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CDH-152
M-3676

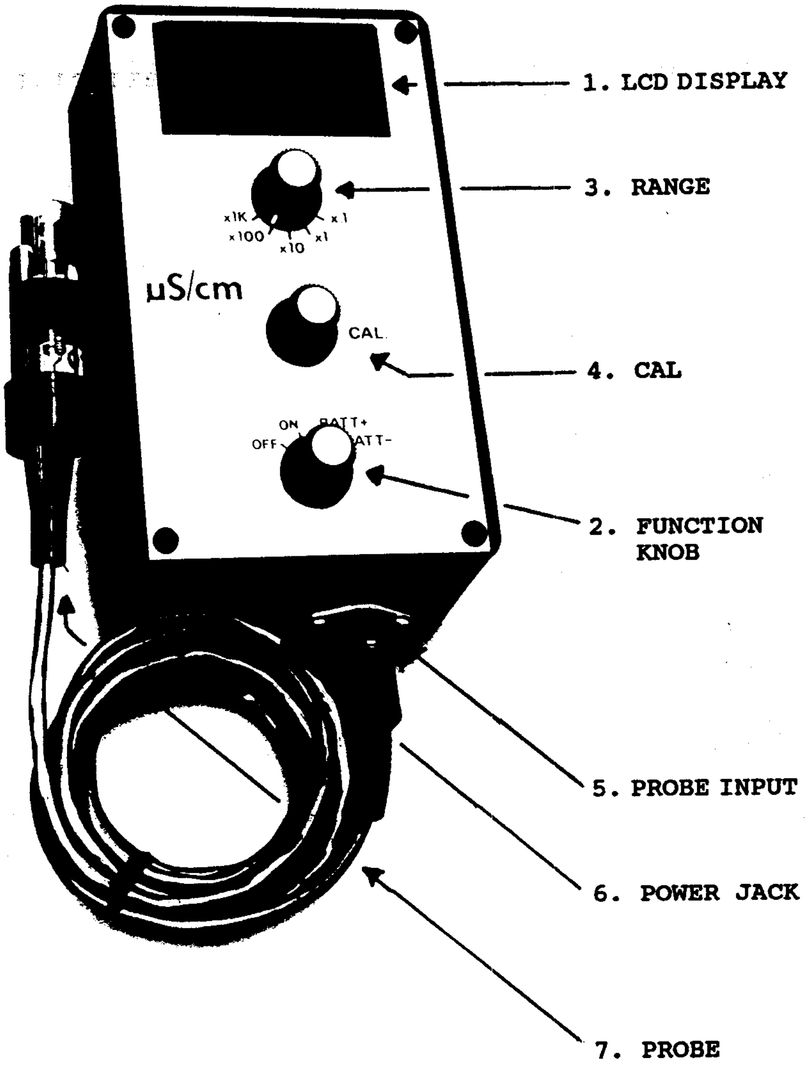
1.0 GENERAL OVERVIEW

This meter measures the total ionized substances of an aqueous solution, in one convenient, economical package. Re-chargeable batteries and an AC adapter allow versatility for use in the field and in the lab.

The meter displays conductivity in five ranges from 0 to 20,000 micromhos/cm. It comes with a break-resistant, platinized probe which has an internal thermistor for automatic temperature compensation.

2.0 SPECIFICATIONS

READOUT	3 1/2 Digit LCD
RANGE	0 - 20,000 micromhos
STEPS	0 - 2, 0 - 20, 0 - 200, 0 - 2000, 0 - 20,000
ACCURACY	±2% of full scale
RESOLUTION	0.1% of full scale
TEMP. COMP.	Automatic
PROBE	Platinized, dip style
SIZE	6"H,3"W,2"D
WEIGHT	1.8 Lbs (0.8 Kg)
POWER	8 Rechargeable AA NICAD Batteries


1. LCD DISPLAY
3. RANGE
x1K
x100
x10
x1
x1
µS/cm
CAL
4. CAL
ON
OFF
BATT+
BATT-
2. FUNCTION KNOB
5. PROBE INPUT
6. POWER JACK
7. PROBE

3.0 INSTRUMENT FAMILIARITY

1. **Liquid Crystal Display**
   3 1/2 digit display for conductivity readings.

2. **Function Knob: Off/On/+Batt/-Batt**
   Off: Turns power off.
   On: Activates meter.
   +Batt: Displays positive battery voltage.
   -Batt: Displays negative battery voltage.

3. **Range**
   Five position switch which is used to select the proper conductivity scale.

   x.1..........0 - 2 micromhos
   x 1..........0 - 20 micromhos
   x 10.........0 - 200 micromhos
   x 100........0 - 2000 micromhos
   x 1k.........0 - 20,000 micromhos

4. **CAL**
   Adjustment knob used to standardize meter and probe with conductivity standards.

5. **Conductivity Probe Input**
   A 5 pin din connector for the detachable conductivity probe.

6. **Power Jack**
   The wall plug adaptor output is attached to operate from line voltage. Input is 12vdc, 500mA. When the adaptor is connected, the batteries will be automatically re-charged.

7. **Conductivity Probe**
   The body is 3/4 inch diameter, 4 inches long. It is constructed of epoxy and polycarbonate connected to a six foot cable. The strain relief is urathane. The conductive pins are nickel. The probe constant, K = 1.

4.0 OPERATION

1. The meter is powered by internal rechargeable batteries. Connecting the AC adaptor will re-charge the batteries as well as power the meter. Prior to field use, charge the batteries overnight.
2. Turn function switch to +Batt, then -Batt. Meter should read within Batt ok scale for proper operation.

3. Plug the conductivity probe into the DIN connector.

4. Set **on/off** switch to the **on** position.

5. Turn the range switch to position **x1K.** Rinse the probe with distilled or deionized water.

6. Insert the probe into the unknown solution, at least one inch, without touching the sides or bottom of the container.

7. Decrease the range one step at a time, until the display reads between 2.00 and 19.99.

8. The probe will automatically compensate for sample temperatures between 5 °C and 45 °C.

Note: It may take several minutes for the reading to stabilize when the solution temperature differs from the test environment.

9. After determining the measurement range, chose a standard within that range and calibrate the meter at the selected range.

10. Re-measure the unknown solution. If the display reads over range after calibration, recalibrate on the next higher range and take the measurement.

5.0 CALIBRATION

1. Connect the conductivity probe.
2. Set on/off switch to the on position.
3. Set the **RANGE** switch to the **x10** position.
4. Select a conductivity standard in the range of 1000uS that will read in the **x10** range on the meter, 0 to 2000uS.
5. Insert the probe into the standard solution at least one inch without touching the sides or bottom of the container.

Note: It is best to calibrate with probe and standards at the same temperature as the environment.

6. Adjust the **CAL** knob so the meter displays the value of the standard solution.
7. The meter is now ready for use.

6.0 MEASUREMENT GUIDELINES

1. Avoid contaminating the standard and sample solutions. For best results, rinse in D.I. water after each measurement, then rinse with a small amount of the next standard or sample to be measured.

2. Choosing a calibration solution whose value lies as close as possible to the sample solution increases measurement accuracy.

3. If possible the calibration solution and sample solution should be at the same temperature.

4. The instrument functions by sensing very low signals at the electrode surfaces. Tests in solutions with stray AC voltages may cause spurious results. If in doubt, shield both the solution and cell.

5. After exposure to a sample, standard or rinse solution, shake the electrode with a snap motion to remove residual drops of solution. This will minimize contamination from carryover.

6. As a rinse solution, use a part of the next sample or buffer which is to be measured. This will minimize contamination from carryover.

7. When measuring low conductivity levels the sample should be protected from the atmosphere since dissolved gases will rapidly change the conductivity of a solution.

7.0 ELECTRODE CARE

The conductivity probe is a rugged, general purpose device which will be consistently accurate **if properly cared for.**

If the electrode surface area is scratched, or congested with impurities, probe linearity will suffer, especially above 1000 micromhos. Therefore, it is essential that the probe is kept clean, rinsed in DI water after each measurement, and if possible, stored in DI water with a small amount(a pinch) of KCl in it when not in use.

Coatings on the probe can lead to erroneous readings and shorten the probe life span. The type of coating will determine the cleaning technique. Soft coatings can be removed by vigorous stirring or by use of a squirt bottle. Salt deposits can be removed by scrubbing the electrode with a small soft brush. Organic chemicals or hard coatings should be chemically removed (electrocleaned in KCl solution).

Following cleaning, the probe should be rinsed with DI water and stored in water with a small amount of KCl added.

8.0 BATTERIES

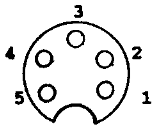
The batteries when fully charged should last for approximately 50 hours. Do not let the batteries run completely down before recharging them. The meter will display a "BAT" on the LCD when the batteries are low.

The batteries maybe re-charged while the unit is being used or with the meter turned off.

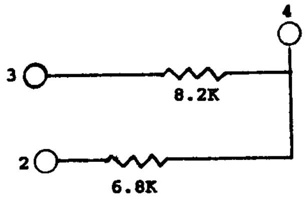
Should the batteries not hold a charge, replace batteries with new re-chargeable batteries.

9.0 TROUBLESHOOTING GUIDE

1. Isolate the problem to either the instrument or the probe.
   - A. If available, test the instrument with a spare probe.
   - B. The probe be can simulated with a resistor network.

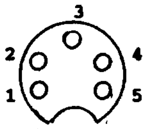


METER INPUT

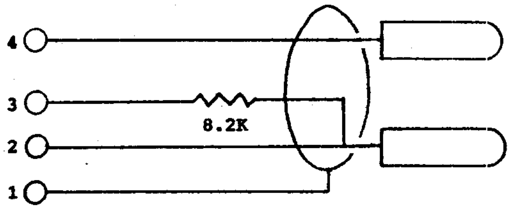


RANGE.....x100
1000 MICROMHOS

2. Probe Fault:
   - A. Check nickel surface on electrodes for impurities.
   - B. Probe sketch allows for continuity check.



PROBE CONNECTOR



3. Unable to standardize meter.
   - A. Open a new bottle or make a fresh batch of standards and re-check standardization.
   - B. Visually check electrode for cracks or other abnormalities. A cracked or damaged electrode should be replaced.
   - C. Changing sample temperature. Allow sufficient time for a sample temperature to stabilize.

Note: Stirring on an uninsulated stirring motor can lead to small but significant sample temperature changes.

   - D. A non-uniform sample. "Zones", which result in erratic or drifting readings, can be eliminated by gentle stirring using an insulated stirring motor.
   - E. A very low or very high ionic strength sample. These readings can take a long time to stabilize.
   - D. Chemicals that can poison an electrode, be certain that you are using the correct electrode. If you have any questions your electrode supplier can usually help.

10.0 THEORY OF MEASUREMENT

Conductivity is the measurement of the amount of electrical current that will flow across two noble metal surfaces when a constant voltage is applied. Conductivity is a nonselective measurement with any charged ion contributing to the total conductivity. Organic compounds such as phenols, alcohols, oils, etc., do not dissociate (ionize) in water and therefore have little or no effect on the conductivity. Conductivity is normally expressed as micromhos per centimeter. In the International Systems of Units (S) conductivity is expressed as millisiemens per meter, where 1 mS/m is equal to 10 micromhos per centimeter.

Conductivity can be used to determine concentration. A nearly linear relationship exists between conductivity and ion concentration for most ionic compounds below 2000 micromhos/cm. As a result conductivity is often measured to determine total dissolved solids (TDS). It is important to note that this is only a valid methodology when the ionic solution is composed of a pure compound since the exact relationship between conductivity and concentration varies with each ionic compound.

Some examples of the relationship between concentration and conductivity are:

CONCENTRATION VS CONDUCTIVITY @ 25°C

SALT	CONCENTRATION	CONDUCTIVITY
Calcium Carbonate (CaCo)	1 G/L (1000 ppm)	2300 micromhos/cm
Sodium Chloride (NaCl)	1 G/L (1000 ppm)	1990 micromhos/cm
Potassium Chloride (KCl)	1 G/L (1000 ppm)	1880 micromhos/cm

TOTAL DISSOLVED SOLIDS (TDS)

Conductivity in uS	Sodium Chloride ppm	Calcium Carbonate ppm
10	4.6	3.9
50	24	20
100	47	40
200	91	78
500	240	205
1000	495	424
2000	1020	873
5000	2560	2190
10000	5400	4620
20000	10800	9240

For "in between" measurements the following formula will give a good approximation:

ppm Sodium Chloride = uS X 0.5
ppm Calcium Carbonate = uS X 0.4