16. Warranty

OAKTON warrants this controller to be free from significant deviations in material and workmanship for a period of three years from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the warrantied time period, please return—freight prepaid—and correction will be made without charge. OAKTON alone will determine if the product problem is due to deviations or customer misuse.

Out-of-warranty products will be repaired on a charge basis.

17. Return of items

Authorization must be obtained from our Customer Service Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. We will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: We reserve the right to make improvements in design, construction, and appearance of products without notice.

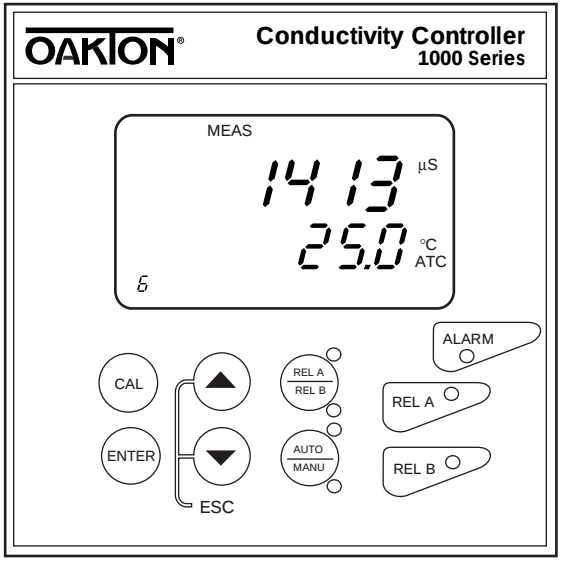
OAKTON®

List the name and information of your OAKTON distributor in the space below.

OPERATING INSTRUCTIONS

OAKTON 1000 series

¼ DIN Conductivity and Resistivity Controllers



CE

R2 Printed in the U.S.A. 9/00

OAKTON®

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1. Introduction

Thank you for purchasing a microprocessor-based OAKTON 1000-series ¼ DIN Conductivity or Resistivity controller. You can use this unit to measure either Conductivity or Resistivity with fast-responding on / off control. This controller has many user-friendly features; some of its features include:

- A **menu-driven program** that simplifies set-up
- Large **dual display** LCD shows conductivity (resistivity) and temperature along with clear multiple annunciators
- **Two set point, two SPDT relay operation** for lo / lo, lo / hi, hi / lo or hi / hi control
- 0 to 2000 second **time delay adjustment** on all relays—minimizes false alarms
- **Separate alarm relay** alerts you to set points exceeded for a specific length of time or a failed temperature sensor
- Separately adjustable **high and low set point hysteresis bands** prevent rapid contact switching if your measured value is fluctuating near the set point
- **Adjustable temperature coefficient** from 0.00 to 10.00% per °C lets you input your solution's true temperature correction for higher accuracy
- **Choice of 0.01, 0.1, 1.0 or 10.0 cell constants** for accurate readings in any solution
- **0-20/4-20 mA transmitter/recorder output** for remote monitoring and hard copy recording
- Protection against electromagnetic interference—**galvanically isolated output**
- **Push button keypad** gives you fast access to one-point calibration, switchable manual or automatic temperature compensation, and call up to view set points
- **Two level password protection**—first level allows quick access to calibration; second level lets you change set up parameters
- **LED indicators** signal control activities to monitor controller status from a distance
- **Nonvolatile memory** maintains setup even when power fails

Included with your controller

Your controller includes:

- 17-way and 5-way right angled terminal block (one each)
- side threaded rod with catch (two)
- receptacle cable lug (one)
- rubber gasket (one)

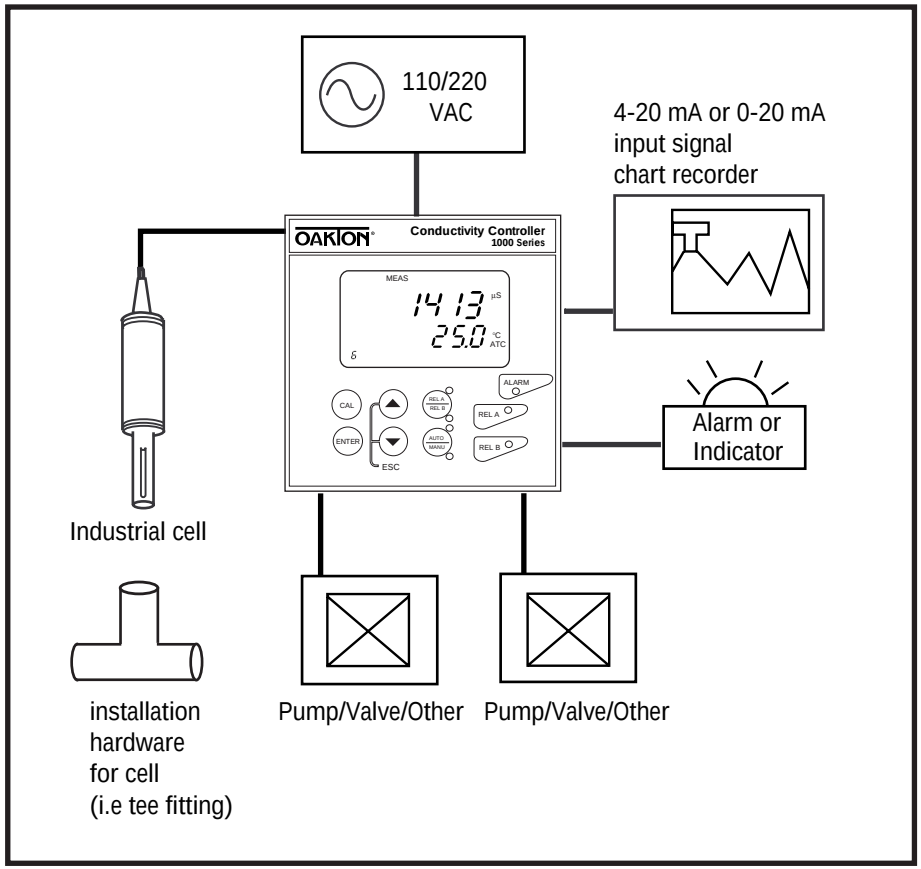
Please read through this manual carefully before installing and operating your controller.

2. Assembly and Installation

2.1 Typical Measurement and Control System

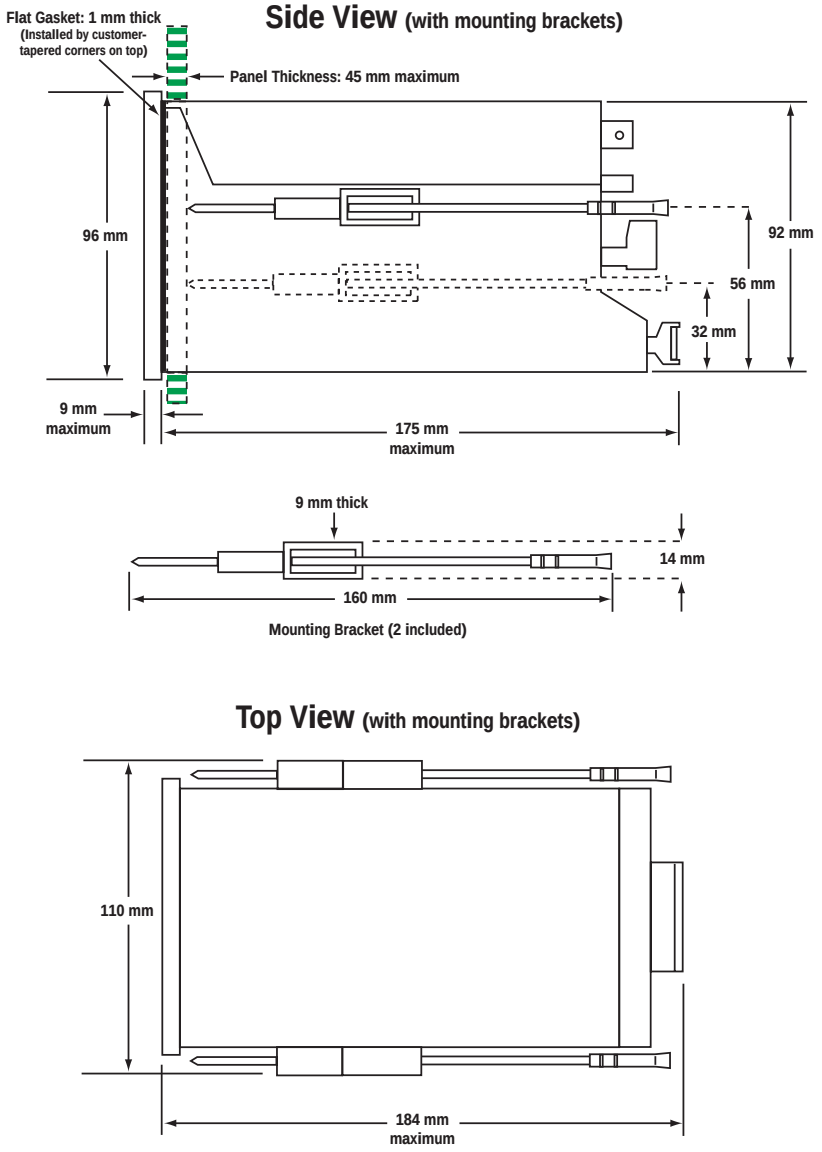
A typical measurement system consists of:

- power source
- the OAKTON 1000-series controller
- a conductivity (or resistivity) cell with or without built-in temperature sensor (Pt 100 or 1000)
- installation hardware for cell
- an appropriate measurement cable
- a final control element such as a pump or valve
- a recorder (optional)
- a visual and / or audible alarm (optional)



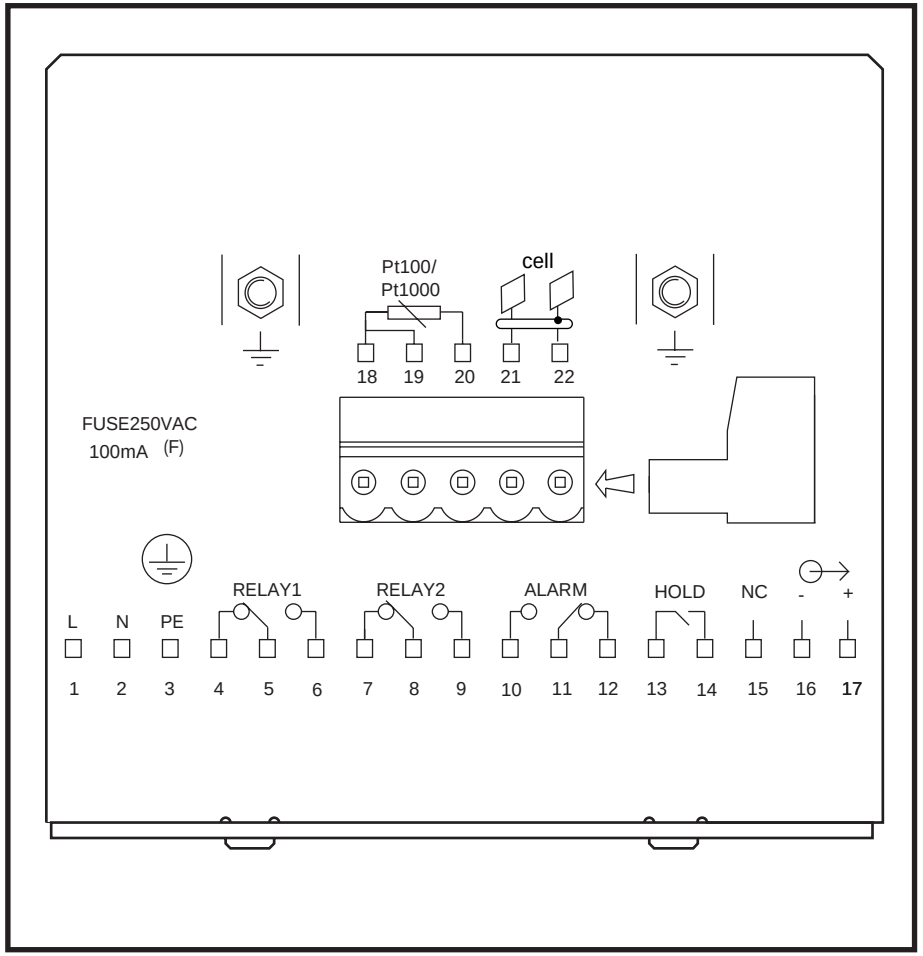
2.2 Unit dimensions

The field-tested control panel housing is 3.78" x 3.78" (96 x 96 mm).
The front panel meets protection class IP 54.



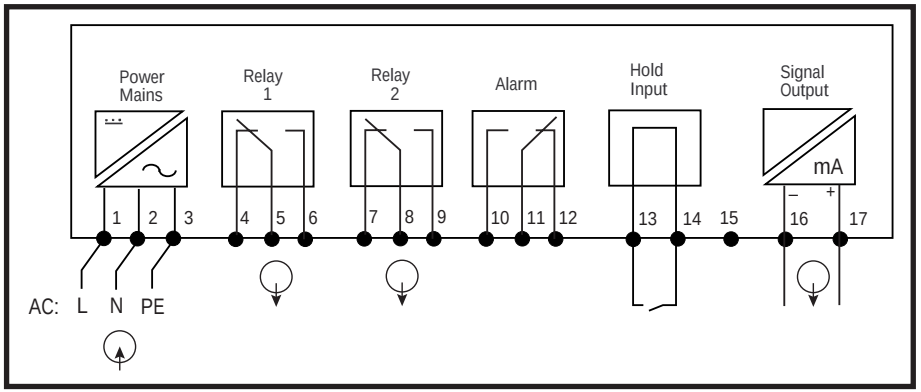
2.3 Back panel

The back panel consists of two different connectors: the 17-way PCB edge connector and the 5-way screw terminal connector.



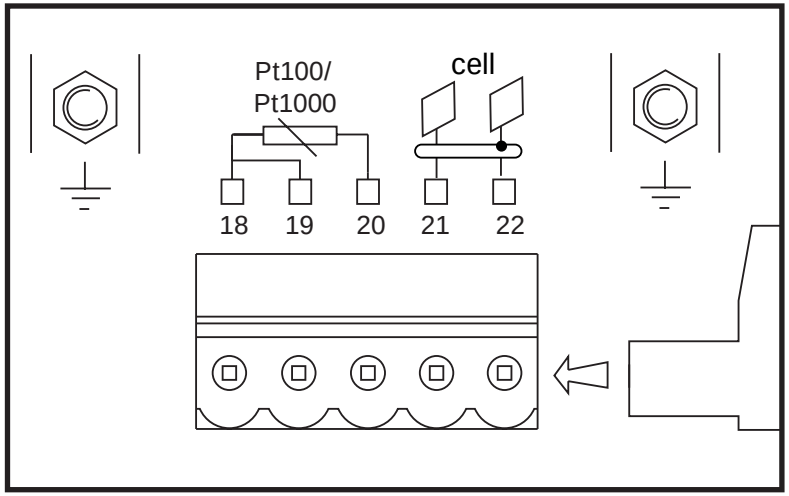
2.4 Electrical Connections

CAUTION: Electrical shock hazard! Make sure to remove AC power to the controller before wiring input and output connections, and before opening the controller housing.



1. VAC live wire
2. VAC neutral wire
3. VAC protective ground wire
   NOTE: Power is selectable for 110 or 220 VAC via an internal jumper. Factory setting is indicated on the label on top of the controller. See Appendix 3 on page 65 for directions on switching the power type.
4. Low set relay resting position
5. Low set relay common
6. Low set relay working position
7. High set relay resting position
8. High set relay common
9. High set relay working position
10. Alarm relay resting position
    IMPORTANT: The alarm relay functions as an “Active Low” device; e.g. it switches OFF under alarm condition. Therefore the alarm display device should be connected to the 'NC' contacts of the relay.
11. Alarm relay common
12. Alarm relay working position
13. Hold function switch terminal 1
14. Hold function switch terminal 2
15. No connection
16. 0/4 - 20 mA for – current connection
17. 0/4 - 20 mA for + current connection

2.5 Cell/temperature sensor connections



18. Pt100 / Pt1000 lead 1 terminal
19. Pt100 / Pt1000 sense lead terminal
20. Pt100 / Pt1000 lead 2 terminal

    NOTE: If using a two-wire RTD, short terminal 19 to terminal 18.

    NOTE: Pt100 / Pt1000 is selectable via an internal jumper setting. Factory default is Pt100. See “Jumper Positions” on page 65 for directions on switching the RTD type.

21. Cell lead 1
22. Cell lead 2

2.6 HOLD function

The HOLD function lets you force the relays to their resting position by applying a contact closure across terminals 13 and 14.

When the HOLD function is activated, the HOLD indicator will appear in the upper left corner of the display (see page 12 for a diagram of display characters).

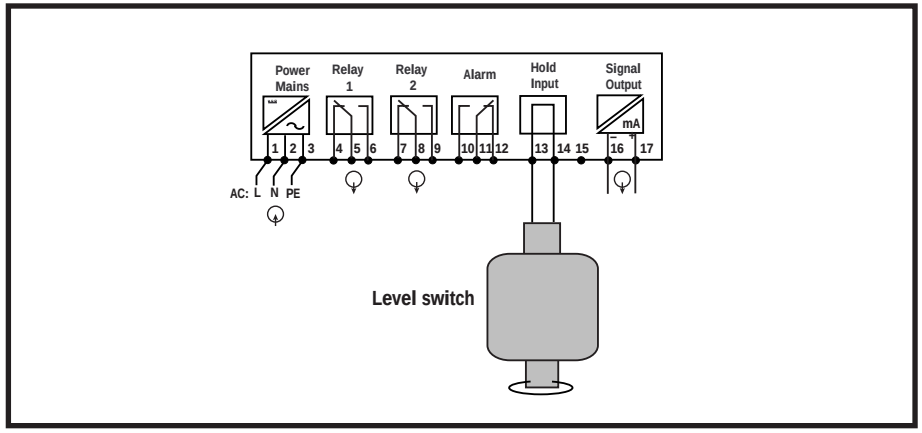
Typical applications:

Float or level switch: Connect to a float switch in your reagent feed tank to shut down pumps or tanks when out of reagent.

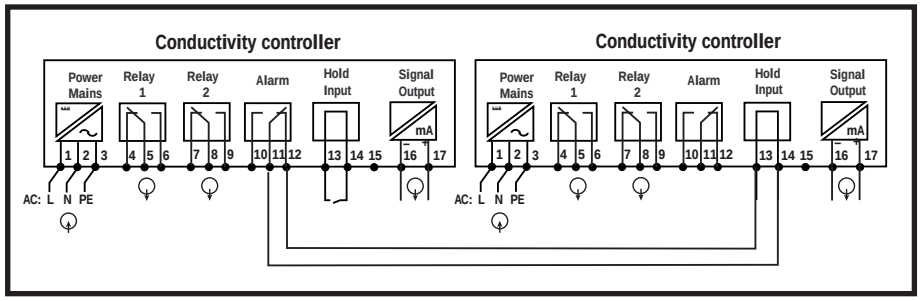
Flow switch: Connect to a flow switch to shut down pumps or valves when the process stream is shut down.

Dual conductivity control: Use for dosing two chemicals in stepwise addition.

Typical level switch wiring



Typical dual controller wiring



3. Overview: Keypad and display

3.1 Keypad

Calibration key



Lets you:

1. Perform rapid 1- point calibration.

Enter key



Lets you:

1. Select individual parameters within the parameter group.
2. Store input data in the Set-up mode.
3. Start calibration in the Calibration mode.

▲ and ▼ keys





Let you:

1. Select various parameter groups.
2. Set parameters and numerical values in the Set-up mode.
   If you continuously hold the button, the setting speed increases.
3. Control the relays in the Manual mode.
4. Return to the Measurement mode when both keys are pressed at once.

Relay control key



Lets you:

1. Switch between Auto and Manual relay operation (password required).

Relay Selection key



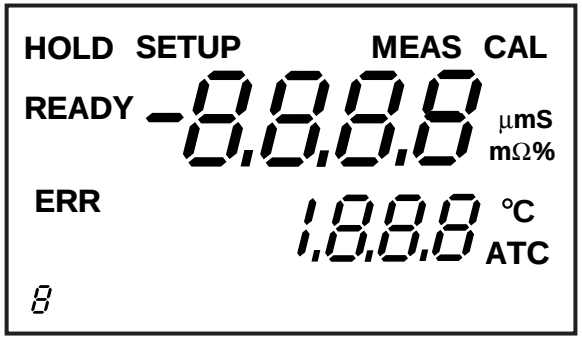
Lets you:

1. Display momentarily set-point values for the relay contacts in Auto relay operation mode.
2. Switch between Relay 1 and Relay 2 in Manual relay operation mode.

3.2 Display

The LCD display features two numerical displays that show measured values and status messages for easy, quick reference. The display provides short-text information for configuration and for setting parameters.

- The upper (primary) display shows conductivity or resistivity readings
- The lower (secondary) display shows temperature readings



The LCD display area includes the following indicators:

HOLD: HOLD indicator

SETUP: Advanced Set-up mode

MEAS: Measurement mode

CAL: Calibration mode

ERR: error / alarm indicator

°C: temperature units

ATC: indicates automatic temperature compensation

Number in lower left hand corner indicates range number (see page 45 for more information)

3.3 LED Indicators

The LED indicators provide a quick way to check controller status. They show whether a parameter within its set limits (green light) or outside its set limits (red light).

Relay A

GREEN — Measured value is within limit entered for Set-point 1.

RED — Measured value is outside limit entered for Set-point 1.



Relay B

GREEN — Measured value is within limit entered for Set-point 2.

RED — Measured value is outside limit entered for Set-point 2.



Alarm

NONE — No alarm condition exists.

RED — Alarm condition exists. Measured value has been outside of set-point 1, set-point 2, or both for longer than set alarm delay time value. This indicator also will light if the temperature sensor fails. The error indicator will also appear on the display.



4. Starting up

When you initially connect power to the controller, it will automatically enter Measurement mode. This controller features a large dual display.

- The upper display will show the present conductivity (resistivity) value
- The lower display will show the temperature value

Annunciators along the right side of the display will indicate whether the controller is set for conductivity or resistivity measurement.

4.1 Security codes

To access calibration and set up functions, you need to enter a security code. This controller features two levels of security codes to protect the numerical values, calibration data and unit parameters from unintentional alteration.

The two security codes are as follows:

—conductivity (resistivity) calibration mode security code = 11.
— Setup mode security code = 22.

You cannot change calibration and set up parameters unless you first enter the security code. You can, however, view all parameters without knowing the security code.

- Refer to Section 5 on page 18 for more information on the Calibration mode
- Refer to Section 6 on page 23 for more information on the Advanced Set-up mode.

Security code notes

If you are viewing the parameters only, the controller automatically reverts to Measurement mode if you do not press a button for 1 minute. If you are changing parameters, the controller automatically reverts to Measurement mode if you do not press a button for 15 minutes.

4.2 Viewing operating parameters

You can view operating parameters without entering the security code. However, you must enter the security code to change parameters.

Viewing relay set point values:

1. **Press the Relay Selection (Rel A/Rel B) key.** The upper display will show your set-point value for Relay A; the lower display will show “SP1”.
2. After two seconds the upper display will show your set-point value for Relay B; the lower display will show “SP2”.
3. After an additional two seconds the controller will return to Measurement mode.

Viewing electrode status:

1. **Press the CAL key.** The display will cue you to enter a security code (C.Cd).
2. **Leave the security code at “000”**.
3. **Press the ENTER key.** The upper display shows the electrode status. The lower display will show “CEL”.
4. **Press the ENTER key again** to return to measurement mode.

Viewing set up parameters:

1. **Press the ENTER key.** The display will cue you to enter a security code (S.Cd).
2. **Leave the security code at “000”**.
3. **Press the ENTER key again.** This lets you view (not change) sub groups.
4. **Press the ▲ and ▼ keys** to scroll through the groups.
5. **Press the ENTER key** to view a sub group you wish to see in more detail.
6. **Press the ENTER key repeatedly** to scroll through the parameters of the sub group you selected.
7. **Press the ▲ and ▼ keys** when you return to the sub group head to select another subgroup.
8. Repeat steps 4 to 7 as needed.
9. **Press the ▲ and ▼ keys together (escape)** at any time to return to Measurement mode.

4.3 Entering Conductivity (Resistivity) Calibration mode

To change calibration data, follow these steps:

1. **Press the CAL key.** The upper display will show “000” and the lower display will show “C.Cd”.

See figure A

2. **Press the ▲ key** to scroll the upper display to Calibration security code “11”.

See figure B

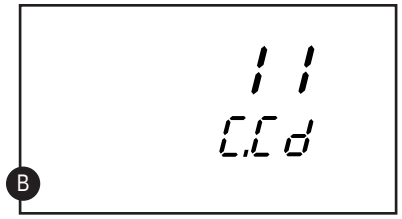
3. **Press the ENTER key.**
   NOTE: Pressing ENTER at a security code other than “11” will cause the controller to revert to the Measurement mode.

4. **Press ENTER again** . This lets you begin calibration.

Press the ▲ and ▼ keys simultaneously (escape) to return to Measurement mode.



A



B

See pages 18-22 for conductivity and resistivity calibration instructions.

Clearing the Calibration security code from the display

The Calibration security code automatically resets from “11’ to “000” after you return to Measurement mode, so you do not need to clear the security code from the display.

Notes

When you enter the Calibration mode with code “11”, the unit will automatically enter into the HOLD mode until you program further instructions (HOLD annunciator appears in upper left corner of display). While on HOLD, the current output and alarm relay positions are frozen. The SP1 and SP2 relays are deactivated and will not be allowed to switch on even if the measured value goes beyond the set points.

4.4 Entering Advanced Set-up mode

1. **Press the ENTER key.** The upper display will show “000” and the lower display will show “S.Cd”.

See figure A

2. **Press the ▲ key** to scroll the upper display to Set-up security code “22”.

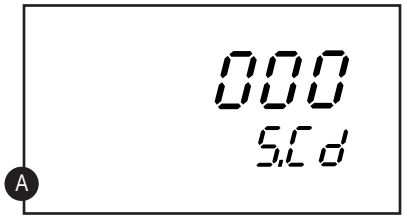
See figure B

3. **Press the ENTER key.**

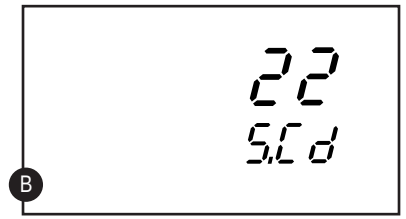
NOTE: Pressing ENTER at a value other than “22” will cause the controller to revert to the Measurement mode.

4. You are now in the Advanced set-up mode.

Press the ▲ and ▼ keys simultaneously (escape) to return to Measurement mode.



A



B

See pages 23-57 for Advanced Set Up mode instructions.

Clearing the Advanced Set-up security code from the display

After you have entered the security code and returned to Measurement mode, whenever you press the ENTER key the security code “22” will appear on the display. **To conceal the security code, you must manually reset the code.**

To clear the Advanced Set-up security code from the display:

1. **Press the ENTER key** in the Measurement mode.
2. **Press the ▲ and ▼ keys** to set display to any security code except 11 or 22.
3. **Press the ENTER. key.**

Notes

When you enter the Advanced Set-up mode with security code “22”, the unit will automatically enter into the HOLD mode until you program further instructions (HOLD annunciator appears in upper left corner of display). While on HOLD, the current output and alarm relay positions are frozen. The SP1 and SP2 relays are deactivated and will not be allowed to switch on even if the measured value goes beyond the set points.

5. Conductivity (resistivity) calibration

You can calibrate your meter in two ways:
- by adjusting the value of your cell constant
- by using a standard conductivity calibration solution (or a precision resistor for resistivity controllers).

You only need to know one of these values to calibrate your controller.

If there is a error during the calibration process, the controller displays “ERR”. If this happens, push both ▲ and ▼ (escape) to restart the calibration beginning from step 1.

When calibrating with manual temperature compensation, the controller automatically changes from the preset process temperature to the calibration temperature. After leaving the Calibration mode, the controller switches back to process temperature (to set the calibration temperature and the process temperature, see pages 33-34.

Accessing calibration mode

You can reach the Calibration mode in two ways:

- **From calibration mode.** From measurement mode, press the CAL key. Press the ▲ and ▼ keys to enter Security code “11”. Press the ENTER key.
- **From advanced set up mode.** From measurement mode, press the ENTER key. Press the ▲ and ▼ keys to enter Security code “22”. Press the ENTER key. Press the ▲ and ▼ keys to scroll to set up mode “CAL CON”.

If you enter the Calibration mode using the CAL key, the controller will automatically return to the Measurement mode. If you enter the Calibration mode from the Advanced Set-up mode, the controller will return to the sub group menu.

5.1 Method 1: Using the true cell constant value

For conductivity or resistivity controllers:

1. **Enter Calibration mode**. From measurement mode, press the CAL key. Press the ▲ key to enter Security code “11”. Press the ENTER key.

See figure A

2. **Press the ENTER key** to begin calibration. The upper display will show a percent value and the lower display will show CEL (cell). The “CAL” indicator will appear at the top of the display.

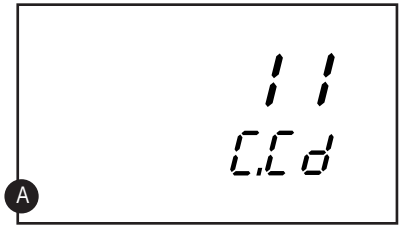
See figure B

3. **Note your conductivity cell’s true cell constant.** Example: a cell with a 1.0 cell constant may actually be rated at 0.96.

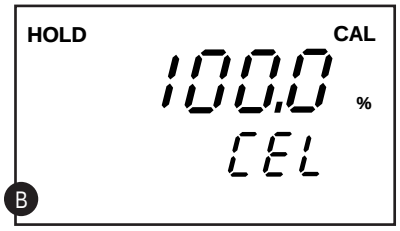
NOTE: If you do not know your true cell constant use calibration method 2 (see pages 20-21).

4. **Press the ▲ and ▼ keys** to match the display reading to the exact cell constant of your cell. **Example:** You have a cell with a cell constant of 1.0. If your true cell constant is exactly 1.0 (or exactly 0.01, 0.1 or 10), leave the display at 100%. If your true cell constant is 0.96, adjust the display reading to 96%. You can adjust the cell constant from 80 to 120%.

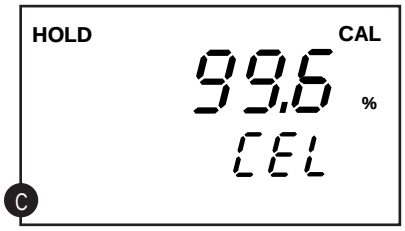
See figure C



A



B



C

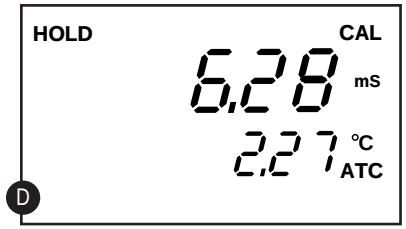
5. **Press the ENTER key** to confirm your cell constant selection. The upper display will show the adjusted conductivity (resistivity) reading and the lower display will show the temperature.

See figure D

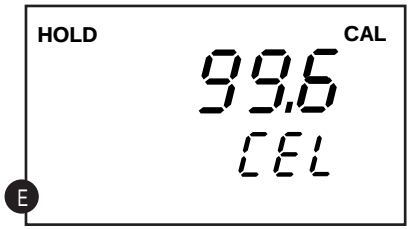
6. **Press the ENTER key again.** The upper display will show the adjusted cell constant value and the lower display will show CEL.

See figure E

7. **Press the ENTER key again** to return to Measurement mode.



D



E

Notes

You can view the entered cell constant without calibration—see page 15 for instructions. The cell constant is re-determined after each calibration.

5.2 Method 2: Using a calibration standard

IMPORTANT: You **MUST** use a conductivity solution calibration standard (or a precision resistor for resistivity controllers) with a value of at least 40% of the full-scale range. See section 6.6.1on page 45 for directions on selecting the range.

Conductivity calibration: using a conductivity calibration standard

For conductivity controllers:

1. **Enter Calibration mode**. From measurement mode, press the CAL key. Press the ▲ key to enter Security code "11". Press the ENTER key.

See figure A

2. **Press the ENTER key.**. The upper display will show a percent value and the lower display will show CEL (cell). The "CAL" indicator will appear at the top of the display.

See figure B

3. **Press the ENTER key again.** The upper display will show the current conductivity reading and the lower display shows the temperature.

See figure C

4. **Make sure the cell is in your conductivity calibration solution**. Use a standard conductivity calibration solution so you will know the the solution's exact value.

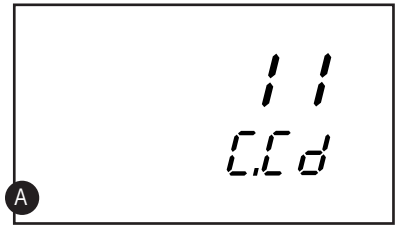
5. **Press the ▲ and ▼ keys** to match the display reading to the exact value of your conductivity solution.

See figure D

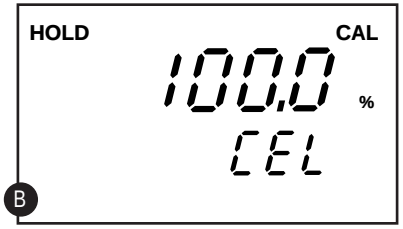
6. **Press the ENTER key** to confirm your selection. The upper display will show the adjusted cell constant value and the lower display will show CEL.

See figure E

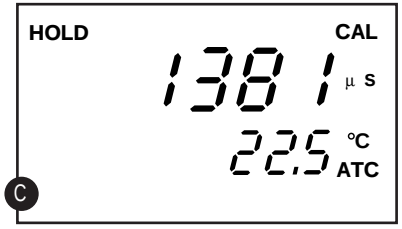
7. Press the ENTER key again to return to Measurement mode.



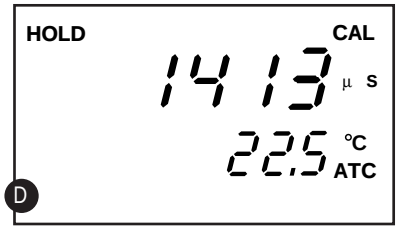
A



B



C



D



E

Resistivity calibration: using a precision resistor

For resistivity controllers:

NOTE: You need a precision resistor to perform this calibration method.

1. **Disconnect controller from power.**
2. **Connect the resistor to the terminals used for the resistivity cell (pins 21 and 22)**. See page 9 for terminal connections.
3. **Reconnect controller to power.** Controller will automatically enter Measurement mode.
4. **Set controller to manual temperature compensation and enter a value of 25°C.** See page 31 for directions.
5. **Enter Calibration mode**. From measurement mode, press the CAL key. Press the ▲ key to enter Security code "11". Press the ENTER key.

See figure A

6. **Press the ENTER key.** The upper display will show a percent value and the lower display will show CEL (cell). The "CAL" indicator will appear at the top of the display.

See figure B

7. **Press the ENTER key again.** The upper display will show the current resistivity reading and the lower display shows the manual temperature setting (25°C).

See figure C

NOTE: A mΩ indicator appears on the display, but is equivalent to MΩ.

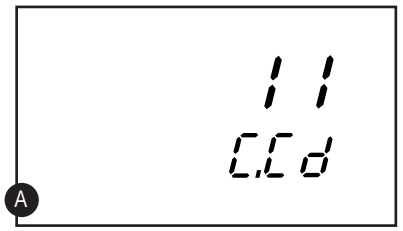
8. **Press the ▲ and ▼ keys** to match the display reading to the calculated resistance. *calculated resistance = the specified resistance value of the resistor ÷ by the cell constant*.

See figure D

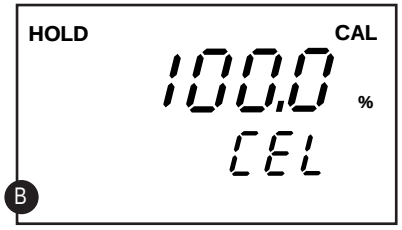
9. **Press the ENTER key** to confirm your selection. The upper display will show the adjusted cell constant value and the lower display will show CEL.

See figure E

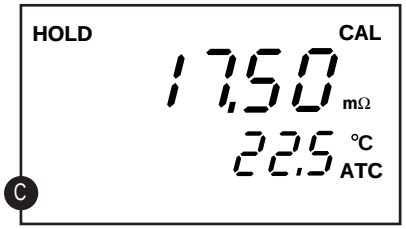
10. Press the ENTER key again to return to Measurement mode.



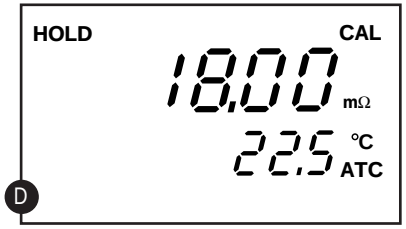
A



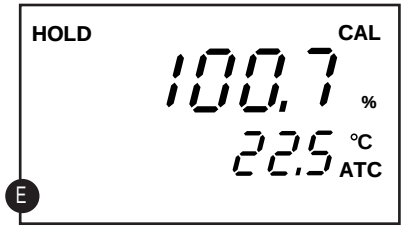
B



C



D



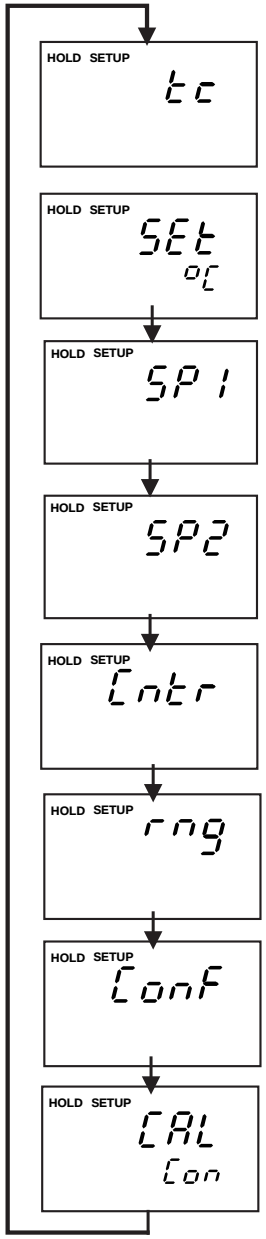
E

6. Advanced set up mode

The OAKTON 1000-series conductivity or resistivity controller features eight sub groups that organize all set-up parameters. These parameters let you customize your controller for your exact process.

The sub groups are:

1. Temperature compensation curve (tC)
2. Temperature settings (SEt °C)
3. Control Relay 1 configuration (SP1)
4. Control Relay 2 configuration (SP2)
5. Control type (Cntr)
6. Current output (rng)
7. Controller configuration (ConF)
8. conductivity or resistivity calibration (CAL)



To view set-up parameters without access to change them:
From measurement mode:
- Push the ENTER key.
- Leave the security code at "000".
- Push the ENTER key again.

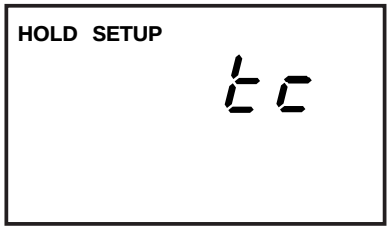
To change set-up parameters:
From measurement mode:
- Push the ENTER key.
- Press the ▲ key to scroll to security code "22".
- Push the ENTER key again.

See pages 26-57 for detailed information on each set up parameter.

Notes

To simplify operations, the controller will not display set up parameters that are not relevant to the set up of the controller. For example:
If you set the controller for Automatic Temperature Compensation, you will not see the parameters for setting a calibration temperature or a process temperature.

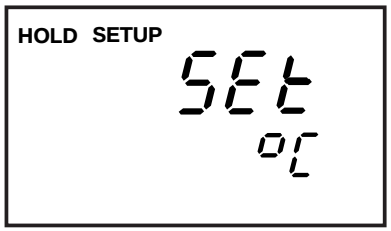
6.1 Advanced set-up mode sub group overview



See pages 26-29 for complete temperature compensation curve set up instructions

tC: Temperature Compensation Curve

- Select temperature compensation curve
- Set process temperature coefficient
- Set calibration temperature coefficient



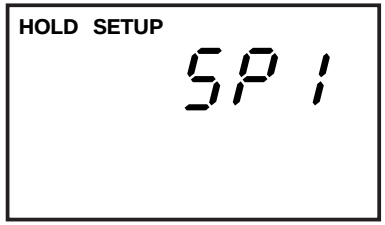
See pages 30-34 for complete temperature settings set up instructions

SET °C: Temperature settings

- Toggle automatic temperature compensation (ATC) on or off

If ATC selected on:
- Temperature sensor calibration

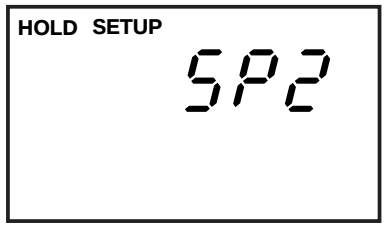
If ATC selected off:
- Set process temperature
- Set calibration temperature



See pages 35-40 for complete Control Relay 1 set up instructions

SP1: Set up for relay 1

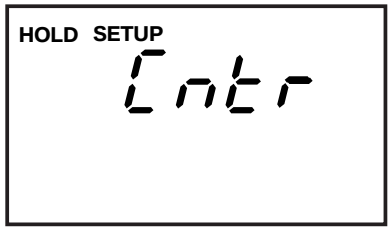
- Select value for relay 1
- Select relay as low or high set point
- Set hysteresis (dead band)
- Set time delay for when relay switches on
- Set time delay for when relay switches off



See pages 35-40 or complete Control Relay 2 set up instructions

SP2: Set up for relay 2

- Select value for relay 2
- Select relay as low or high set point
- Set hysteresis (dead band)
- Set time delay for when relay switches on
- Set time delay for when relay switches off

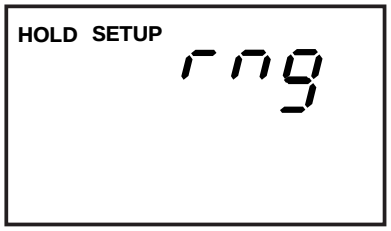


See pages 41-43 for complete controller type set up instructions

CNTR: Control type

- Select control type (on / off or controller off)

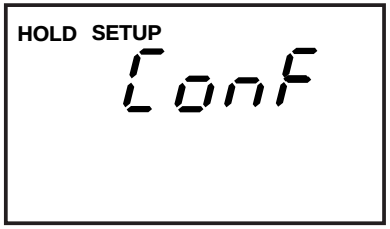
On/off mode only:
- Select break contact (de-energized) or make contact (energized) relay type



See pages 44-48 for complete range set up instructions

rng: Range subgroup

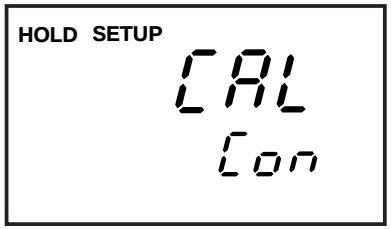
- Select measuring range and cell constant
- Choose 0-20 or 4-20 mA output
- Select value equivalent to 0 (4) mA
- Select value equivalent to 20 mA



See pages 49-53 for complete controller configuration set up instructions

ConF: Controller configuration

- Select alarm relay delay in seconds
- Select steady or pulse alarm contact
- Select line resistance
- Reset to controller default settings



See pages 54-57 for complete calibration set up instructions

CAL : Con (Res) Calibration

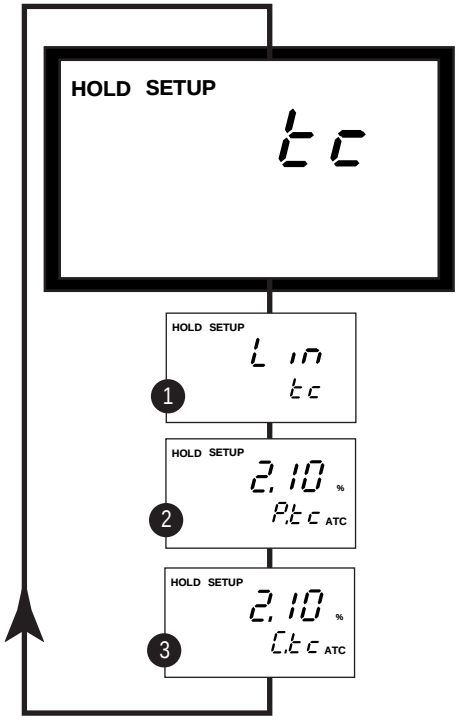
- Calibrate by cell constant or by calibration standard

6.2 tC: Temperature compensation curve sub group

tC: Temperature compensation curve subgroup overview

The “tC” sub group lets you:

1. Select the temperature compensation curve
2. Set process temperature coefficient
3. Set calibration temperature coefficient



6.2.1 Selecting the temperature compensation curve

This mode lets you select between an ultrapure water curve or a linear temperature compensation curve. Use an ultrapure water curve for solutions with very low µS (or mΩ) values; use a linear temperature compensation curve for all other solutions. Default is linear temperature compensation curve.

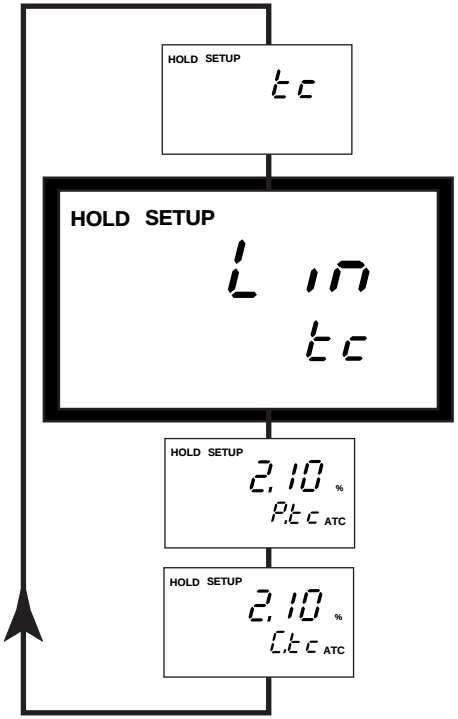
From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows tc.
3. **Press the ENTER key.** The upper display will show the current temperature compensation curve and the lower display shows tc.

See bold figure at right

—Pur = ultrapure water curve
—Lin = linear temperature compensation curve

4. **Press the ▲ and ▼ keys** to select the temperature compensation curve.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.2.2, or press the ▲ and ▼ keys together to return to measurement mode.



6.2.2 Setting the process temperature coefficient

If the temperature compensation curve type "Pur" is set in 6.2.1, the parameters listed in 6.2.2 are blanked out. You will automatically return to Advanced Set-up mode.

This mode lets you input your solution's true process temperature correction for higher accuracy. The controller will be set at 2.10% per °C standard, but you can adjust the value from 0.00 to 10.00% per °C.

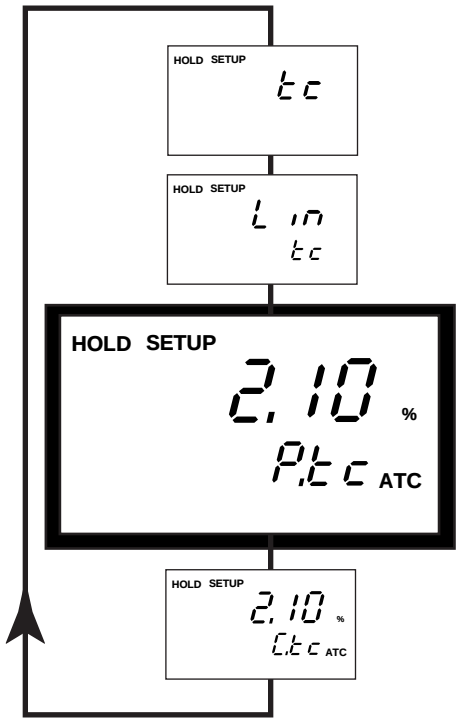
To calculate your solution's temperature coefficient, see Appendix 2 on page 64.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows tc.
3. **Press the ENTER key** until the lower display shows P.tc and the upper display shows the temperature coefficient in a %.

See bold figure at right

4. **Press the ▲ and ▼ keys** to choose your process temperature coefficient. You can select a value from 0.00 to 10.00%
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.2.3, or press the ▲ and ▼ keys together to return to measurement mode.



6.2.3 Setting the calibration temperature coefficient

If the temperature compensation curve type "Pur" is set in 6.2.1, the parameters listed in 6.2.3 are blanked out. You will automatically return to Advanced Set-up mode.

This mode lets you input your solution's true calibration temperature correction for higher accuracy. Adjust this value if the temperature coefficient of the calibration solution is different from that of the process solution; otherwise, leave the calibration temperature coefficient at the same value as the process temperature coefficient. The controller will be set at 2.10% per °C standard, but you can adjust the value from 0.00 to 10.00% per °C.

To calculate your solution's temperature coefficient, see Appendix 2 on page 64.

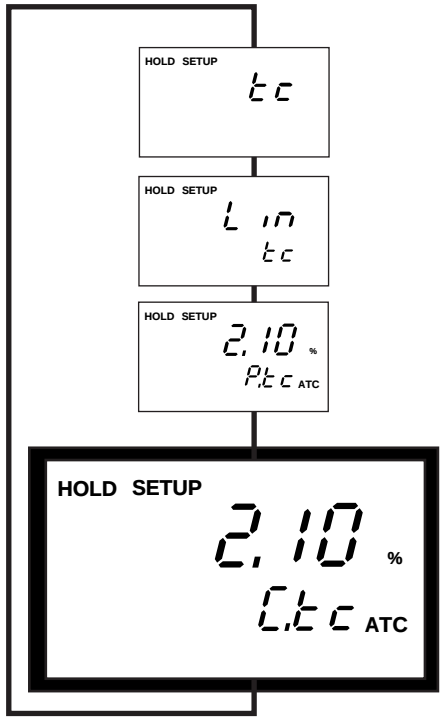
From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows tc.
3. **Press the ENTER key** until the lower display shows C.tc and the upper display shows the temperature coefficient in a %.

See bold figure at right

4. **Press the ▲ and ▼ keys** to choose your process temperature coefficient. You can select a value from 0.00 to 10.00%
5. **Press the ENTER key** to confirm your selection and return to advanced set up mode.

Return to Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.



6.3 SET °C: Temperature settings

SET °C: Temperature settings

The temperature settings sub group lets you:

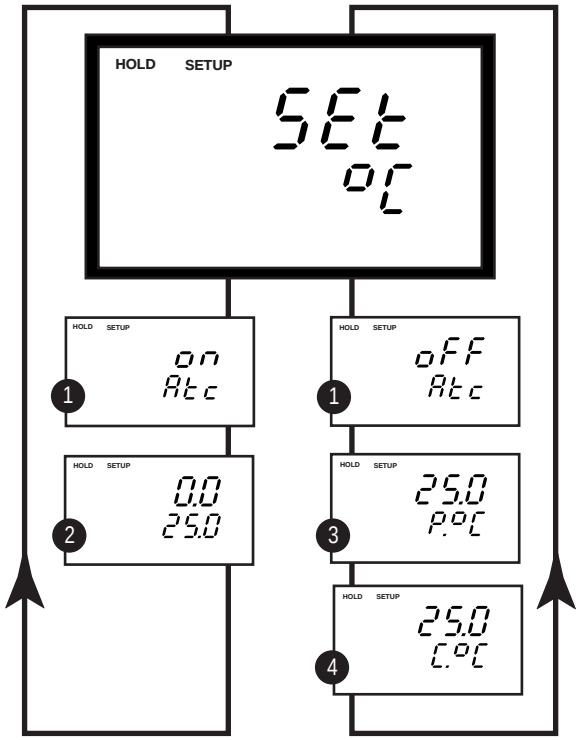
1. Toggle automatic temperature compensation (ATC) on or off

If ATC selected on:

2. Temperature sensor calibration

If ATC selected off:

3. Set process temperature
4. Set calibration temperature

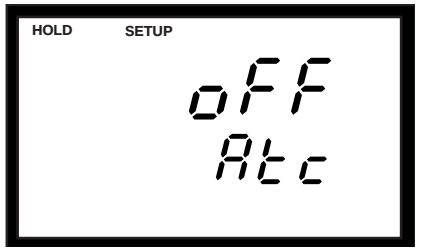


This set up group has two different sub paths. The screens you see depend on if you select ATC on or off.

6.3.1 Selecting automatic or manual temperature compensation

From measurement mode:





1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SEt °C.
3. **Press the ENTER key.** The lower display will show “Atc”; the upper display will show “on” or “oFF”.

   See figures at right
4. **Press the ▲ and ▼ keys** to toggle between ATC on and off.
5. **Press the ENTER key** to confirm selection.
6. • **If you selected ATC on:** Proceed to step 3 of section 6.3.2.
   • **If you selected ATC off:** Proceed to step 3 of section 6.3.3.
   • **To return to Measurement mode:** Press the ▲ and ▼ keys together.

6.3.2 Temperature sensor calibration (ATC mode only)

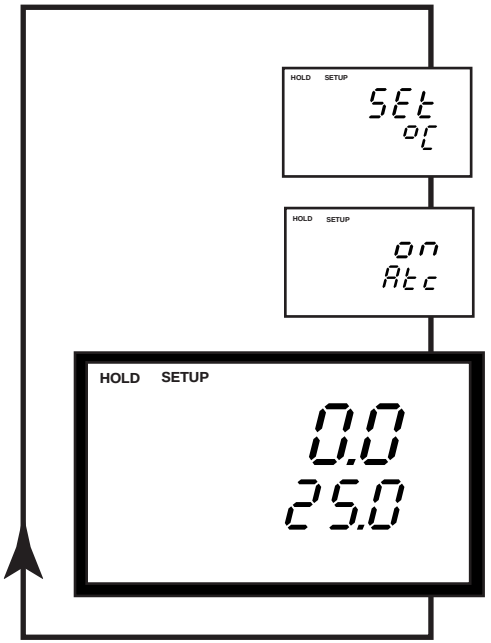
NOTE: *This parameter is blanked out when the controller is set for ATC off.*

This mode lets you offset the controller to compensate for small inaccuracies in your temperature sensor. You can offset the temperature sensor up to ±5°C.

1. **Select "ATC on"** as described in Section 6.3.1.
2. **Press the ENTER key.** The upper display shows the temperature offset. The lower display shows the current measured temperature.

   See bold figure at right
3. **Compare the current measured temperature on the controller display to a thermometer known to be accurate.**
4. **Press the ▲ and ▼ keys** to scroll the lower display to match the known temperature. The upper display shows the amount of offset. You can offset temperature up to ±5°C.
5. **Press the ENTER key** to confirm selection and return to advanced set up mode.

Return to Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.



6.3.3 Manual temperature compensation

Manual temperature compensation lets you ignore your temperature probe input or use a probe without a built-in temperature sensor. The controller will compensate for temperature at the values you enter.

For manual temperature compensation, you can set two different temperatures:
- process temperature
- calibration temperature

This allows calibration at a temperature other than your process temperature.

Example: setting a calibration temperature of 25°C lets you calibrate using standard buffer solutions at 25°C, even if your process temperature is a different temperature.

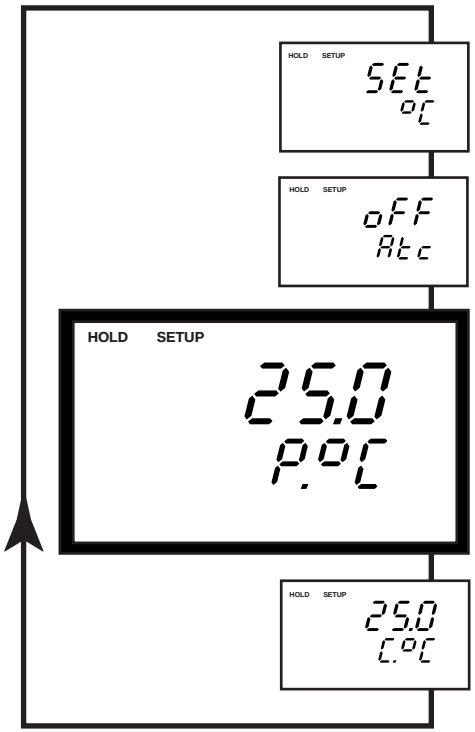
You can set process and calibration temperatures between –9.9 to 125°C.
Default temperature is 25°C.

6.3.4 Setting Process Temperature

NOTE: *This parameter is blanked out when the controller is set for ATC on.*

1. **Select "ATC off"** as described in Section 6.3.1.
2. **Press the ENTER key.** The upper display shows the current process temperature and the lower display shows P.°C (process temperature).

   See bold figure at right
3. **Press the ▲ and ▼ keys** to adjust the process temperature value. You can adjust the value from –9.9 to 125°C.
4. **Press the ENTER key** to confirm selection.
5. Proceed to step 3 of section 6.3.5, or press the ▲ and ▼ keys together to return to measurement mode.



6.3.5 Setting Calibration Temperature

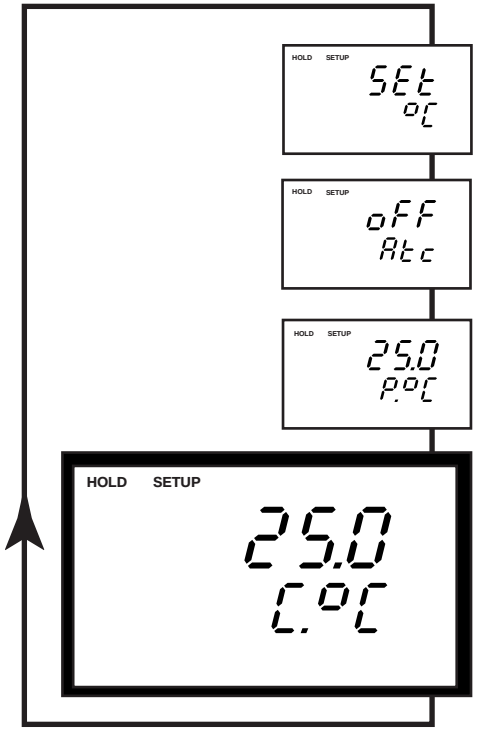
NOTE: *This parameter is blanked out when the controller is set for ATC on.*

From measurement mode:

1. **Select "ATC off"** as described in Section 6.3.1
2. **Press the ENTER key twice.** The upper display shows the current calibration temperature and the lower display shows C.°C (calibration temperature).

   See bold figure at right
3. **Press the ▲ and ▼ keys** to adjust the calibration temperature value. You can adjust the value from –9.9 to 125°C.
4. **Press the ENTER key** to confirm selection and return to advanced set up mode.

Return to Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.



6.4 SP1 (SP2): Set up for Relay 1 (2) sub group

SP1 (SP2): Set up for relay SP1 (SP2) overview:

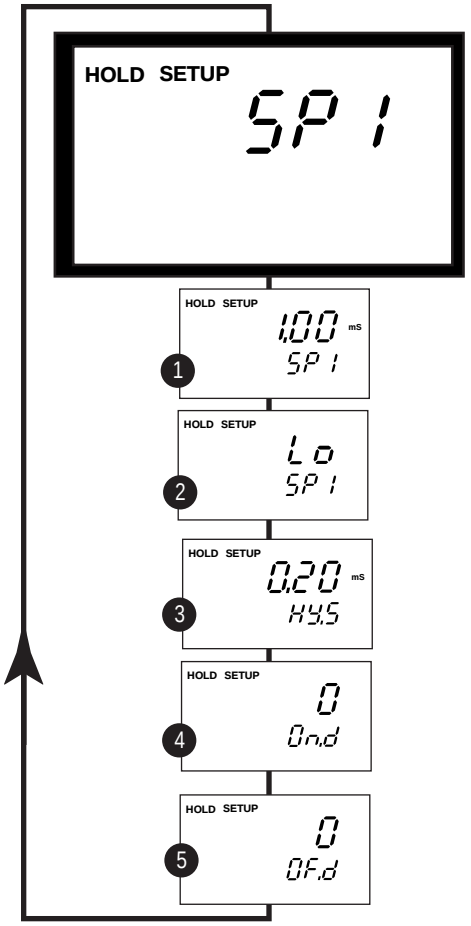
Relay set up 1 and relay set up 2 sub groups let you:

1. Select value for relay SP1 (SP2)
2. Select relay as low or high set point

These modes appear only if on/off control type is selected (select control type in Controller sub group—see page 42):

3. Set hysteresis (dead band)
4. Set time delay for when relay switches on
5. Set time delay for when relay switches off

The SP1 option sets the operating parameters for relay 1; the SP2 option sets the operating parameters for relay 2. Since these two groups offer the same set-up parameters, they are described together.



6.4.1 Selecting the relay set point values

This lets you choose the conductivity (or resistivity) value that will cause your controller to activate.

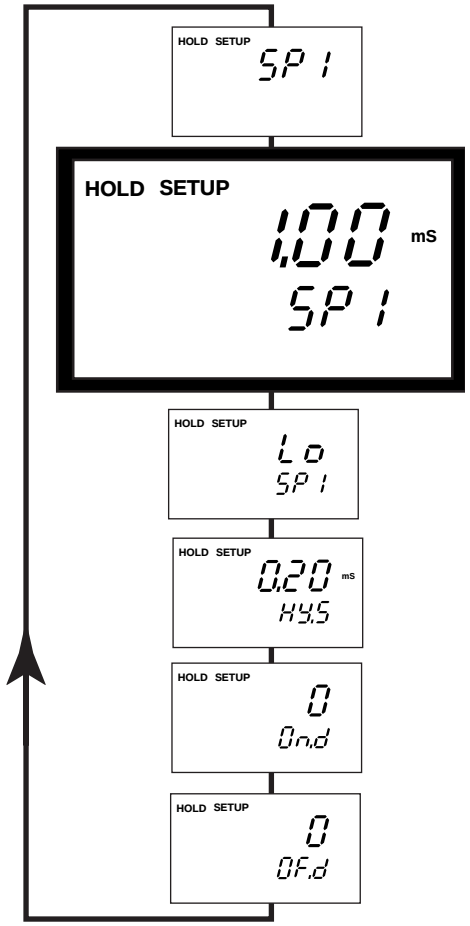
If this value is crossed, and the alarm relay is selected ON, the alarm will trigger. Additionally, the set point relay LED will turn from green to red.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key.** The upper display shows the current set point value and the lower display shows SP1 (SP2).

See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter your value for Set Point 1 (Set Point 2). Your controller will activate at the value you select.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.2, or press the ▲ and ▼ keys together to return to measurement mode.



6.4.2 Selecting relay as high or low set point

Select a low set point to activate controller when your value undershoots the set point; select a high set point to activate controller when your value overshoots the set point.

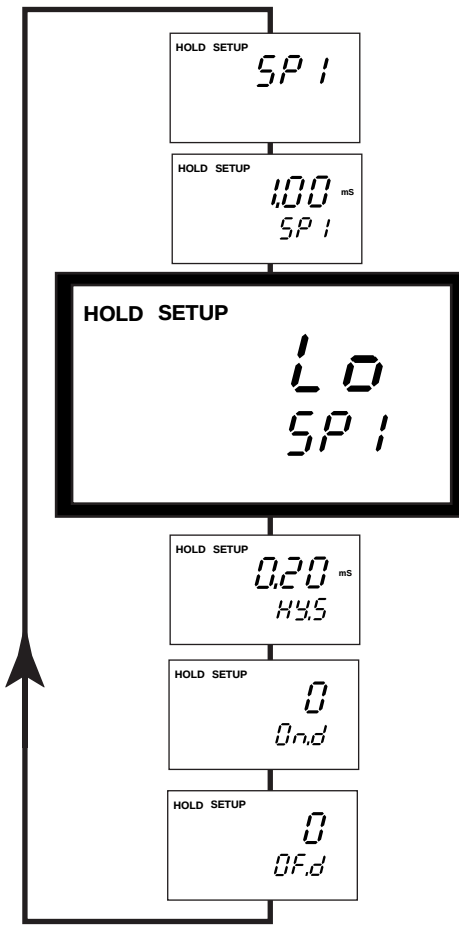
Using both SP1 and SP2, you can select lo/lo, lo/hi, hi/lo, or hi/hi set points.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows Lo or Hi (for low or high set point) and the lower display shows SP1 (SP2).

See bold figure at right.

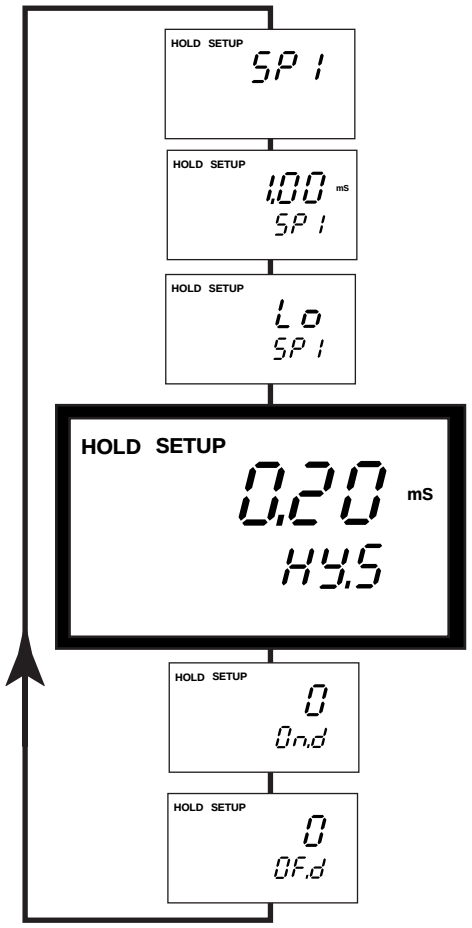
4. **Press the ▲ and ▼ keys** to toggle between low (lo) or high (hi) set point for SP1 (SP2).
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.3, or press the ▲ and ▼ keys together to return to measurement mode.



6.4.3 Selecting a hysteresis (dead band) value

NOTE: *this parameter appears only if on/off control type is selected.*

Hysteresis prevents rapid contact switching if your value is fluctuating near the set point. It allows the set point value to overshoot by the specified hysteresis value. You can set the hysteresis value from 0 to 10% of range.



From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows the hysteresis (dead band) value and the lower display shows HYS.

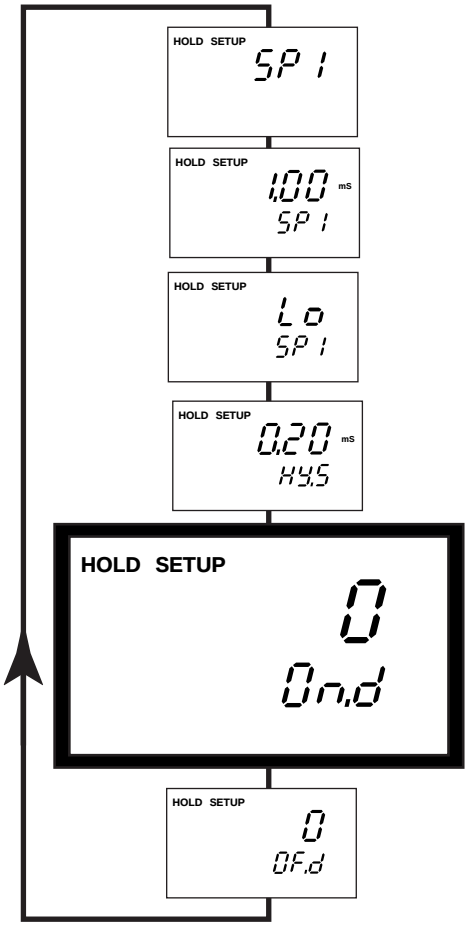
See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter your hysteresis value for SP 1 (SP 2). Your controller will activate at the value you select.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.4, or press the ▲ and ▼ keys together to return to measurement mode.

6.4.4 Setting an on-delay time lag

NOTE: *this parameter appears only if on/off control type is selected.*

You can set a time delay for each relay, which stops the relay from switching on too soon. This helps prevent premature relay action and false alarms. This controller lets you set a 0 to 2000 second time delay before your relay activates.



From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows the "on delay" time and the lower display shows On.d.

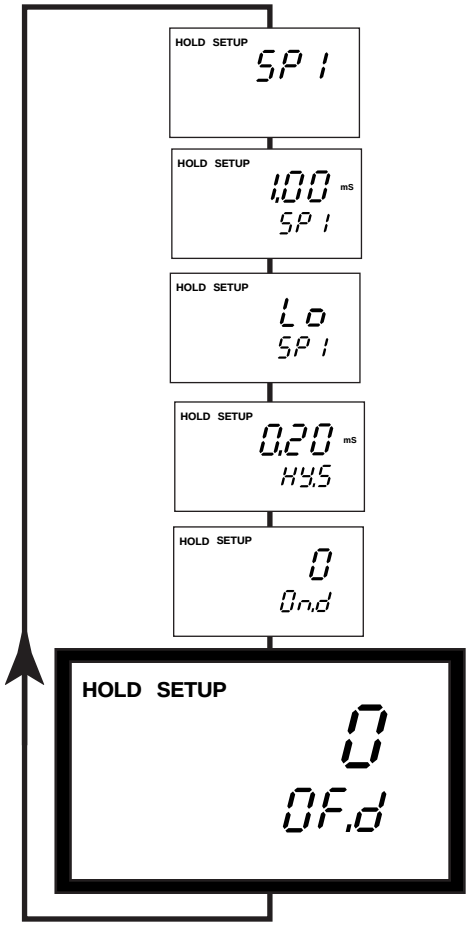
See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter on delay time for Set Point 1 (Set Point 2). Your controller will delay activation for the number of seconds (0 to 2000) you select.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.4.5, or press the ▲ and ▼ keys together to return to measurement mode.

6.4.5 Setting an off-delay time lag

NOTE: *this parameter appears only if on/off control type is selected.*

You can set a time lag for each relay, which helps to prevent your relay from switching off too soon. This helps prevent premature relay action and false alarms. This controller lets you set a 0 to 2000 second time delay before your relay deactivates.



From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows SP1 (SP2).
3. **Press the ENTER key** until the upper display shows "off delay" time and the lower display shows OF.d.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to enter off delay time for Set Point 1 (Set Point 2). Your controller will delay activation for the number of seconds (0 to 2000) you select.
5. **Press the ENTER key** to confirm your selection and return to advanced set up mode.

Press the ▲ and ▼ keys together to return to measurement mode.

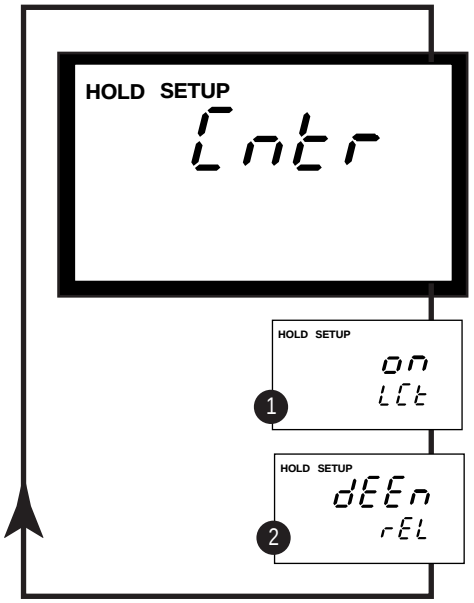
6.5 Cntr: Control type sub group

CNTR: Control type sub group overview

1. Select control type: on / off or controller off

On/off mode only:

2. Select break contact (de-energized) or make contact (energized) relay type



6.5.1 Selecting control type

This mode lets you choose one of two controller types:

On/off control (LCt): use with pumps or valves for fast response.

Controller off: use to operate controller as a monitor only or to keep relays from switching when changing set-up parameters.

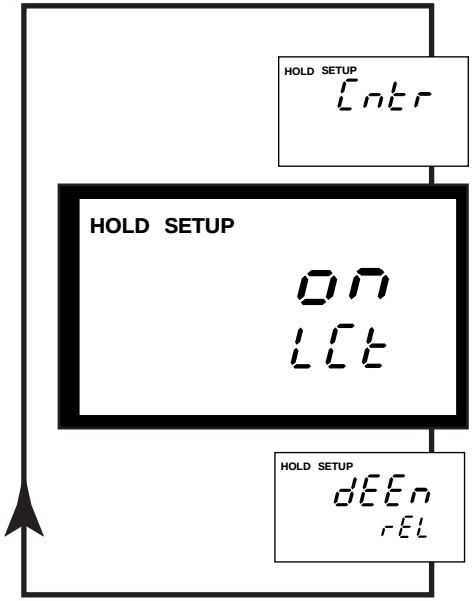
Default is on / off control.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows Cntr.
3. **Press the ENTER key** until the lower display shows L.Ct.
4. **Press the ▲ and ▼ keys** to select your controller type.
   —LCt on = on / off control
   —LCt off: controller off

See bold figure at right.

5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.5.2, or press the ▲ and ▼ keys together to return to measurement mode.



6.5.2 Selecting break/make contact relay type

NOTE: *If the controller type “LCt oFF” is set, this parameter is blanked out.*

This mode lets you determine which relay state will trigger the alarm state:

- **de-energized (break contact):** relay is de-energized in no alarm condition
- **energized (make contact):** relay is energized in no alarm condition

Controller default is de-energized (break contact).

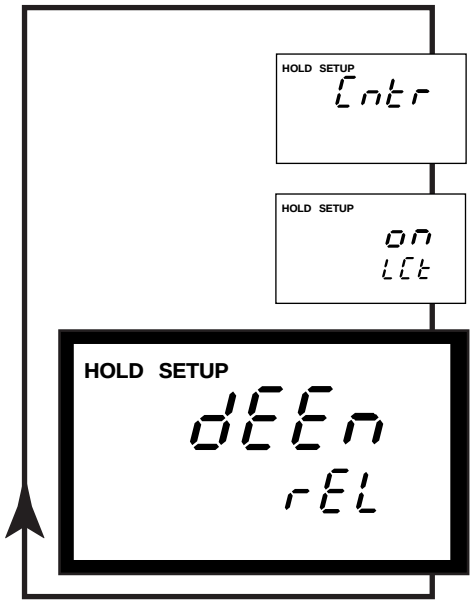
From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows Cntr.
3. **Press the ENTER key** until the lower display shows rEL and the upper display shows the current relay selection (de-energized = dEEN or energized = EN).

See bold figures at right.

4. **Press the ▲ and ▼ keys** to choose de-energized (break contact) or energized (make contact) relays.
5. **Press the ENTER key** to confirm your selection and return to advanced set up mode.

Press the ▲ and ▼ keys together to return to measurement mode.

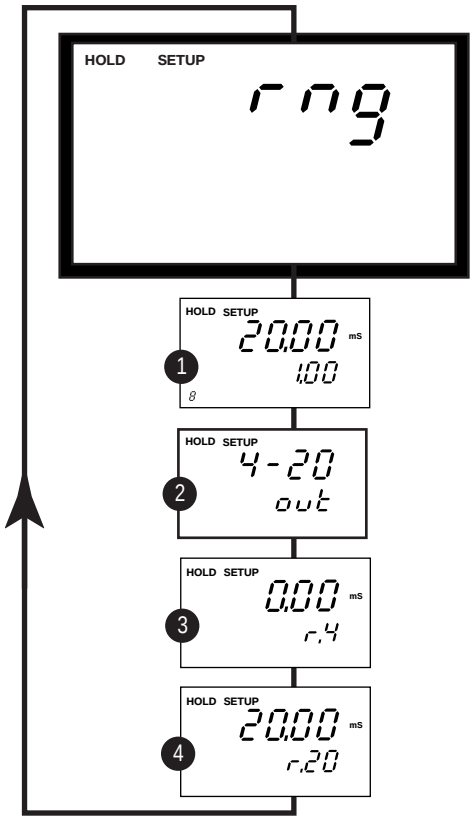


6.6 rng: Range sub group

rng: Range subgroup overview

Current output sub group lets you:

1. Selecting measurement range and cell constant
2. Choose 0-20 or 4-20 mA output
3. Select value equivalent to 0 (4) mA
4. Select value equivalent to 20 mA



6.6.1 Selecting measurement range and cell constant

Use this parameter to select the measurement range (and appropriate cell constant) in which you want to operate your controller. A single digit number corresponding to the range and cell constant you select will appear in the lower left hand corner of the display during measurement mode.

If you have a conductivity controller:
This parameter lets you select from seven conductivity ranges and four cell constants (K) in ten possible combinations:

1. 0.000 to 2.000 µS, K = 0.01
2. 0.00 to 20.00 µS, K = 0.01
3. 0.00 to 20.00 µS, K = 0.10
4. 0.0 to 200.0 µS, K = 0.10
5. 0.0 to 200.0 µS, K = 1.00
6. 0 to 2000 µS, K = 1.00
7. 0 to 5000 µS, K = 1.00
8. 0.00 to 20.00 mS, K = 1.00
9. 0.0 to 200.0 mS, K = 10.0
0. 0.0 to 200.0 mS, K = 1.00

If you have a resistivity controller:
This parameter lets you select from two resistivity ranges and two cell constants (K) in two possible combinations:

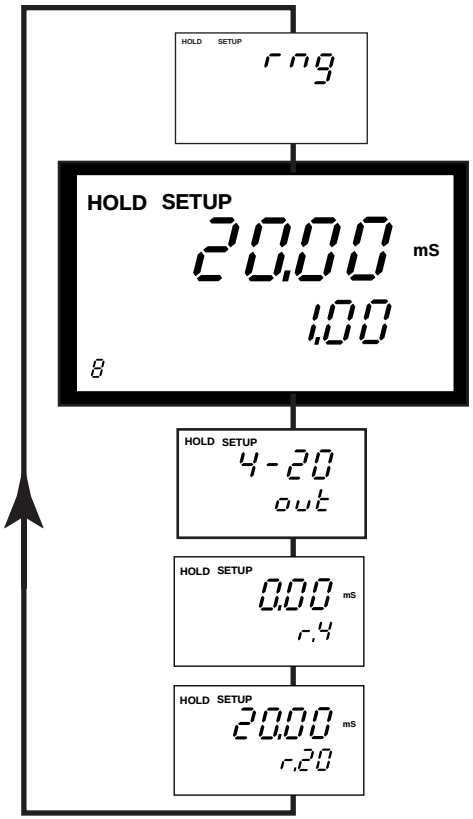
1. 0.00 to 20.00 mΩ, K = 0.01
2. 0.00 to 2.000 mΩ, K = 0.10

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows rng.
3. **Press the ENTER key** until the upper display shows the top value of a range and the lower display shows the cell constant.

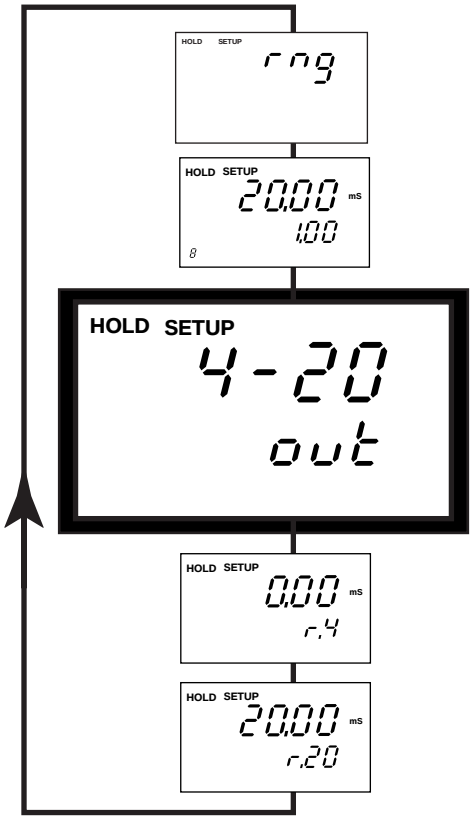
See bold figure at right

4. **Press the ▲ and ▼ keys** to select your range and cell constant.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.6.2, or press the ▲ and ▼ keys together to return to measurement mode.



6.6.2 Choosing output range (4-20 or 0-20 mA)

This parameter lets you select an output range of 4-20 or 0-20 mA. If you select 4-20 mA, the minimum current supplied by terminal 17 and 16 of the 17-way terminal block corresponds to 4 mA. If you select 0-20 mA, the minimum current corresponds to 0.



From measurement mode:

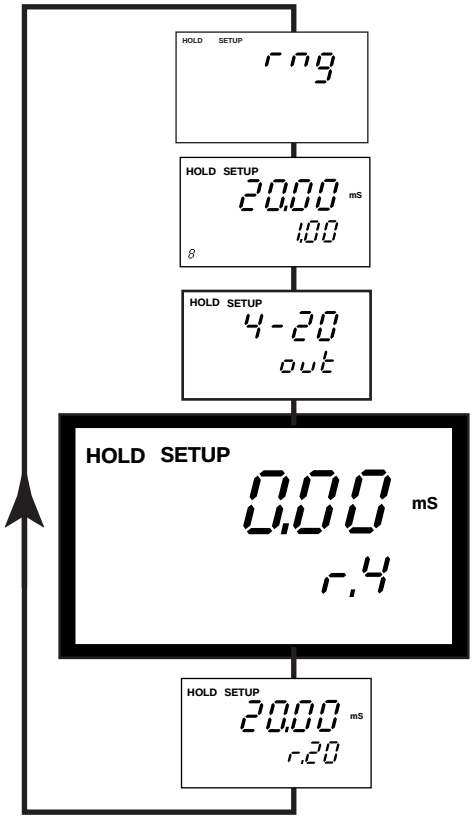
1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows “rng”.
3. **Press the ENTER key** until the upper display shows the output type (0-20 or 4-20) and the lower display shows “out”.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to select your output range: 0-20 or 4-20 mA.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.6.3, or press the ▲ and ▼ keys together to return to measurement mode.

6.6.3 Selecting conductivity (resistivity) value at 0 (4) mA

This parameter lets you choose a conductivity (resistivity) value to be equivalent to 0 (4) mA. Select the lowest value of the conductivity (resistivity) range that you want a recorder or transmitter to detect.



From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows “rng”.
3. **Press the ENTER key** until the upper display shows a conductivity (resistivity) value and the lower display shows “r.0” or “r.4”

See bold figure at right.

4. **Press the ▲ and ▼ keys** to select the conductivity (resistivity) value equivalent to 0 (4) mA.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.6.4, or press the ▲ and ▼ keys together to return to measurement mode.

6.6.3 Selecting conductivity (resistivity) value at 20 mA

This parameter lets you choose a conductivity (resistivity) value to be equivalent to 20 mA. Select the highest value of the conductivity (resistivity) range that you want a recorder or transmitter to detect.

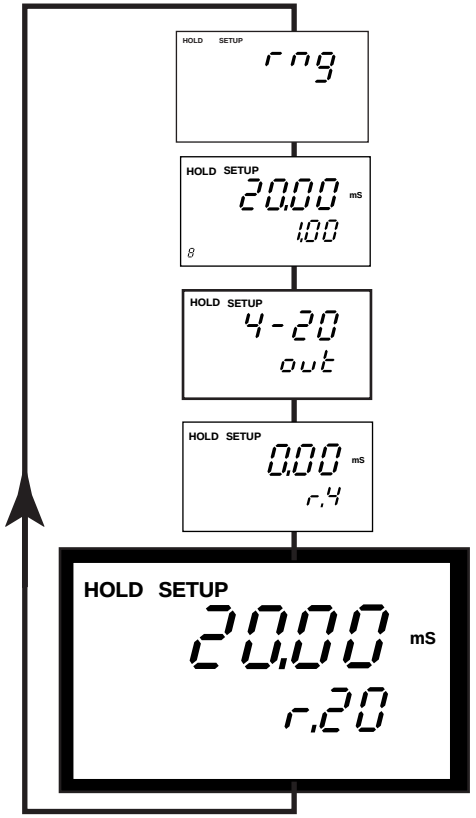
From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows “rng”.
3. **Press the ENTER key** until the upper display shows a conductivity (resistivity) value and the lower display shows “r.20”.

See bold figures at right.

4. **Press the ▲ and ▼ keys** to select the conductivity (resistivity) value equivalent to 20 mA.
5. **Press the ENTER key** to confirm your selection and return to advanced set up mode.

Press the ▲ and ▼ keys together to return to measurement mode.



Notes

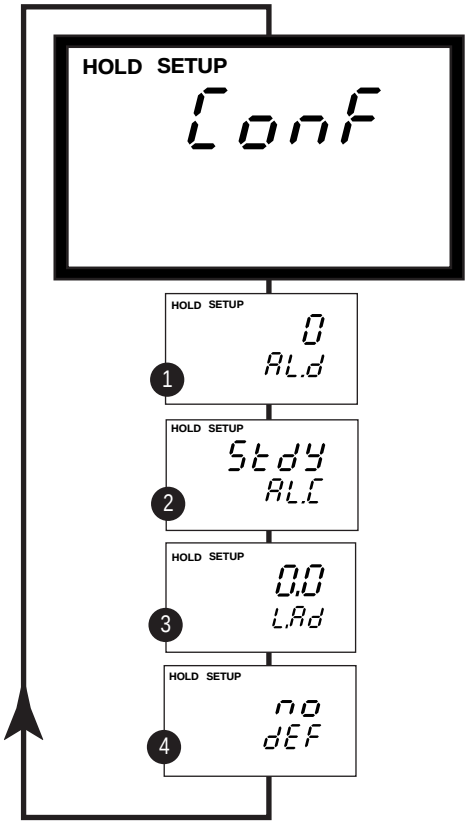
The minimum measurement span must be 20% of full scale.

6.7 ConF: Configuration sub group

ConF: Configuration subgroup overview

Configuration sub group lets you:

1. Select alarm delay in seconds
2. Select steady or pulse alarm contact
3. Selecting line resistance
4. Reset to default settings



6.7.1 Selecting the alarm time lag

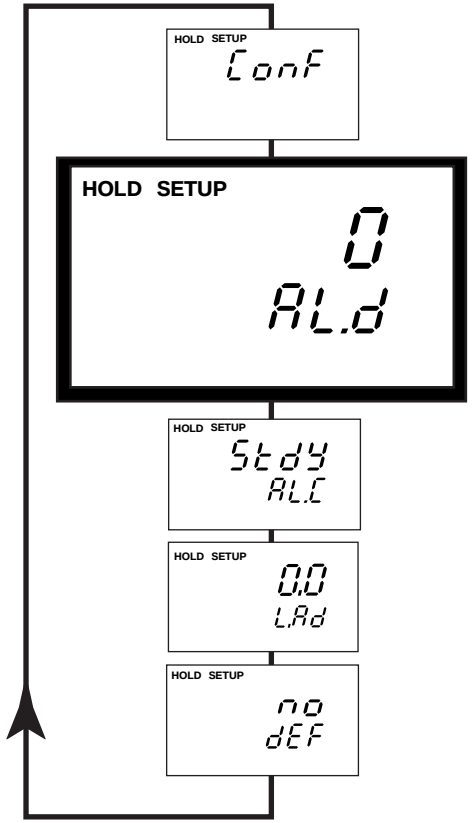
This parameter group lets you select a period of time before the alarm relay activates when your set point has been overshot. You can select from 0 to 2000 seconds.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows ConF.
3. **Press the ENTER key** until the upper display shows a numerical value (in seconds) and the lower shows AL.d.

See bold figure at right.

4. **Press the ▲ and ▼ keys** to select the length of the alarm delay (0 to 2000 seconds) you want.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.7.2, or press the ▲ and ▼ keys together to return to measurement mode.



6.7.2 Selecting steady or pulse contact for the alarm relay

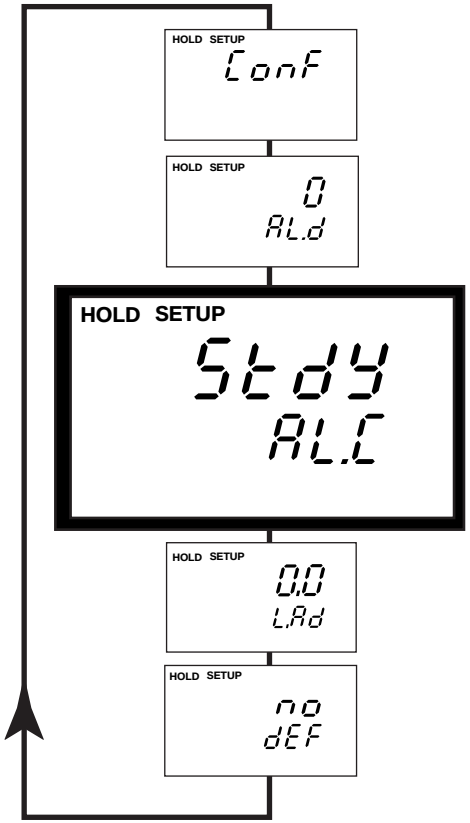
This parameter group lets you select whether the alarm contact will operate as a steady contact or a fleeting (single pulse) contact. Pulse contact closing time is 1 second.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows ConF.
3. **Press the ENTER key** until the upper display shows StdY or FLEt and the lower shows AL.C.
   —AL.C = alarm contact
   —StdY = steady contact
   —FLEt = fleeting (single pulse) contact

See bold figure at right.

4. **Press the ▲ and ▼ keys** to select steady or pulse contact.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.7.3, or press the ▲ and ▼ keys together to return to measurement mode.



6.7.3 Selecting line resistance (LAd)

NOTE: If you use a cell with a cable under 30 feet long, leave the line resistance value at 0 and press the ENTER key to skip to the next step.

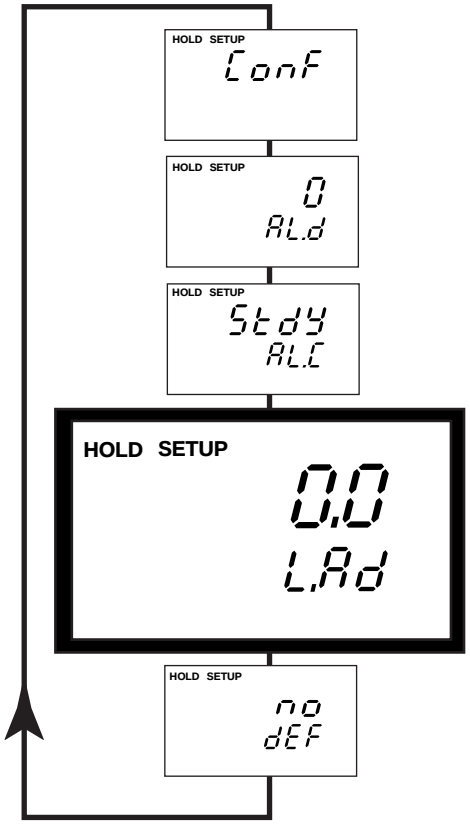
This parameter lets you compensate for lengths of cable over 30 feet long between the cell and the controller. You can adjust the line resistance from 0.0 to 100.0 Ω.

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows ConF.
3. **Press the ENTER key** until the upper display shows a number value and the lower display shows LAd (line adjustment resistance)

See figure

4. **Press the ▲ and ▼** to adjust the line resistance. Use an ohmmeter to determine the line resistance of your cable.
5. **Press the ENTER key** to confirm your selection.
6. Proceed to step 3 of section 6.7.4, or press the ▲ and ▼ keys together to return to measurement mode.



6.7.4 Reverting to factory default settings

Use this parameter to reset all settings to factory default. Changing from "no" to "YES" and pressing the ENTER key resets all settings to factory default. See Appendix 1 on page 63 for a listing of default settings.

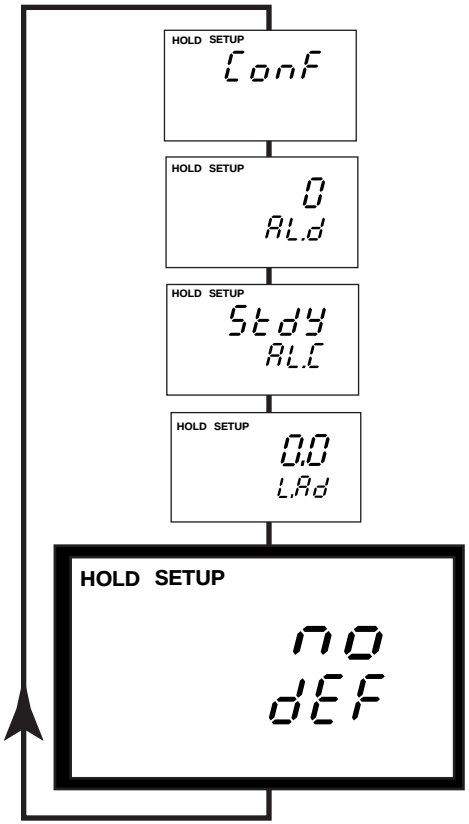
WARNING: If you select yes, all settings you have made are overwritten as a result!

From measurement mode:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows ConF.
3. **Press the ENTER key** until the upper display shows no and the lower shows dEF (default).

See bold figure at right.

4. **Press the ▲ and ▼ keys** to select yes or no.
5. **Press the ENTER key** to confirm your selection.
   - **If you selected "YES",** pressing the ENTER key will overwrite all settings you have made and automatically return you to Measurement mode.
   - **If you selected "NO",** pressing the ENTER key confirms your selection and returns you to advanced set up mode. Press the ▲ and ▼ keys together to return to measurement mode.



Notes

See Appendix 1 on page 63 for a chart of all factory default settings.

6.8 Calibration sub group

The calibration procedure in Advanced Set-up mode is identical to the procedure in Calibration mode. The only difference is that the controller will revert back to Set-Up Mode (instead of Measurement mode) after calibration is complete.

You can calibrate your meter in two ways:
- by adjusting the value of your cell constant
- by using a standard conductivity calibration solution (or a precision resistor for resistivity controllers).

You only need to know one of these values to calibrate your controller.

If there is a error during the calibration process, the controller displays “ERR”. If this happens, push both ▲ and ▼ (escape) to restart the calibration beginning from step 1.

When calibrating with manual temperature compensation, the controller automatically changes from the preset process temperature to the calibration temperature. After leaving the Calibration mode, the controller switches back to process temperature (to set the calibration temperature and the process temperature, see pages 33-34.

Accessing calibration mode

You can reach the Calibration mode in two ways:

- **From calibration mode.** From measurement mode, press the CAL key. Press the ▲ and ▼ keys to enter Security code “11”. Press the ENTER key.
- **From advanced set up mode.** From measurement mode, press the ENTER key. Press the ▲ and ▼ keys to enter Security code “22”. Press the ENTER key. Press the ▲ and ▼ keys to scroll to set up mode “CAL CON”.

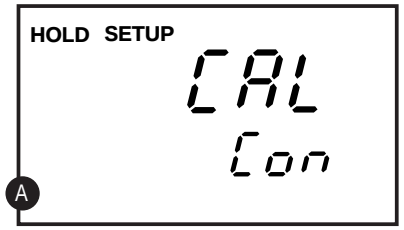
If you enter the Calibration mode using the CAL key, the controller will automatically return to the Measurement mode. If you enter the Calibration mode from the Advanced Set-up mode, the controller will return to the sub group menu.

6.8.1 Method 1: Using the true cell constant value

For conductivity or resistivity controllers:

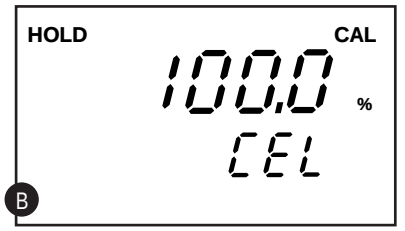
1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code “22”. Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows CAL.

See figure A



3. **Press the ENTER key** to begin calibration. The upper display will show a percent value and the lower display will show CEL (cell).

See figure B

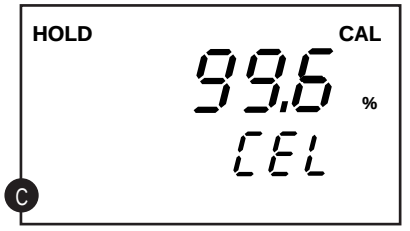


4. **Note your conductivity cell’s true cell constant.** Example: a cell with a 1.0 cell constant may actually be rated at 0.96.

NOTE: If you do not know your true cell constant use calibration method 2 (see pages 56-57).

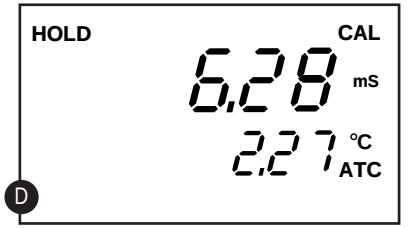
5. **Press the ▲ and ▼ keys** to match the display reading to the exact cell constant of your cell. **Example:** You have a cell with a cell constant of 1.0. If your true cell constant is exactly 1.0 (or exactly 0.01, 0.1 or 10), leave the display at 100%. If your true cell constant is 0.96, adjust the display reading to 96%. You can adjust the cell constant from 80 to 120%.

See figure C



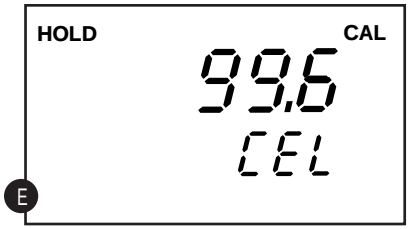
6. **Press the ENTER key** to confirm your cell constant selection. The upper display will show the adjusted conductivity (resistivity) reading and the lower display will show the temperature.

See figure D



7. **Press the ENTER key again.** The upper display will show the adjusted cell constant value and the lower display will show CEL.

See figure E



8. **Press the ENTER key again** to return to Measurement mode.

6.8.2 Method 2: Using a calibration standard

IMPORTANT: You **MUST** use a conductivity solution calibration standard (or a precision resistor for resistivity controllers) with a value of at least 40% of the full-scale range. See section 6.6.1 on page 45 for directions on selecting the range.

Conductivity calibration: using a conductivity calibration standard

For conductivity controllers:

1. **Enter Advanced set-up mode.** Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
2. **Press the ▲ and ▼ keys** to scroll until the upper display shows CAL.

See figure A

3. **Press the ENTER key.**. The upper display will show a percent value and the lower display will show CEL (cell). The "CAL" indicator will appear at the top of the display.

See figure B

4. **Press the ENTER key again.** The upper display will show the current conductivity reading and the lower display shows the temperature.

See figure C

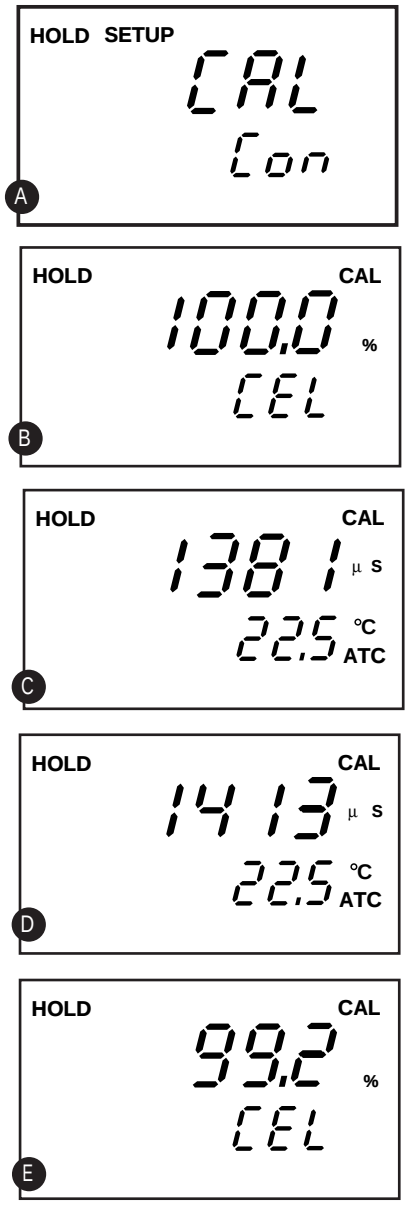
5. **Make sure the cell is in your conductivity calibration solution**. Use a standard conductivity calibration solution so you will know the the solution's exact value.
6. **Press the ▲ and ▼ keys** to match the display reading to the exact value of your conductivity solution.

See figure D

7. **Press the ENTER key** to confirm your selection. The upper display will show the adjusted cell constant value and the lower display will show CEL.

See figure E

8. Press the ENTER key again to return to Measurement mode.



Resistivity calibration: using a precision resistor

For resistivity controllers:

NOTE: You need a precision resistor to perform this calibration method.

1. **Disconnect controller from power.**
2. **Connect the resistor to the terminals used for the resistivity cell (pins 21 and 22)**. See page 9 for terminal connections.
3. **Reconnect controller to power.** Controller will automatically enter Measurement mode.
4. **Set controller to manual temperature compensation and enter a value of 25°C.** See page 31 for directions.
5. **Enter Calibration mode**. From measurement mode, press the CAL key. Press the ▲ key to enter Security code "11". Press the ENTER key.

See figure A

6. **Press the ENTER key.** The upper display will show a percent value and the lower display will show CEL (cell). The "CAL" indicator will appear at the top of the display.

See figure B

7. **Press the ENTER key again.** The upper display will show the current resistivity reading and the lower display shows the manual temperature setting (25°C).

See figure C

NOTE: A mΩ indicator appears on the display, but is equivalent to MΩ.

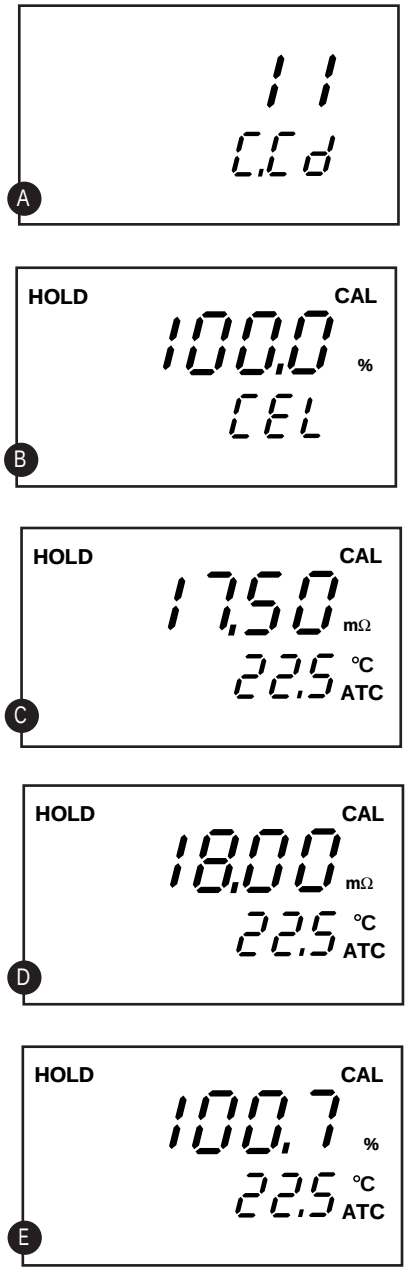
8. **Press the ▲ and ▼ keys** to match the display reading to the calculated resistance. *calculated resistance = the specified resistance value of the resistor ÷ by the cell constant*.

See figure D

9. **Press the ENTER key** to confirm your selection. The upper display will show the adjusted cell constant value and the lower display will show CEL.

See figure E

10. Press the ENTER key again to return to Measurement mode.



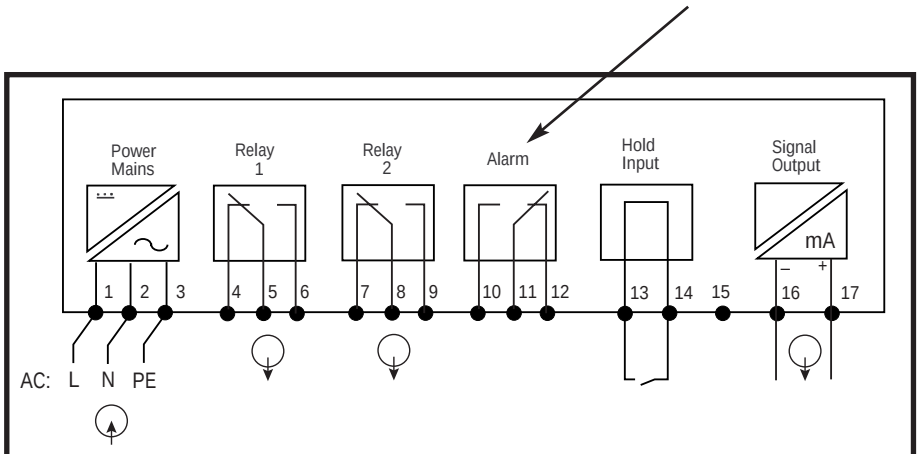
7. Alarm relay

This controller features a separate alarm relay. When the alarm is activated, the red alarm LED will light on the controller and the ERR indicator will appear on the controller display. The ATC and ERR indicators will blink if the error is due to temperature measurement. Additionally, you can hook a separate visual or audible alarm to this relay.

IMPORTANT: The alarm relay functions as an “Active Low” device; e.g. it switches OFF under alarm condition. Therefore the alarm display device should be connected to the “NC” contacts of the relay.

Delaying alarm relay action

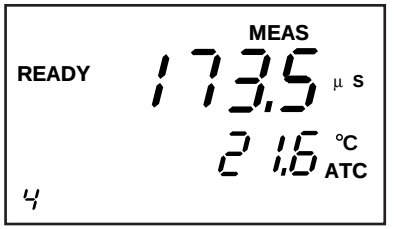
Delay relay activation by 0 to 2000 seconds (factory default is 0 seconds).
See section 6.7.1 on page 50 for information on how to set an alarm delay.



10. Alarm relay resting position
11. Alarm relay common
12. Alarm relay working position

8. Taking measurements

In normal measurement mode, the display will appear as shown in the figure at right.



The readings that appear depend on the range selected (see section 6.6.1 on page 45). A range number corresponding to the range you are in appears in the lower left hand corner of the display.

If ATC is selected on, the ATC indicator should be lit. If manual temperature selection is chosen, the ATC annunciator will be off. When the controller is in ATC mode, and the temperature sensor wire is broken or disconnected, an error message will be displayed, plus the alarm LED indicator and relay will be activated.

When taking resistivity readings, A mΩ indicator appears on the display, but is equivalent to MΩ.

9. Manual control mode

You can control devices connected to Relay A or Relay B from the front panel of this controller. Automatic mode is the mode that the controller normally enters when you switch it on. In Automatic mode, the controller's set-point values actuate the relays.

In Manual mode, you have manual control of your relays so you can prime your pump or check pump status without operating the entire system.

To enter manual mode:

1. **Press the Relay Control (auto/manu) key.** The upper display will show "000"; the lower display will show "S.Cd" to prompt you to enter the Advanced Set-up Code.
2. **Press the ▲ and ▼ keys** to scroll the upper display until it reads "22".
3. **Press the ENTER key.** The Manual indicator by the Relay Control key will light.

NOTE: Pressing ENTER at a value other than "22" will cause the controller to revert to the Measurement mode, and the relays will remain in automatic mode.

4. **Press the Relay Selection key** to select either Relay A or Relay B. The LED next to the currently selected relay (A or B) will light. The upper display will read the current measured value. The lower display will show "oFF" or "on" depending on the relay status of the currently selected relay.
5. **Press the ▲ and ▼ keys** to change the Relay on / off status. The LED indicators at the right of the controller will also change between Red and Green to indicate Relay status.

NOTE: If you wish to manually change the status of both relays, press the RELAY SELECTION key at this point and repeat step 5 for the second relay. This first relay will remain under manual control while you are setting the second relay.

6. **Press the RELAY CONTROL (auto/manu) key** to return to Measurement mode. The relays are now back under automatic control.

10. Technical Specifications

Range no.	Range	Resolution	Cell Constant (K)
Conductivity controllers			
1	0.000 to 2.000 µS	0.001 µS	0.01
2	0.00 to 20.00 µS	0.01 µS	0.01
3	0.00 to 20.00 µS	0.01 µS	0.10
4	0.0 to 200.0 µS	0.1 µS	0.10
5	0.0 to 200.0 µS	0.1 µS	1.0
6	0 to 2000 µS	1 µS	1.0
7	0 to 5000 µS	5 µS	1.0
8	0.00 to 20.00 mS	0.01 mS	1.0
9	0.0 to 200.0 mS	0.1 mS	10.0
0	0.0 to 200.0 mS	0.1 mS	1.0
Resistivity controllers			
1	0.0 to 20.00 MΩ	0.01 MΩ	0.01
2	0.000 to 1.999 MΩ	0.001 MΩ	0.10

Control type: on / off

Control accuracy: ±0.5% full-scale

Number of inputs: one

Number of set points: two

Output:
- Control: 2 SPDT relays, 6 A @ 110 VAC, 250 VAC max
- Alarm: 1 SPDT relay, 6 A @ 110 VAC, 250 VAC max
- Current: isolated 0-20 / 4-20 mA, with 20% to 100% full-scale scalable boundaries, 600 Ω max. load

Hysteresis (dead band): 0 to 10% of range

Relay delay: selectable, 0 to 2000 seconds

Electrical isolation: yes, galvanically

Temperature:
- Range: 0 to 100°C
- Resolution: 0.1°C
- Accuracy: ±0.5°C
- Sensor: 100 Ω or 1000 Ω Platinum RTD, terminal strip

Temperature compensation:
- Automatic / manual from –9.9 to 125°C

Temperature coefficient:
- Conductivity: linear 0.00 to 10.00% per °C
- Resistivity: ultra-pure / linear 0.00 to 10.00% per °C

Calibration:
- Conductivity or resistivity: one point
- Temperature: offset up to ±5°C

Password protection: two level protection with four-digit password lockout; first level gives calibration access, second level allows set-up parameter changes

Display: Dual-line LCD; 4-digit upper and 3½-digit lower

Operating temperature: 14 to 140°F (–10 to 60°C)

Housing: IP54 front; ¼ DIN size

Dimensions:
- Unit only: 3 13/16"W x 3 13/16"H x 6 15/16"D (9.6 x 9.6 x 17.5 cm)
- Boxed: 6½"W x 6"H x 9¼"D (16.5 x 15.2 x 23.5 cm)

Panel cut-out: 3⅜"W x 3⅜"H (9.2 x 9.2 cm)

Weight:
- Unit only: 1.5 lbs (0.7 kg)
- Boxed: 2.5 lbs (1.2 kg)

11. Accessories

Extra Controllers

WD-35200-20 Conductivity controller, 120 VAC, 48 to 62 Hz

WD-35200-25 Conductivity controller, 220 VAC, 48 to 62 Hz

WD-35200-40 Resistivity controller, 120 VAC, 48 to 62 Hz

WD-35200-45 Resistivity controller, 220 VAC, 48 to 62 Hz

WD-35100-90 Power cord; 3 ft with bare leads, 3 prong U.S. plug, 110 VAC

Industrial Conductivity/Resistivity Cells

WD-35820-20 Conductivity cell; epoxy body, graphite electrode, cell constant = 1.0, ¾" NPT thread

WD-35820-21 Conductivity cell; epoxy body, graphite electrode, cell constant = 0.1, ¾" NPT thread

WD-35820-22 Conductivity cell; epoxy body, graphite electrode, cell constant = 10, ¾" NPT thread

WD-35820-25 Conductivity cell; glass body, platinum electrode, cell constant = 1, ¾" NPT thread

WD-35820-26 Conductivity cell; glass body, platinum electrode, cell constant = 0.1, ¾" NPT thread

WD-35820-40 Conductivity/resistivity cell; epoxy body, stainless steel electrode, cell constant = 0.01, ¾" NPT thread

Conductivity Calibration Standards

WD-00653-47 Conductivity/TDS solution, 447 µS (225.6 ppm KCl; 215.5 ppm NaCl; 50.50 ppm 442)

WD-00653-15 Conductivity/TDS solution, 1500 µS (757.1 ppm KCl; 737.1 ppm NaCl; 1050 ppm 442)

WD-00653-20 Conductivity/TDS solution, 2764 µS (1382 ppm KCl; 1414.8 ppm NaCl; 2062.7 ppm 442)

WD-00606-10 Conductivity/TDS solution, 12,880 µS (7447 ppm KCl; 7230 ppm NaCl; 11,367 ppm 442)

WD-00653-50 Conductivity/TDS solution, 15,000 µS (8759 ppm KCl; 8532 ppm NaCl; 13,455 ppm 442

12. Appendix 1: Factory default settings

Type	Parameter	Value	Remarks
tc	Temp comp curve	Lin	Linear temperature compensation curve
	Ptc	2.10%	Process temperature coefficient
	Ctc	2.10%	Calibration temperature coefficient
SET C	ATC	ATC = ON	Automatic Temperature Compensation
	Temp. offset	0.0°C	Zero temperature offset
SP1	SP1	100 µS (1 MΩ)	set point 1
	LO / HI trigger	LO	LO trigger mode
	Hysteresis	20 µS (0.2 MΩ)	—
	On delay time	0 seconds	—
	Off delay time	0 seconds	—
SP2	SP2	1900 µS (19.00 MΩ)	set point 2
	LO / HI trigger	HI	HI trigger mode
	Hysteresis	20 µS (0.2 MΩ)	—
	On delay time	0 seconds	—
	Off delay time	0 seconds	—
Cntr	Control type	LCt on	On / off control
	Relay type	dEEn	Relay de-energized in no alarm condition
rng	Range / cell constant	2000 µS / K=1.00 (20.00 MΩ / K = 0.01)	range number 6 for conductivity; range number 1 for resistivity
	mA output	4-20 mA	—
	4 mA value	0 µS (0 MΩ)	4 mA corresponds to 0 µS (0 MΩ)
	20 mA value	2000 µS (20.00 MΩ)	20 mA corresponds to 2000 µS (20.00 MΩ)
ConF	Alarm delay	0 seconds	ALd = alarm delay = 0 seconds
	Relay mode	StdY	Relay activated mode: steady
	Line resistance	0.0	no line resistance
	Factory default	no	Do not reset to factory default
CAL	Calibration	K =100.0	default setting assumes cell constant of 100%

13. Appendix 2: Calculating Temperature Coefficients

To determine the temperature coefficient of your **sample solution** use this formula:

$$\mathbf{TC} = 100 \times \frac{C_{T2} - C_{T1}}{C_{T1}(T_2 - 25) - C_{T2}(T_1 - 25)}$$

TC = Temperature coefficient

$\mathbf{C_{T1}}$ =Conductivity at Temp. 1 $\mathbf{C_{T2}}$ = Conductivity at Temp. 2

$\mathbf{T_1}$ = Temp. 1 $\mathbf{T_2}$ = Temp. 2 **25** = 25°C

NOTE: A controlled temperature water bath is ideal for this procedure.

1. Immerse the probe into a sample of your solution and adjust the temperature coefficient to 0% (that is, no compensation) by performing the following:
   A. From measurement mode, Enter Advanced set-up mode. Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
   B. Press the ▲ and ▼ keys to scroll until the upper display shows tc.
   C. Press the ENTER key until the lower display shows P.tc and the upper display shows the temperature coefficient.
   D. Press the ▼ key until the upper display shows 0.0.
   E. Press ENTER key to confirm the value.
   F. Press the ▲ and ▼ keys together to return to measurement mode.
2. Wait for 5 minutes. Note $\mathbf{T_1}$ and $\mathbf{C_{T1}}$ (conductivity at $\mathbf{T_1}$).
3. Condition the sample solution and probe to a temperature ($\mathbf{T_2}$) that is about 5°C to 10°C different from $\mathbf{T_1}$, and note the conductivity reading $\mathbf{C_{T2}}$.

NOTE: Record your results for future reference. Ideally $\mathbf{T_1}$ and $\mathbf{T_2}$ should bracket your measurement temperature, and should not differ by more than 5°C.

4. Calculate the temperature coefficient of your solution according to the formula shown above.
5. Enter the temperature coefficient you calculated into the meter.
   A. From measurement mode, Enter Advanced set-up mode. Push the ENTER key. Press the ▲ key to scroll to security code "22". Push the ENTER key again.
   B. Press the ▲ and ▼ keys to scroll until the upper display shows tc.
   C. Press the ENTER key until the lower display shows P.tc and the upper display shows the temperature coefficient.
   D. Press the ▲ key until the upper display shows your calculated temperature coefficient.
   E. Press ENTER key to confirm the value.
   F. Press the ▲ and ▼ keys together to return to measurement mode.

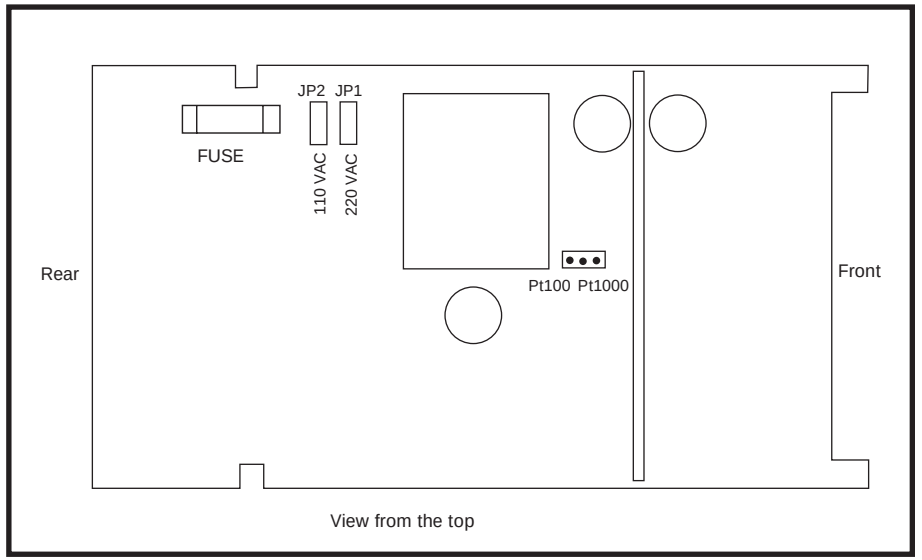
The calculated temperature coefficient will now be applied to all the meter readings.

14. Appendix 3: Jumper positions

Note that there is a fuse internal to the controller. Before opening the unit, ENSURE that the power cable is physically separated from the mains supply. Replace the fuse with the recommended part specified by the manufacturer.

Jumper Positions - Internal to the controller

JP 1	Selects the input voltage 220 VAC. To switch to 110 VAC, use tweezers or needle nose pliers to remove jumper from JP1 pins to JP2 pins.
JP 2	Selects the input voltage 110 VAC. To switch to 220 VAC, use tweezers or needle nose pliers to remove jumper from JP2 pins to JP1 pins.
Pt 100 / Pt 1000	Selects between Pt100 and Pt1000. To switch between Pt 100 and Pt 1000, de-solder and remove jumper from left-center position, move and re-solder to right center position.



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