



CDS 5000 INSTRUCTION MANUAL

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CONDUCTIVITY: WHAT IS IT?

Conductivity is defined as the ability of a solution to conduct an electrical current, or the reciprocal of the solution's ability to resist the current. This current is conducted by electrically charged particles called ions, which are present in almost all solutions. Different solutions have different kinds and amounts of ions: distilled water has very few ions, and therefore a low conductivity, while sea water has a large number of ions, and a high conductivity.

Although a conductivity reading provides an overall measurement of the ionic content of a solution, it is not able to distinguish among the different ions. For this reason, conductivity is often used to measure the total dissolved solids (TDS) of a solution. TDS is defined as the amount of solids which will pass through a 45 micron filter. Rather than filtering a solution, the TDS can be estimated by multiplying the conductivity measurement by a predetermined factor. This factor, which is determined gravimetrically, will fall between 0.55 and 0.9; 0.7 is a commonly used factor.

The conductivity measurement can also be used to estimate the salinity of water, or the total amount of all salts dissolved in the water. Typically, the conductivity reading is converted to salinity using charts, such as the one found on page 10 of this manual. These charts are based on water containing the same amount and proportion of ions as standard seawater, so this form of measurement is most effective for slight concentrations and dilutions of seawater.

Conductivity is measured in microsiemens per centimeter (μ siemens/cm). Siemens are also called mhos. In waters of higher conductivity, μ siemens/cm may be multiplied by 1000, giving results as millisiemens per centimeter (msiemens/cm). Total dissolved solids are measured in parts per million. Therefore, using the information discussed above:

$$\mu\text{siemens/cm} \times 0.7 = \text{ppm TDS}$$

Salinity is usually measured in parts per thousand (ppt). The chart on page 10 of this manual can be used to convert conductivity readings to salinity.

Because it is a quick, reliable, and inexpensive way of monitoring the ionic content of a solution, conductivity measurements are widely used in many areas of water testing, from environmental monitoring to municipal water supplies to many industrial applications.

CONDUCTIVITY

Conductivity is measured using a probe which contains two electrodes, separated by a fixed distance. When a voltage is applied from the meter across the electrodes, the ions in solution conduct a current, which flows between the electrodes. The greater the concentration of ions in the solution, the larger the current generated and the higher the conductivity. Likewise, the smaller the concentration of ions, the lower the conductivity. The meter converts the current measured to a conductivity reading.

Over time the electrodes may become dirty or fouled with contaminants from the sample. For specific probe cleaning instructions for the CDS 5000 see **Maintaining The Meter** on page 13 of this manual.

Conductivity measurements are very dependent on temperature. The ability of the ions to move through the solution, and conduct the current, is related to the temperature of the solution. As the temperature rises, the ions move more quickly through the solution, increasing the conductivity; likewise as the temperature decreases the ions move more slowly and the conductivity decreases. Since the conductivity of the same solution can change by as much as 2%/°C, accurate temperature measurements must be made simultaneously to the conductivity reading. The CDS 5000 includes a temperature probe to measure the temperature.

To make conductivity readings taken at different times and places comparable, measurements are often converted to what the conductivity of the solution would be at 25°C. The CDS 5000 automatically makes this conversion before providing a final reading.

METER BASICS

RANGE	1-199.9 $\mu\text{S/cm}$ 200-1999 $\mu\text{S/cm}$ 2-19.99 mS/cm 20-199.9 mS/cm 0 to 50°C
RESOLUTION	± 0.1 ± 1 ± 10 ± 100
READOUT	3½ digit LCD
CONTROLS	SLOPE CONDUCTIVITY $\mu\text{S/ppm}$ mS/ppt °C OFF
TEMP. COMPENSATION	Automatic by separate probe
PROBE	Carbon electrodes; 3 ft. cable
POWER	1604A Alkaline Battery (9 volt) 3.5 mm jack adapter
SIZE	5⅞" x 3¼" x 1¾" (15cm x 8 cm x 5 cm)

ACCESSORIES

Description	Code #
AC Adapter	1708
Funnel	0459
Filter Paper	0465
Cond. Std., 0.0005M KCl, 74 $\mu\text{mhos/cm}$	6416-L
Cond. Std., 0.005M KCl, 718 $\mu\text{mhos/cm}$	6417-L
Cond. Std., 0.01M KCl, 1,413 $\mu\text{mhos/cm}$	6354-L
Cond. Std., 0.05M KCl, 6,668 $\mu\text{mhos/cm}$	6418-L
Cond. Std., 0.5M KCl, 58,640 $\mu\text{mhos/cm}$	6419-L

METER SPECIFICATIONS

The CDS 5000 is precalibrated at the factory; simply place the TDS knob in the 12 o'clock position and proceed. This procedure will give results within 10% of the actual reading. For more accurate results, follow the procedure below.

1. Press "°C" button.
2. Set TDS knob in 12 o'clock position.
3. Insert temperature and conductivity probes at least 1/2" into conductivity standard.
4. Gently stir with conductivity probe until reading stabilizes. Press "µS/ppm" or "mS/ppt" button.
5. Adjust SLOPE knob until display reads conductivity of chosen standard. The CDS 5000 is now calibrated and ready for use.

LaMotte offers several ranges of conductivity standards. Choose the standard most appropriate for your testing needs and order using the four digit code number listed.

STANDARDS

Description	Code #
Cond. Std., 0.0005M KCl, 74 µmhos/cm	6416-L
Cond. Std., 0.005M KCl, 718 µmhos/cm	6417-L
Cond. Std., 0.01M KCl, 1,413 µmhos/cm	6354-L
Cond. Std., 0.05M KCl, 6,668 µmhos/cm	6418-L
Cond. Std., 0.5M KCl, 58,640 µmhos/cm	6419-L

CALIBRATING

CONDUCTIVITY

1. Press “°C” button.
2. Set TDS and SLOPE knobs in 12 o'clock position.
NOTE: If meter was calibrated according to procedure on page 7, leave SLOPE knob set in the same position.
3. Insert temperature and conductivity probes at least 1/2" into sample.
4. Gently stir with conductivity probe until reading stabilizes. Press “ $\mu\text{S/ppm}$ ” button. Record reading as $\mu\text{siemens/cm}$.
5. If a 1 appears on the far left side of the display, the reading is out of range. Repeat procedure using “ mS/ppt ” button. Record as msiemens/cm . To convert to $\mu\text{siemens/cm}$, multiply reading by 1000. Record as $\mu\text{siemens/cm}$.
6. Press “OFF” button when finished testing. Rinse probe with distilled water and dry thoroughly before storing.

TOTAL DISSOLVED SOLIDS

1. Set TDS knob to desired multiplication factor.
NOTE: 0.7 is a commonly used multiplication factor.
2. Press “°C” button.
3. Set SLOPE knob in 12 o'clock position.
NOTE: If meter was calibrated according to procedure on page 7, leave SLOPE knob set in the same position.
4. Insert temperature and conductivity probes at least 1/2" into sample.
5. Gently stir with conductivity probe until reading stabilizes. Press “ $\mu\text{S/ppm}$ ” button. Record reading as $\mu\text{siemens/cm}$.
6. If a 1 appears on the far left side of the display, the reading is out of range. Repeat procedure using “ mS/ppt ” button. Record as msiemens/cm . To convert to $\mu\text{siemens/cm}$, multiply reading by 1000. Record as $\mu\text{siemens/cm}$.
7. Press “OFF” button when finished testing. Rinse probe with distilled water and dry thoroughly before storing.

TESTING WATER

1. Press “°C” button.
2. Set TDS and SLOPE knobs in 12 o'clock position.
NOTE: If meter was calibrated according to procedure on page 7, leave SLOPE knob set in the same position.
3. Insert temperature and conductivity probes at least 1/2" into sample.
4. Gently stir with conductivity probe until reading stabilizes. Press “mS/ppt” button. Record reading as msiemens/cm.
5. Using chart on the following page, convert conductivity reading to salinity. Record as ppt Salinity.
6. Press “OFF” button when finished testing. Rinse probe several times with distilled water and dry thoroughly before storing.

TESTING SALINITY

The Total Dissolved Solids (TDS) level of soil samples can be determined using the CDS 5000. A soil extraction is made using distilled water, and the TDS level measured.

1. Fill a 50 mL beaker with sample soil. Tap lightly to eliminate trapped air. Remove excess soil from the surface.
2. Empty beaker into a 250 mL widemouth flask. Add 100 mL of distilled water. Stopper and shake vigorously. Wait 30 minutes.

NOTE: During the waiting period, vigorously shake the sample three or four times.

3. Filter contents of flask, collecting filtrate in a beaker or other suitable container.

NOTE: LaMotte Company offers a funnel and filter paper which can be used for this filtration. Order as code numbers 0459 and 0465 respectively.

4. Set TDS knob to desired multiplication factor.

NOTE: 0.7 is a commonly used multiplication factor.

5. Press “°C” button.

6. Set SLOPE knob in 12 o'clock position.

NOTE: If meter was calibrated according to procedure on page 7, leave SLOPE knob set in the same position.

7. Insert temperature and conductivity probes at least 1/2" into sample.
8. Gently stir with conductivity probe until reading stabilizes. Press “ μ S/ppm” button. Record reading as μ siemens/cm.
9. If a 1 appears on the far left side of the display, the reading is out of range. Repeat procedure using “mS/ppt” button. Record as msiemens/cm. To convert to μ siemens/cm, multiply reading by 1000. Record as μ siemens/cm.
10. Press “OFF” button when finished testing. Rinse probe with distilled water and dry thoroughly before storing.

TESTING SOIL

REPLACING THE BATTERY

When “BAT” appears on the display, the battery should be replaced. The temperature reading will be the first function to be affected by a low battery.

1. Use a #1 Phillips head screwdriver to remove four screws on the back of the meter case.
2. Gently lift back panel from meter.
3. Lift battery from bottom of meter. Remove from connector.
4. Snap new battery onto connector.

NOTE: The CDS 5000 uses a type 1604A (9 volt) battery.

5. Lower battery into compartment. Replace back panel and screws.

AC ADAPTER

An AC adapter is available for use with the CDS 5000. Order as code #1708. Insert connector into small hole next to the probe connector.

CLEANING THE PROBE

The graphite probe may occasionally become dirty and need to be cleaned. After each use the probe should be thoroughly rinsed with distilled water. If further cleaning is necessary, the probe can be washed with a mild detergent, and then thoroughly rinsed with distilled water. Always thoroughly dry the probe before storing.

**CONVERSION TABLE
FOR CHANGING CONDUCTIVITY* INTO SALINITY**

Conductivity			Salinity					
0°C	5°C	10°C	15°C	20°C	25°C	30°C	‰	
1.200	1.400	1.500	1.700	2.000	2.200	2.400	1	
2.220	2.500	2.900	3.300	3.700	4.100	4.500	2	
3.200	3.700	4.200	4.700	5.300	5.900	6.500	3	
4.100	4.700	5.400	6.100	6.900	7.600	8.400	4	
5.000	5.800	6.600	7.500	8.400	9.300	10.300	5	
5.900	6.800	7.900	8.800	9.900	11.000	12.100	6	
6.700	7.800	8.900	10.100	11.300	12.600	13.900	7	
7.600	8.800	10.100	11.400	12.800	14.200	15.700	8	
8.500	9.800	11.200	12.700	14.200	15.800	17.400	9	
9.300	10.800	12.300	13.900	15.600	17.300	19.100	10	
10.200	11.800	13.400	15.200	17.000	18.900	20.800	11	
11.000	12.800	14.500	17.600	18.900	20.400	22.500	12	
11.900	13.700	15.600	18.900	19.700	21.900	24.100	13	
12.600	14.600	16.700	20.100	21.100	23.400	25.800	14	
13.400	15.600	17.800	20.100	22.400	24.900	27.400	15	
14.200	16.400	18.800	21.200	23.800	26.400	29.100	16	
15.000	17.400	19.800	22.400	25.100	27.800	30.700	17	
15.800	18.300	20.900	23.600	26.400	29.300	32.300	18	
16.600	19.200	21.900	24.800	27.700	30.700	33.900	19	
17.400	20.100	23.000	25.900	29.000	32.200	35.500	20	
18.200	21.100	24.000	27.100	30.300	33.600	37.000	21	
19.000	22.000	25.100	28.300	31.600	35.000	38.600	22	
19.800	22.900	26.100	29.400	32.900	36.500	40.100	23	
20.600	23.800	27.100	30.600	34.200	37.900	41.700	24	
21.400	24.700	28.100	31.700	35.400	39.300	43.200	25	
22.100	25.500	29.100	32.800	36.700	40.700	44.800	26	
22.800	26.400	30.100	33.900	37.900	42.100	46.300	27	
23.600	27.300	31.100	35.100	39.200	43.500	47.800	28	
24.400	28.100	32.100	36.200	40.400	44.800	49.400	29	
25.200	29.000	33.100	37.300	41.700	46.200	50.900	30	

**CONVERSION TABLE
FOR CHANGING CONDUCTIVITY* INTO SALINITY**

Conductivity		Salinity						
0°C	5°C	10°C	15°C	20°C	25°C	30°C	‰	
26.800	30.900	35.100	39.600	44.200	49.000	53.900	32	
27.500	31.700	36.100	40.700	45.400	50.300	55.400	33	
28.300	32.600	37.100	41.800	46.700	51.700	56.800	34	
29.100	33.500	38.100	42.900	47.900	53.000	58.300	35	
29.700	34.200	39.000	44.000	49.100	54.400	59.800	36	
30.500	35.100	40.000	45.100	50.300	55.700	61.300	37	
31.200	36.000	41.000	46.200	51.500	57.100	62.800	38	
32.000	36.800	41.900	47.200	52.700	58.400	64.200	39	
32.700	37.700	42.900	48.300	53.900	59.700	65.700	40	

*Conductivity values are given in millisiemens/cm

Data derived from the equation of P.K. Weyl, Limnology and Oceanography; 9,75 (1964).

NOTICE

The Model CDS 5000 automatically converts all conductivity readings to 25°C. To convert conductivity reading to salinity, only use the 25°C column. Record as ppt Salinity.

MAINTAINING THE METER

REPLACING THE PROBE

If the probe cannot be adequately cleaned, or becomes damaged, it must be replaced. When a new probe is attached to the meter, the CDS 5000 must be recalibrated using the following procedure. Do not allow the CDS 5000 to contact any conductive surfaces while performing this procedure.

- 1.** Set SLOPE and TDS knobs to 12 o'clock position.
- 2.** Use a Phillips head screwdriver to remove four screws from back of meter. Remove back from meter.
- 3.** Follow the Conductivity testing procedure described on page 8 to measure the conductivity of a chosen standard. Choose the standard that is closest to the value of the solutions commonly measured.
- 4.** Using a small, flat edge screwdriver, adjust the top potentiometer (indicated in the diagram) until value of standard solution is displayed.

NOTE: Only adjust the top potentiometer; adjusting any other potentiometer voids the meter's warranty. If these other potentiometers are adjusted, the meter must be returned to LaMotte for repair.

- 5.** Replace back on meter and replace the four screws. The CDS 5000 is now calibrated and ready for use.

WARRANTY INFORMATION

REPAIRS

If it is necessary to return the instrument for repair, contact LaMotte Company at 1-800-344-3100 for a return authorization number.

INSTRUMENT GUARANTEE

This instrument, excluding the probe, is guaranteed to be free of defects in material and workmanship for one year from date of original purchase. If, in that time, it is found to be defective, it will be repaired without charge, except for transportation expenses. This guarantee does not cover the batteries.

This guarantee is void under the following circumstances:

- operator's negligence
- improper application
- unauthorized servicing

LIMITS OF LIABILITY

Under no circumstances shall LaMotte Company be liable for loss of life, profits, or other damages incurred through the use of misuse of their products.

PACKAGING AND DELIVERY

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered during shipping. After the product leaves the manufacturer, all responsibility for its safe delivery is assured by the transporter. Damage claims must be filed immediately with the transporter to receive compensation for damaged goods.