for details).

1. With the ≡SET RELAY A / ▶SET PARAMETER ↓ screen displayed, press ⇩ **key** once 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, or STATUS).

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

Selecting 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 each relay to a preset on/off state.

To set a relay on/off transfer state for a control or alarm relay to suit your application:

1. With the `≡SET RELAY A` `▶SET FUNCTION ⇕` screen displayed, press **⇩ key** once to display `≡SET RELAY A` `▶SET TRANSFER ⇕`.

2. Press **ENTER key** to display `SET TRANSFER?` `(DE-ENERGIZED )`. Use **⇩ and ⇧ keys** to view both choices (DE-ENERGIZED or ENERGIZED).

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

Setting Activation (Configuration) Values

The group of configuration settings available to a relay is dependent on its selected function mode (alarm or control). **Relays set for status function mode are not configurable.** Table B describes all relay configuration settings, categorized by relay function mode:

Table B -- 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.

Table B -- RELAY CONFIGURATION SETTINGS (continued)	
Setting	Description
For Alarm Relay (continued)	
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 Part Three, Section 6.
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.

NOTE: *When a relay is set to function as a status relay, the ▷ symbol at the start of the "ACTIVATION" line denotes that this menu item is not relevant and, therefore, not available.*

Also, it is possible to enter values which always keep a relay active or inactive. To avoid this, be sure that "low" values are lower than "high" values.

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

To set Relay A configuration values:

1. With the `≡SET RELAY A` / `▶SET TRANSFER ⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡SET RELAY A` / `▶ACTIVATION ⇕`.

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.

3.7 Enabling/Disabling Passcode

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

- **DISABLED:** With the passcode feature disabled, all configuration settings can be displayed and changed, and the analyzer can be calibrated.
- **ENABLED:** With the passcode feature enabled, all configuration settings can be displayed -- but they cannot be changed -- and the analyzer cannot be calibrated. When you attempt to change a setting 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 and return 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. With the `≡CONFIGURE` / `▶SET OUTPUT 1 ↓` screen displayed, press ⇩ **key** four times to display `≡CONFIGURE` / `▶SET PASSCODE ⇳`.

2. Press **ENTER key** to display `SET PASSCODE?` / `(DISABLED )`. Use ⇩ **and** ⇧ **keys** to view both choices (DISABLED or ENABLED).

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

3.8 Summary of Configuration Settings

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

Table C – ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
LANGUAGE Configuration Setting			
LANGUAGE?	ENOMEGASH, FRENCH, GERMAN, SPANISH, etc.	ENOMEGASH	
SENSOR A and B Configuration Settings			
SELECT MEASURE?	CONDUCTIVITY, RESISTIVITY, or TDS	CONDUCTIVITY	
DISPLAY FORMAT? (full scale value)	CONDUCTIVITY: µS/cm: 2.000, 20.00, 200.0, or 2000 mS/cm: 2.000, 20.00, 200.0, or 2000 RESISTIVITY: XX.XX MΩ • cm or XXX.X KΩ • cm TDS: XXXX ppm or XXXX ppb	CONDUCTIVITY: For 0.05 cell: 20.00 µS/cm For 0.5 cell: 200.0 µS/cm For 1.0 cell: 2000 µS/cm For 5.0 cell: 20.00 mS/cm For 10 cell: 200.0 mS/cm RESISTIVITY: XX.XX MΩ • cm TDS: XXXX ppm	
T-COMPENSATION?	LINEAR, AMMONIA, NATURAL WATER, OPTIONAL TABLE, or NONE	Sensor A: LINEAR at 2.00% per °C with 25.0°C reference temp. Sensor B: MANUAL	
TDS: SELECT FACTOR?	NaCl or USER DEFINED	NaCl	
TDS: SET FACTOR?	0.01-99.99 ppm/µS	0.492 ppm/µS	
LINEAR: SET SLOPE?	0-4.00% per °C	2.00% per °C	
LINEAR: SET REF TEMP?	0-200.0°C or 32-392°F	25.0°C or 77°F	
SELECT CELL K?	0.05, 0.5, 1.0, 5.0, or 10	1.0	
SET CELL K?	0.0500-10.0000	1.0000	
SET FILTER?	0-60 seconds	0 seconds	
PULSE SUPPRESS?	OFF or ON	OFF	
ENTER NOTE?	Enter up to eight characters to replace COND A or COND B	COND A and COND B	
TEMP ELE: SELECT TYPE?	PT1000, PT100, or MANUAL	PT1000	
TEMP ELEMENT: SET T FACTOR?	950-1050 ohms or 95-105 ohms	1000 OHMS	
TEMP ELE: SET MANUAL?	0.0-200.0°C	25.0°C	
CALCULATION Configuration Settings (Sensor A and B)			
SELECT MEASURE?	NONE, % REJECT, % PASS, RATIO (A/B), RATIO (B/A), DIFF (A-B), or DIFF (B-A)	NONE	
DISPLAY FORMAT?	% REJECT: non-selectable % PASS: non-selectable RATIO: XXXX, XXX.X, XX.XX, or X.XXX DIFF: Same ranges as those listed in "SENSOR A and B Configuration Settings" category above	% REJECT: 0-100% % PASS: 0-100% RATIO A/B or B/A: XXXX DIFF: Same defaults as those listed in "SENSOR A and B Configuration Settings" category above	Not applicable Not applicable

(Table C continued on next page.)

Table C -- ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS -- continued)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
TEMPERATURE Display Configuration Setting			
CONFIGURE: °C OR °F?	°C or °F	°C	
OUTPUT Configuration Settings			
SET PARAMETER?	SENSOR A, SENSOR B, TEMPERATURE A, TEMPERATURE B, or CALCULATED	Output 1: SENSOR A Output 2: SENSOR B	
SET 4mA VALUE?	CONDUCTIVITY: µS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 RESIST: 0-19.99 MΩ • cm or 0-999.9 KΩ • cm TDS: 0-9999 ppm or 0-9999 ppb TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: 0 µS/cm or 0 mS/cm RESIST: 0 MΩ or 0 KΩ • cm TDS: 0 ppm or 0 ppb TEMP: 0.0°C or 32.0°F	
SET 20mA VALUE?	CONDUCTIVITY: µS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 RESIST: 0-19.99 MΩ • cm or 0-999.9 KΩ • cm TDS: 0-9999 ppm or 0-9999 ppb TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 2.000, 20.00, 200.0, or 2000 mS/cm: 2.000, 20.00, 200.0, or 2000 RESIST: 19.99 MΩ or 999.9 KΩ • cm TDS: 9999 ppm or 9999 ppb TEMP: 200.0°C or 392.0°F	
SET TRANSFER?	0-20 mA or 4-20 mA	All Outputs: 12 mA	
SET FILTER?	0-60 seconds	All Outputs: 0 seconds	
SCALE 0mA/4mA?	0mA or 4mA	All Outputs: 4 mA	
RELAY Configuration Settings			
Settings Common To Alarm and Control Relays:			
SET PARAMETER?	SENSOR A, SENSOR B, TEMPERATURE A, TEMPERATURE B, or CALCULATED	Relay A: SENSOR A Relay B: SENSOR B	
SET FUNCTION?	ALARM, CONTROL, or STATUS	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 Alarm Relays Only:			
LOW ALARM?	CONDUCTIVITY: µS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 RESIST: 0-19.99 MΩ • cm or 0-999.9 KΩ • cm TDS: 0-9999 ppm or 0-9999 ppb TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: 0 µS/cm or 0 mS/cm RESIST: 0 MΩ or 0 KΩ • cm TDS: 0 ppm or 0 ppb TEMP: 0.0°C or 32.0°F	

(Table C continued on next page.)

Table C -- ANALYZER CONFIGURATION SETTINGS (RANGES/CHOICES and DEFAULTS -- continued)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
RELAY Configuration Settings (continued)			
Settings For Alarm Relays Only (continued):			
HIGH ALARM?	CONDUCTIVITY: µS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 RESIST: 0-19.99 MΩ • cm or 0-999.9 KΩ • cm TDS: 0-9999 ppm or 0-9999 ppb TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 2.000, 20.00, 200.0, or 2000 mS/cm: 2.000, 20.00, 200.0, or 2000 RESIST: 19.99 MΩ or 999.9 KΩ • cm TDS: 9999 ppm or 9999 ppb TEMP: 200.0°C or 392.0°F	
LOW DEADBAND?	CONDUCTIVITY: 0-10% of range RESISTIVITY: 0-10% of range TDS: 0-10% of range TEMPERATURE: 0-10% of range	COND: 0 µS/cm or 0 mS/cm RESIST: 0 MΩ or 0 KΩ • cm TDS: 0 ppm or 0 ppb TEMP: 0.0°C or 0.0°F	
HIGH DEADBAND?	CONDUCTIVITY: 0-10% of range RESISTIVITY: 0-10% of range TDS: 0-10% of range TEMPERATURE: 0-10% of range	COND: 0 µS/cm or 0 mS/cm RESIST: 0 MΩ or 0 KΩ • cm TDS: 0 ppm or 0 ppb TEMP: 0.0°C or 0.0°F	
Settings For Control Relays Only:			
PHASE?	HIGH or LOW	For Relays A and B: HIGH	
SET SETPOINT?	CONDUCTIVITY: µS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0, or 0-2000 RESIST: 0-19.99 MΩ • cm or 0-999.9 KΩ • cm TDS: 0-9999 ppm or 0-9999 ppb TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 2.000, 20.00, 200.0, or 2000 mS/cm: 2.000, 20.00, 200.0, or 2000 RESIST: 19.99 MΩ or 999.9 KΩ • cm TDS: 9999 ppm or 9999 ppb TEMP: 200.0°C or 392.0°F	
DEADBAND?	CONDUCTIVITY: 0-10% of range RESISTIVITY: 0-10% of range TDS: 0-10% of range TEMPERATURE: 0-10% of range	COND: 0 µS/cm or 0 mS/cm RESIST: 0 MΩ or 0 KΩ • cm TDS: 0 ppm or 0 ppb TEMP: 0.0°C or 0.0°F	
OVERFEED TIMER?	0-999.9 minutes	0 minutes	
PASSCODE CONFIGURATION Setting			
SET PASSCODE?	DISABLED or ENABLED	DISABLED	
TEST/MAINTENANCE Simulation Function Settings			
SELECT SIM?	SENSOR A, SENSOR B, TEMPERATURE A, TEMPERATURE B, or CALCULATED	SENSOR A	
SIM SENSOR?	Same ranges as those listed in the "OUTPUT Configuration Settings" category under "SET 4 mA VALUE."	Present measured value of Sensor A's selected parameter.	

SECTION 4
CALIBRATING THE ANALYZER

4.1 Things to Know About Calibration

Each contacting conductivity sensor has a unique zero point and offset. Consequently, **always zero the sensor when calibrating it the first time** (Section 4.2). Zeroing provides the best possible measuring accuracy, and eliminates any discrepancies between Sensor A and B measurement channels. Then calibrate for sensor offset using the DRY method (Section 4.3) or the 1-POINT SAMPLE method (Section 4.4).

☞ **Calibration Tip!** Conductivity measurement is greatly affected by small changes in temperature. To measure temperature and, therefore, conductivity more accurately, OMEGA highly recommends using the DRY method to calibrate for sensor offset. This is actually a normal part of configuring the sensor characteristics during initial startup. **DRY eliminates the need for conductivity reference solutions.** It also automatically sets the analyzer measuring range to match the inherent range of the sensor's cell constant. Furthermore, DRY eliminates the need to periodically re-calibrate! The only requirement, depending on the application, may be periodic cleaning of the sensor. Only when the sensor is replaced is a new DRY calibration necessary.

In addition to zeroing and calibrating each sensor for offset, you can also calibrate the mA values for each analog output. Refer to Section 4.5 for details.

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.7), you must successfully enter the passcode before attempting to calibrate the analyzer.*

Also, an in-progress calibration can always be aborted by pressing the ESC key. *After the "ABORT: YES?" screen appears, do one of the following:*

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

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

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

4.2 Zeroing Sensor for First-time Calibration

Zero the sensor if it is being calibrated the first time. If not, disregard this section and proceed with sensor offset calibration using the DRY method (Section 4.3) or the 1 POINT SAMPLE CAL method (Section 4.4).

1. Make sure that the sensor is dry before zeroing.
2. Press **MENU key** to display
```
≡MAIN MENU
▶CALIBRATE          ↓
```
.
3. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR A           ↓
```
.
4. Press **ENTER key** again to display
```
≡SENSOR A
▶1 POINT SAMPLE     ↓
```
.
5. Press ⇩ **key** once to display
```
≡SENSOR A
▶ZERO               ↓
```
.
6. Press **ENTER key** to display
```
ZERO?
(HOLD OUTPUTS       )
```
. 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.
7. With the desired screen displayed, press **ENTER key** to enter this selection.
8. With the "ZERO: IN DRY AIR?" screen displayed and the dry sensor held in air, press **ENTER key** to confirm and to start automatic zeroing.

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

10. 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 (first-time calibration only). Now calibrate for sensor offset using the DRY method (Section 4.2) or the 1 POINT SAMPLE method (Section 4.3).

4.3 DRY Calibration Method (highly recommended)

Each Omega's CDE680 Series conductivity sensor has two unique, OMEGA-certified values that must be entered to complete a DRY calibration:

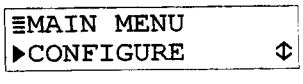
- **Sensor cell "K" value** shown on a label attached to its cable or to the inside cover of its optional junction box.
- **Temperature "T" factor** shown on the same label. (Since the inherent ohm value of the Pt 1000 RTD temperature element built into each sensor varies slightly, OMEGA tests each sensor to provide its specific "T" factor.)

If these two certified values were previously entered during initial setup (Section 3.2 under respective subheadings), DRY calibration is complete. If the certified values have not been entered, follow the steps in the "Entering K Value" and "Entering Temperature T Factor" subsections.

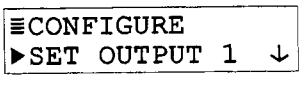
When using both sensors, enter each set of unique values using the respective sensor menu screens.

1. Press **MENU key** to display

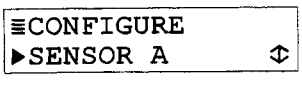

.

2. Press ⇩ **key** once to display


.

3. Press **ENTER key** to display


.

4. Press ⇩ **key** until you display


.

5. Press **ENTER key** to display
```
≡SENSOR A
▶SELECT MEASURE↓
```
.

6. Press ⇩ **key** until you display
```
≡SENSOR A
▶CELL CONSTANT ⇕
```
.

7. Press **ENTER key** to display
```
≡CELL CONSTANT
▶SELECT CELL K ↓
```
.

8. Press **ENTER key** again to display a cell category selection screen like
```
SELECT CELL K?
(0.0500          )
```
. Use ⇧ **and** ⇩ **keys** to select the nominal cell category that corresponds to the sensor's OMEGA-certified "K" value (shown on label attached to sensor cable or to inside cover of its junction box). Then press **ENTER key** to enter this selection.

9. After the
```
≡CELL CONSTANT
▶SELECT CELL K ↓
```
screen re-appears, press ⇩ **key** once to display
```
≡CELL CONSTANT
▶SET CELL K      ⇕
```
.

10. Press **ENTER key** to display a cell "K" value screen like
```
SET CELL K?
(0.0500          )
```
. Use ⇨ **and** ⇦ **keys** to coarse adjust, and ⇧ **and** ⇩ **keys** to fine adjust the displayed value to exactly match the sensor's OMEGA-certified "K" value. Then press **ENTER key** to enter the value.

After entering the "K" value, complete DRY calibration by entering the OMEGA-certified "T" factor:

Entering Temperature "T" Factor

1. After the
```
≡CELL CONSTANT
▶SET CELL K      ⇕
```
screen re-appears, press **ESC key** once to display
```
≡SENSOR A
▶CELL CONSTANT ⇕
```
.

2. Press ⇩ **key** until you display
```
≡SENSOR A
▶TEMP ELEMENT    ⇕
```
.

3. Press **ENTER key** to display
```
≡TEMP ELEMENT
▶SELECT TYPE     ↓
```
.

4. Press ⇩ **key** once to display
```
≡TEMP ELEMENT
▶SET T FACTOR    ⇕
```
.

5. Press **ENTER key** to display a "T" factor value screen like `SET T FACTOR?` `(1000.0 OHMS )`. Use ⇨ **and** ⇦ **keys** to coarse adjust, and ⇧ **and** ⇩ **keys** to fine adjust the displayed value to exactly match the sensor's OMEGA-certified "T" factor. Then press **ENTER key** to enter the value.

SPECIAL CASE -- ALTERED SENSOR CABLE LENGTH
(only for sensors with PT 1000 temperature elements*)

Changing the standard 20 ft. (6 m) sensor cable length, by shortening it or adding an interconnect cable, will affect temperature measuring accuracy. The OMEGA-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.

*Sensors with PT100 temperature elements provide inherently less accurate temperature readings and are not recommended.

6. After the `≡TEMP ELEMENT` `▶SET T FACTOR ⇕` screen re-appears, press **MENU key** once and then **ESC key** once to display the MEASURE screen.

This completes OMEGA's DRY calibration.

4.4 1 POINT SAMPLE Method (wet calibration)

This "wet" calibration method requires removing the sensor from the process, immersing it into a properly prepared conductivity reference solution or process sample, and entering the solution's known value. **If using both sensors, calibrate each one in the same way using its respective sensor menu screens.**

1. When using a conductivity reference solution, its value should be near the typical measured process value for best accuracy. Prepare the solution by adding the listed grams of pure, dried NaCl shown in Table D on the next page to one liter of high purity, de-ionized, CO_2-free water at 25°C to obtain the listed conductivity. Solution conductivity can be decreased by dilution with de-ionized water.

Table D -- CONDUCTIVITY REFERENCE SOLUTIONS

Desired Solution Value			Grams NaCl To Be Added
µS/cm	mS/cm	ppm (NaCl)*	
100	0.10	50	0.05
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

*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 (or process sample). **Important:** Allow the sensor and solution temperatures to equalize. Depending on their temperature differences, this may take a few minutes.

3. Press **MENU key** to display
```
≡MAIN MENU
▶CALIBRATE          ↓
```
.

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

5. Press **ENTER key** again to display
```
≡SENSOR A
▶1 POINT SAMPLE     ↓
```
.

6. Press **ENTER key** again to display `1 POINT SAMPLE?` `(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.

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

8. If a process sample is used, determine its value using laboratory analysis or a calibrated portable meter.

9. With the sensor in solution and the `1 POINT SAMPLE:` `SAMPLE READY?` screen displayed, press **ENTER key** to confirm. This active `XXXX uS/cm` `READING STABLE?` screen appears showing the measurement reading.

10. Wait for the reading to stabilize which may take a few 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 `1 POINT SAMPLE?` `(XXXX uS/cm )` screen appears showing the "last measured" value.

11. Use ⇧ **and** ⇩ **keys** to adjust the displayed value to exactly match the known value of the reference solution (or process sample).

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 "1 POINT SAMPLE: 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 "1 POINT SAMPLE" calibration.

4.5 Analog Outputs (1 and 2) Calibration

The analyzer analog outputs are factory-calibrated. However, they can be re-calibrated at any time if desired. **Calibrate each output in the same way using its respective menu screens.**

NOTE: *When the passcode feature is enabled (Section 3.7), 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
```
≡MAIN MENU
▶CALIBRATE          ↓
```
.

2. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR A           ↓
```
.

3. Press ⇩ **key** <u>twice</u> to display
```
≡CALIBRATE
▶CAL OUTPUTS        ↓
```
.

4. Press **ENTER key** to display
```
≡CAL OUTPUTS
▶CAL OUTPUT 1       ↓
```
.

5. Press **ENTER key** again to display
```
≡CAL OUTPUT 1
▶CAL OUT 1 4mA      ↓
```
.

6. Press **ENTER key** again to display
```
CAL OUT 1 4mA?
(XXX                )
```
.

7. The displayed value is "counts" -- not mA -- that dynamically change when the output is adjusted. Use a calibrated digital multimeter to measure Output 1's actual <u>minimum</u> value provided at Terminals 4 and 5 on TB4.

8. Use ⇨ **and** ⇦ **keys** (coarse adjust) and ⇧ **and** ⇩ **keys** (fine adjust) to adjust Output 1's minimum value to read <u>exactly</u> "4.00 mA" on the <u>digital</u> <u>multimeter</u> -- not the analyzer display.

9. Press **ENTER key** to complete calibration of the minimum endpoint value.

10. With the
```
≣CAL OUTPUT 1
▶CAL OUT 1 4mA ↓
```
screen displayed, press ⇩ **key** once to display
```
≣CAL OUTPUT 1
▶CAL OUT 1 20mA⇳
```
.

11. Press **ENTER key** to display
```
CAL OUT 1 20mA?
(XXXX          )
```
.

12. Once again, the displayed value is "counts" -- not mA -- that dynamically change when the output is adjusted. Use a calibrated digital multimeter to measure Output 1's actual maximum value.

13. Use ⇨ **and** ⇦ **keys** (coarse adjust) and ⇧ **and** ⇩ **keys** (fine adjust) to adjust Output 1's maximum value to read exactly "20.00 mA" on the digital multimeter -- not the analyzer display.

14. Press **ENTER key** to complete calibration of the maximum endpoint value.

This completes Output 1 calibration.

SECTION 5
TEST/MAINTENANCE

The analyzer has TEST/MAINT menu screens to:

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

5.1 Checking Analyzer, Sensor, and Relay Status

With the analyzer's system diagnostic capabilities, you can check the operating status of the analyzer, sensors (measurement and temperature inputs), 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
```
≡MAIN MENU
▶CALIBRATE          ↓
```
.

2. Press ⇩ **key** <u>twice</u> to display
```
≡MAIN MENU
▶TEST/MAINT         ⇕
```
.

3. Press **ENTER key** to display
```
≡TEST/MAINT
▶STATUS             ↓
```
.

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

5. Press **ENTER key** once to view the "STATUS: SENSOR OK" screen. Then press the **ENTER key** again to view the "STATUS: TEMP OK" screen. If "FAIL" appears on either input status screen, it may indicate:

   - Sensor is disconnected or incorrectly wired.
   - Signal is very noisy or exceeds measuring range.

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.*

7. To end relay status checking, press **ESC** or **ENTER key**.

5.2 Holding Outputs

The analyzer has a convenient feature to hold the analog outputs, 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 operating).

☞ ***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 and return analog outputs back to their "active" states, press **ENTER key**.

5.3 Resetting Overfeed 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 LED stops blinking after reset.

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

2. Press **ENTER key** to reset all overfeed timers ("OVERFEED RESET: DONE" screen appears, acknowledging reset has occurred).

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

5.4 Providing Output (1 and 2) Test Signals

The analyzer can provide analog output test signals of a desired milliamp value to confirm operation of connected devices. **Test signals can be provided for both outputs in the same way using their respective menu screens.**

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≣TEST/MAINT ▶OUTPUT 1 ⇕.
2. Press **ENTER key** to display OUTPUT 1? (XX.XXmA).

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

3. Adjust the displayed value to obtain the desired mA test signal. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)
4. To end the output test signal and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.5 Testing Relay (A and B) Operation

Relays A and B can be tested to confirm their operation. **Test each relay in the same way using its respective menu screens.**

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

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≣TEST/MAINT ▶RELAY A ⇕.
2. Press **ENTER key** to display RELAY A? (ENERGIZE). Relay A should be energized. Confirm this by checking 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 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** or **ENTER key**.

5.6 Testing Alarm LEDs

Both front panel alarm LEDs can be simultaneously tested.

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶ALARM LEDS ⇕.

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** or **ENTER key**.

5.7 Checking EPROM Version

You can check the EPROM version used in your analyzer.

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶EPROM VERSION ⇕.

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

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

5.8 Selecting Type of Simulated Value

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 5.9.

1. With the ≡TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≡TEST/MAINT ▶SELECT SIM ⇕.

2. Press **ENTER key** to display SELECT SIM? (SENSOR A). Use ⇩ **and** ⇧ **keys** to view all choices:

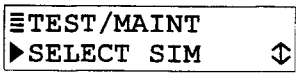
- **SENSOR A:** Depending on the sensor's configured measurement, selects the simulated value to be a Sensor A conductivity, resistivity, or TDS value.
- **SENSOR B:** Depending on the sensor's configured measurement, selects the simulated value to be a Sensor B conductivity, resistivity, or TDS value.
- **TEMPERATURE A:** Selects the simulated value to be a Sensor A temperature value.
- **TEMPERATURE B:** Selects the simulated value to be a Sensor B temperature value.
- ***CALCULATION:** Selects the simulated value to be a calculated Sensor A and B measurement value (% reject, % pass, ratio A/B, ratio B/A, diff. A-B, or diff. B-A).

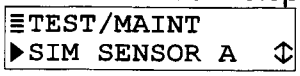
*A simulated value can only represent the calculated measurement when two sensors are used and the analyzer has been correctly configured for CALCULATION.

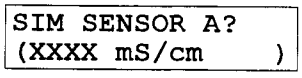
3. With the desired choice displayed, press **ENTER key** to enter this selection.

5.9 Setting Simulation Value

After selecting the type of simulated measurement (subsection 5.8), set the desired simulation value.

1. With the 

screen displayed, press ⇩ **key** until you display 

.
2. Press **ENTER key** to display 

.

NOTE: *The value shown on this screen is now active, providing a corresponding mA value for both analog output signals. (Both relays, depending on their configured settings, may also respond to this simulation value.)*

3. Adjust the displayed simulation value to the desired value. (Use ⇨ **and** ⇦ **keys** for coarse adjust; ⇧ **and** ⇩ **keys** for fine adjust.)
4. To end simulation and return to the previous level of the TEST/MAINT menu branch, press **ESC** or **ENTER key**.

5.10 Resetting Configuration Values to Factory Defaults

You can conveniently reset <u>all</u> stored configuration settings, including calibration settings, simultaneously to factory-set defaults.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until you display ≣TEST/MAINT ▶RESET DEFAULTS⇕.

2. Press **ENTER key** to display the "RESET DEFAULTS: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (If you want to abort this action, press **ESC key** now.)

3. Press **ENTER key** to reset <u>all</u> stored configuration settings to factory defaults ("RESET DEFAULTS: DONE" screen appears, acknowledging reset has occurred).

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

SECTION 6
RELAY OVERFEED TIMER FEATURE

The useful relay overfeed timer feature, **only available to a relay set for the "control" function**, is described in more detail in this section.

6.1 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.

6.2 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.

6.3 Overfeed Timer "Timeout" 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 overfeed timers are reset simultaneously.)

6.4 Resetting Overfeed Timers

To manually reset both relay overfeed timers, please refer to Part Three, Section 5.3.

6.5 Interactions With Other Analyzer Functions

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

Table E – 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 (By 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	

PART FOUR - SERVICE AND MAINTENANCE

SECTION 1
GENERAL INFORMATION

1.1 Inspecting Sensor Cables

If a measurement problem exists and you suspect the sensor cables, inspect them 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.

1.2 Replacing Fuse(s)

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

WARNING:

DISCONNECT LINE POWER TO PREVENT POSSIBLE ELECTRICAL SHOCK.

1. After disconnecting line power, unplug all terminal strip connectors to enable removal of the back panel.
2. Remove the four screws fastening the back panel and remove the panel. The board-mounted fuses are located on the left circuit board.
3. Remove the blown fuse and replace it with a OMEGA fuse or an equivalent. (OMEGA fuse kit part number is 1000G3315-101.)
4. Reinstall the back panel and attach all terminal connectors.

1.3 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 OMEGA Customer Service Dept. for relay replacement.

SECTION 2
PRESERVING MEASUREMENT ACCURACY

2.1 Keeping Sensor(s) Clean

To maintain measurement accuracy, periodically clean the sensor(s). Operating experience will help you determine when to clean the sensor (typically, monthly intervals). Use the recommended cleaning procedure described in the OMEGA contacting conductivity sensor instruction manual.

2.2 Keeping Analyzer Calibrated

If the DRY method (Part Three, Section 4.2) was used to calibrate the analyzer, re-calibration is only required when replacing the OMEGA conductivity sensor. **If the analyzer was calibrated using the 1 POINT SAMPLE method, periodic re-calibration is required.** In all cases, always calibrate the analyzer when a sensor is replaced.

NOTE: *If your measuring application requires utmost accuracy, OMEGA offers a re-certification service to verify a used sensor's "K" value and temperature "T" factor. For details, call your local OMEGA representative or the OMEGA Customer Service Department.*

2.3 Avoiding Electrical Interference

Recommendation: Do not run sensor cables (and interconnect cables, if used) in the same conduit with line power.

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).

SECTION 3
TROUBLESHOOTING

3.1 Ground Loops

The analyzer may be affected by a "ground loop" problem (two or more electrically grounded points at different potentials).

Symptoms Indicating a Possible Ground Loop

- Analyzer reading is offset from the actual value by a consistent amount, or ....
- Analyzer reading is frozen on one value, or ....
- Analyzer reading is "off scale" (upscale or downscale).

Although the source of a ground loop is difficult to determine, there are several common causes.

Common Causes of a Ground Loop

- Components, such as recorders or computers, are connected to non-isolated analog outputs.
- Not using shielded cabling or failure to properly connect all cable shields.
- Moisture or corrosion in a junction box.

Determining if Ground Loop Exists

The following simple test can help to determine if there is a ground loop:

1. With the conductivity MEASURE screen displayed, put the sensor in a non-conductive container (plastic or glass) filled with a known value conductivity reference solution. Note the analyzer reading for this solution.
2. Connect one end of a wire to a known earth ground, such as the analyzer ground terminal on TB1 or a metal water pipe. Place the other end of this wire into the reference solution next to the sensor.
3. Note the analyzer reading now and compare it with the reading taken in step 1. If the reading changed, a ground loop exists.

Finding Source of Ground Loop

Sometimes the source of a ground loop is easy to find, but it usually takes an organized approach to isolate the problem.

Troubleshooting Tip! Use a systematic troubleshooting method. If possible, start by grounding all shields and electrical grounds at one stable point. One at a time, turn off all pumps, motors and switches that are in contact with the process. Each time you do this, check if the ground loop still exists. Since the process media being measured is electrically conductive, the source of the ground loop may not be readily apparent.

3.2 Isolating Measuring System Problem

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

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.

Verifying Sensor Operation

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

Verifying Analyzer Operation

Verify the operation of the Sensor A measuring channel. If the Sensor B channel is used, verify it in the same way. The following procedure applies to the Sensor A channel.

WARNING:

DISCONNECT LINE POWER TO PREVENT POSSIBLE ELECTRICAL SHOCK.

1. After disconnecting line power and the sensor(s) from the analyzer, connect a 1% tolerance, 1097 ohm resistor between Terminals 4 (white) and 5 (blue) on TB3. (When configured for a PT100 temperature element, use a 1% tolerance, 110 ohm resistor.)

2. Depending on the configured sensor cell constant, measuring units, and range, use the listed resistance in Table F (1% tolerance resistor or decade box) and connect it between Terminals 1 (red) and 2 (black) on TB3.

Table F – FULL-SCALE EQUIVALENT TEST RESISTANCE VALUES

Configured Display Format	Configured "Nominal" Cell Constant				
	0.05 (see Note 1)	0.5	1	5	10
For Conductivity Measurement					
0-2.000 µS/cm	25 KΩ	not applicable	not applicable	not applicable	not applicable
0-20.00 µS/cm	2.5 KΩ	25 KΩ	not applicable	not applicable	not applicable
0-200.0 µS/cm	not applicable	2.5 KΩ	5 KΩ	not applicable	not applicable
0-2000 µS/cm	not applicable	not applicable	500 KΩ	2.5 KΩ	5 KΩ
0-2.000 mS/cm	not applicable	not applicable	not applicable	2.5 KΩ	5 KΩ
0-20.00 mS/cm	not applicable	not applicable	not applicable	not applicable	500 Ω
0-200.0 mS/cm	not applicable	not applicable	not applicable	not applicable	50 Ω
For Resistivity Measurement					
0-19.99 MΩ • cm	1 MΩ	not applicable	not applicable	not applicable	not applicable
0-999.9 KΩ • cm	50 KΩ	not applicable	not applicable	not applicable	not applicable
For TDS Measurement					
0-9999 ppm	3.2 Ω	32 Ω	64 Ω	320 Ω	640 Ω
0-9999 ppb	3.2 KΩ	32 KΩ	64 KΩ	320 KΩ	640 KΩ

NOTE 1: When measuring ultrapure water as conductivity (less than 1.00 microSiemens/cm), an 877 KΩ resistance will display 0.057 µS/cm. When measuring ultrapure water as resistivity, a 910 KΩ resistance will display 18.2 MΩ • cm.

3. Reconnect line power to the analyzer.

WARNING:

WHEN LINE POWER IS PRESENT, BE CAREFUL TO PREVENT ELECTRICAL SHOCK.

4. Verify that the analyzer conductivity reading is full-scale for the applicable range. Also, verify that the analyzer temperature reading is 0°C.

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

Verifying Interconnect Cable Integrity

WARNING:

DISCONNECT LINE POWER TO PREVENT POSSIBLE ELECTRICAL SHOCK.

1. After disconnecting line power, reconnect the sensor(s) directly to the analyzer (purposely bypassing the interconnect cable and junction box, if used).

2. Place the sensor(s) in a container of known value conductivity reference solution that is at room temperature.

3. Reconnect line power to the analyzer.

WARNING:

WHEN LINE POWER IS PRESENT, BE CAREFUL TO PREVENT ELECTRICAL SHOCK.

4. Verify that the analyzer reading is the same as the known reference solution value. 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.

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WARRANTY/DISCLAIMER

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FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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