

# DIGITAL CONDUCTIVITY METER

## MODEL 1153 OPERATION MANUAL



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# DIGITAL CONDUCTIVITY METER

## Specifications of the Emcee Model 1153 Digital Conductivity Meter



**Continuous Standard Electrical Conductivity Ranges from**

- 0 to 2,000 picosiemens per meter (pS/m)**
- 0 to 20,000 picosiemens per meter (pS/m)**
- 0 to 2,000 picosiemens per centimeter (pS/cm)**
- 0 to 20,000 picosiemens per centimeter (pS/cm)**
- 0 to 100,000 picosiemens per centimeter (pS/cm)**

**One Pressure Sensitive Switch Operation (Green/White MC Logo)**



**Red LED Illuminates During Automatic Test Cycle (3 seconds)**

**Data Stored (Non Volatile) Until Next Test Cycle is Performed**

**Alphanumeric Liquid Crystal Display (LCD)**

**Conductivity Measured and Displayed in Whole Numbers  
(pS/m or pS/cm)**

**Optional Embedded Temperature Sensor Available**

**Text Presentation of Operational Status of Meter is Displayed  
Automatic Over Range (OVER) and Low Battery (LOW BAT)  
Indications**

**Powered by Three-Standard (3-volt) Lithium Cylindrical Cells (Generic  
Code Panasonic CR 2016)**

**Fuel and Water Resistant**

**Approved as being Intrinsically Safe**

**Listed in American Society of Test and Materials (ASTM)  
Standard Test Method D 2624**

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Service & Warranty Policy	
See Emcee Electronics, Inc Service and Warranty Manual	

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# DIGITAL CONDUCTIVITY METER

## 1. SCOPE

The Emcee Model 1153 Digital Conductivity Meter is a reliable, convenient and inexpensive instrument for measuring the electrical conductivity of fuels and other products that have very low electrical conductivities. The unit of measure is picosiemens per meter (pS/m) commonly referred to as Conductivity Units (CU). The Meter incorporates all solid-state components and is completely self-contained.

## 2. SIGNIFICANCE and USE

The ability of a fuel to dissipate charge that has been generated during pumping and filtering operations is controlled by its electrical conductivity, which depends upon its content of ion species. If the conductivity is sufficiently high, charges dissipate fast enough to prevent their accumulation thus decreasing the build up of dangerously high electrical potentials that could spark and cause a fire and/or explosion. This problem can be mitigated by increasing the electrical conductivity of the product by the addition of certain additives. The Emcee Conductivity Meter is typically used to measure the conductivity before and after the addition of the additives. If it is necessary to measure conductivities below 1 pS/m, for example in the case of clay treated fuels or refined hydrocarbon solvents, the Emcee Model 1154 Precision Conductivity Meter listed in ASTM Test Method D 4308 should be used.

## 3. DEFINITION

3.1 picosiemens per meter (pS/m), n-the unit of electrical conductivity is also called a conductivity unit (CU). A siemen is the Standard International (SI) definition of reciprocal ohm sometimes called mho.

$$1\text{pS/m} = 1 \times 10^{-12} \text{ ohms}^{-1} = 1 \text{ CU} = 1 \text{ picomho/m}$$

The Emcee Conductivity Meter displays electrical conductivity in picosiemens/meter (pS/m) or picosiemens/centimeter (pS/cm).

## 4. THEORY OF OPERATION

The Emcee Conductivity Meter uses a probe consisting of two concentric stainless steel electrodes. When the probe is immersed in fuel, and the pressure sensitive switch is pressed twice, a constant voltage is applied to the electrodes. This results in an electrical current which is amplified and is shown on the meter display.

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## 5. APPARATUS

5.1 The Emcee Model 1153 Conductivity Meter complete with probe is shown in Fig. 1.

5.2 The Meter is operated by a single pressure sensitive switch that is covered by and is directly beneath the Emcee green/white logo as shown in Fig.1. The Switch is used to retrieve the stored data and to initiate a test.

5.3 The Meter is a portable, hand held device that is battery powered. As shown in Fig. 2 the batteries can be accessed by removing the top (cap) on the Meter Fig. 1.

5.4 The TOOL shown in Fig. 2 is used as an Allen wrench to remove the 2-screws that secure the cap to the Meter and to extract the batteries.

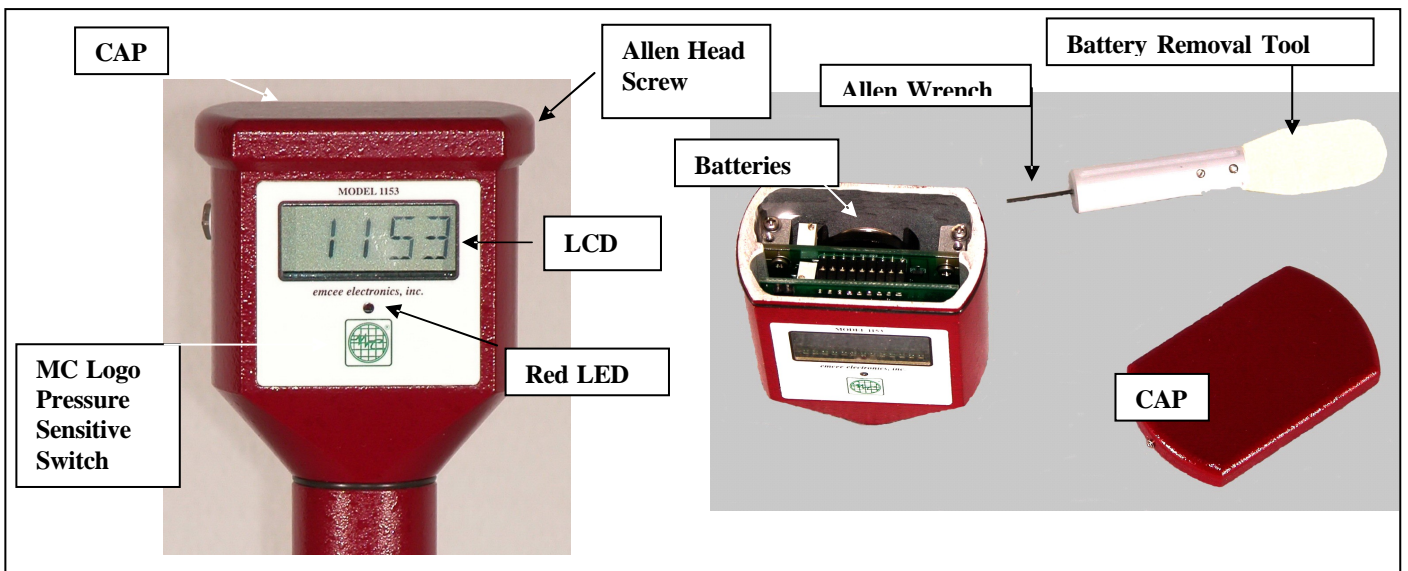
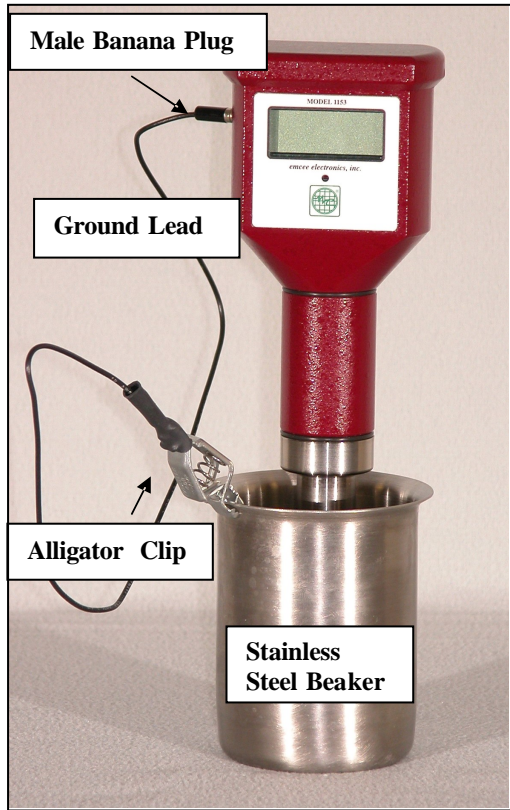


Figure 1 – Model 1153 Meter

Figure 2 – Batteries, Cap, and Tool

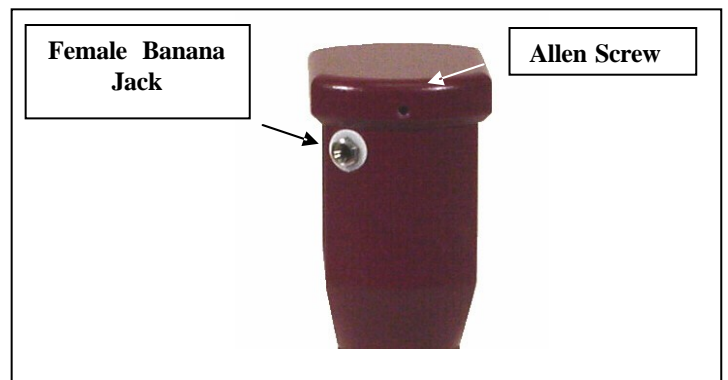
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**Figure 3 – Test Set Up**

5.5 The probe inserted in the sample that is tested with the ground lead attached to the Meter to the sample container is shown in Fig. 3. The location of the female banana plug on the Meter the Allen screw is also shown in Fig. 4.



**Figure 4 – Female Banana Jack and Allen Screw**

### 6. OPERATIONAL CHARACTERISTICS

6.1 To view the previous measurement that is stored in memory, depress the pressure sensitive switch (MC Logo) once. Both the conductivity (pS/m) and the temperature (C and F) will be displayed and retained until another test is performed.

6.2 To initiate a test, depress the pressure sensitive switch (MC Logo) once and then again when EMCEE is displayed. The test will measure conductivity and the temperature of the sample and store the results in memory.

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## 7. CHECK OPERATIONAL PERFORMANCE

### 7.1 Zero Check

7.1.1 With the probe out of the sample to be tested, depress the pressure sensitive switch once and then again when EMCEE is displayed.

7.1.2 The display will scroll through the test operation and the new conductivity data should read "0". The temperature of the environment will be displayed.

7.1.3 If a number other than "0" is displayed, this probably is an indication that the probe is contaminated and should be cleaned. (See Paragraph 9. Cleaning Procedures)

### 7.2 Over-Range Check – Conductivity is greater than 2K pS/m

7.2.1 Insert the probe into a sample of alcohol (isopropanol), depress the pressure sensitive switch once and then again when EMCEE is displayed.

7.2.2 At the end of the test period when the LED extinguishes, the display will scroll through and in lieu of displaying a numerical value for the conductivity the display will read "OVER" thus indicating that the measurement is over range and the meter is operating properly.

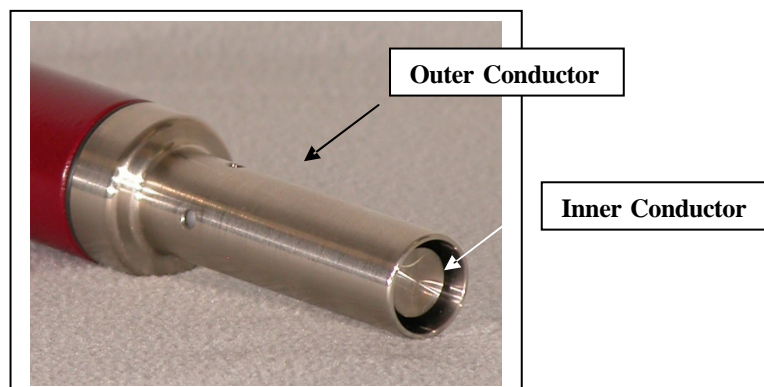


Figure 5 – Inner and Outer Conductors

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## 8.0 TEST PROCEDURE

CAUTION: This device must be grounded before and after introduction of the probe into the tank and remain grounded until after complete withdrawal from the tank.

8.1 To initiate a test, depress the pressure sensitive switch once and then again when EMCEE is displayed. The following will occur:

8.1.1 The red LED located just above the pressure sensitive switch (MC Logo) will begin to blink indicating that the meter is in the ready mode to perform a test.

8.2 Insert the probe into the sample up to and covering the four holes in the probe.

8.2.1 "READ NEW DATA" will be displayed.

8.2.2 The red LED will stop blinking and remain on indicating that a test is in progress. Hold the meter steady during the test period.

8.2.3 A broken line (-----) will blink on and off three times (3-seconds) during the test period.

8.2.4 At the end of the test period, the red LED will extinguish indicating that the test is complete and the measurements are stored in memory.

8.2.5 "NEW DATA PS/M" will be displayed

8.2.5.1 Value of measurement will be displayed – Example 325

8.2.5.2 The temperature of the sample will be displayed as follows:

8.2.5.2.1 Temperature in Degrees Centigrade - Example: 28.8C

8.2.5.2.2 Temperature in Degrees Fahrenheit - Example: 83.8F

Note: The new data (pS/m and temperature) will replace the previous data and will be stored in memory until another test is performed.

It is recommended that the probe be rinsed with alcohol followed by toluene prior to performing another test or storing the meter.

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## 9. CLEANING PROCEDURES

9.1 In normal use, the probe should be cleaned with toluene or a mixture of heptane and isopropanol and air-dried after use, to ensure that ionic materials absorbed on the probe during previous tests will not contaminate the sample and give an erroneous result. The probe can be disassembled by rotating the outer conductor counterclockwise. Typically, the probe is cleaned by rinsing it using alcohol followed by a toluene (or with some of the sample to be tested). Fig. 6 Shows the Probe disassembled.



9.2 If the cell is in contact with water and the instrument is switched on, an immediate off scale reading will be obtained. If the cell has been in contact with water, it shall be thoroughly rinsed with cleaning solvent, preferably isopropyl alcohol, and dried with a stream of air.

9.3 The meter may display a non-zero reading caused by condensation forming on the cell when the meter is taken from a cool, dry environment and subjected to hot, humid conditions. This condition can be avoided by storing the cell at a temperature 2 to 5°C in excess of the ambient temperature, when practicable

**Figure 6 – Probe Disassembled**

## 10. BATTERY REPLACEMENT

10.1 The Model 1153 meter has an internal battery check circuit. If the batteries are weak, the meter will turn on 'LOW BAT' will be displayed and the meter will turn off and not allow a measurement to be performed. If the batteries are too weak, the meter will not turn on.

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Note: The stored data will not be affected even if the batteries are replaced.

**WARNING!** To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

**WARNING!** To reduce the risk of ignition of a flammable or explosive atmosphere, batteries must be changed only in a location known to be non-hazardous. Do not mix new batteries with used batteries, or mix batteries from different manufactures.

Battery requirements: 3 - batteries Panasonic type CR 2016

10.2 When battery replacement is required, using the TOOL (See Fig. 2), remove the two screws (Allen head) that secure the top (cap) of the meter to the body. The screws are located on the lateral sides of the meter cap. (See Figs. 1 and 4)

10.2.1 Remove the cap. Some degree of force will be required to overcome the drag caused by the "O" ring.

10.2.2 The batteries (3) are located behind the printed circuit boards adjacent to the back of the meter. Fig. 2 Shows the location of the batteries in the meter.

10.2.3 Remove the batteries using the TOOL (See Fig. 2) that was furnished with the meter.

10.2.4 Insert the new batteries (the TOOL is not required). Assure that the polarity of the batteries is correct (positive faces to the back of the meter which is the side opposite of the display). See Fig. 2 for battery location in meter.

10.2.5 Replace the cap and secure it using the 2-screws.

10.2.6 Check by depressing the pressure sensitive switch once to assure that the batteries corrected the problem. If the display does not illuminate, this may be an indication that the meter requires factory repair.

## 11. PRECISION\*

The electrical parameters of the meter are factory calibrated to 1% of reading. However, due to variations in product measurement characteristics, the repeatability (r) and reproducibility (R) are as follows:

PS/M	r	R
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## DIGITAL CONDUCTIVITY METER

1	1	1
15	6	8
20	7	9
30	9	11
50	13	16
70	15	19
100	19	24
200	29	36
300	37	46
500	51	62
700	62	76
1000	77	94
1500	98	120

PS/M – picosiemens per meter

r = Repeatability - Maximum allowable difference between 2-successive measurements performed by the same operator using the same meter to test the same sample.

R = Reproducibility – Maximum allowable difference between 2-measurements performed on the same sample by 2-different operators using 2-different meters.

\*Precision is based on a Inter-laboratory Test (ILT) Program conducted in November 2004 under the auspices of the American Society of Test and Materials (ASTM) International. Since the Program was conducted at room temperature (23°C – 73.4°F) the precision may vary at other temperatures.

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