Electrical Level 1

Electrical Test Equipment 26112-14

Objectives

When trainees have completed this session, they should be able to do the following:

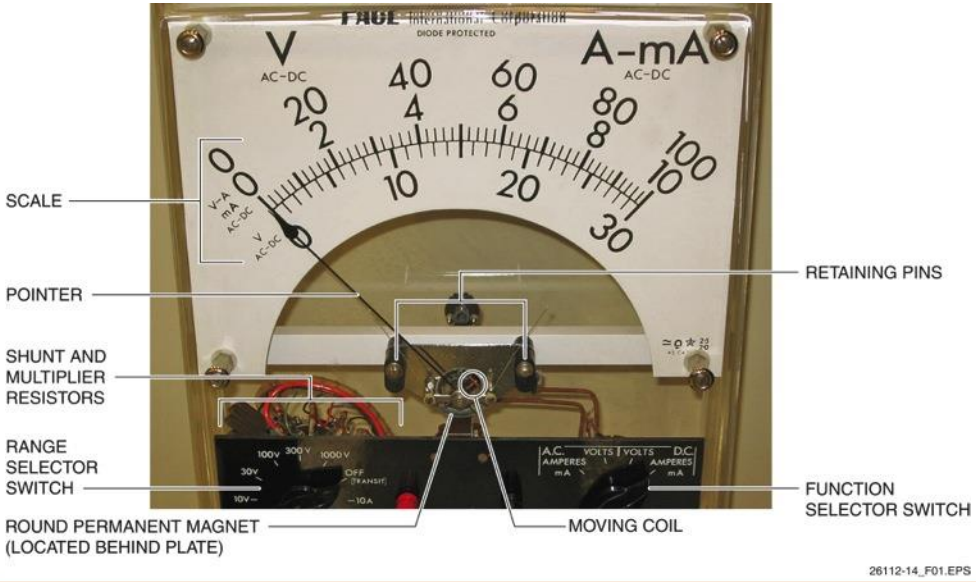
1. Explain the operation of and describe the following pieces of test equipment:
   - Voltmeter
   - Ohmmeter
   - Clamp-on ammeter
   - Multimeter
   - Megohmmeter
   - Motor and phase rotation testers
2. Select the appropriate meter for a given work environment based on category ratings.
3. Identify the safety hazards associated with various types of test equipment.

Performance Tasks

1. Measure the voltage in your classroom from line to neutral and neutral to ground.
2. Use an ohmmeter to measure the value of various resistors.

Introduction; Meters

- Analog meters use a d'Arsonval meter movement with a moving coil that indicates current flow on a calibrated scale.
- Shunt and multiplier resistors are used to extend the range of measurable values.
- Most modern meters are digital rather than analog.



Voltmeter

- A voltmeter is used to provide a precise voltage reading and is connected in parallel with the circuit. When using a voltmeter that is not autoranging, start with the highest scale and work downward.
- A voltage tester is used when a precise reading is not required.

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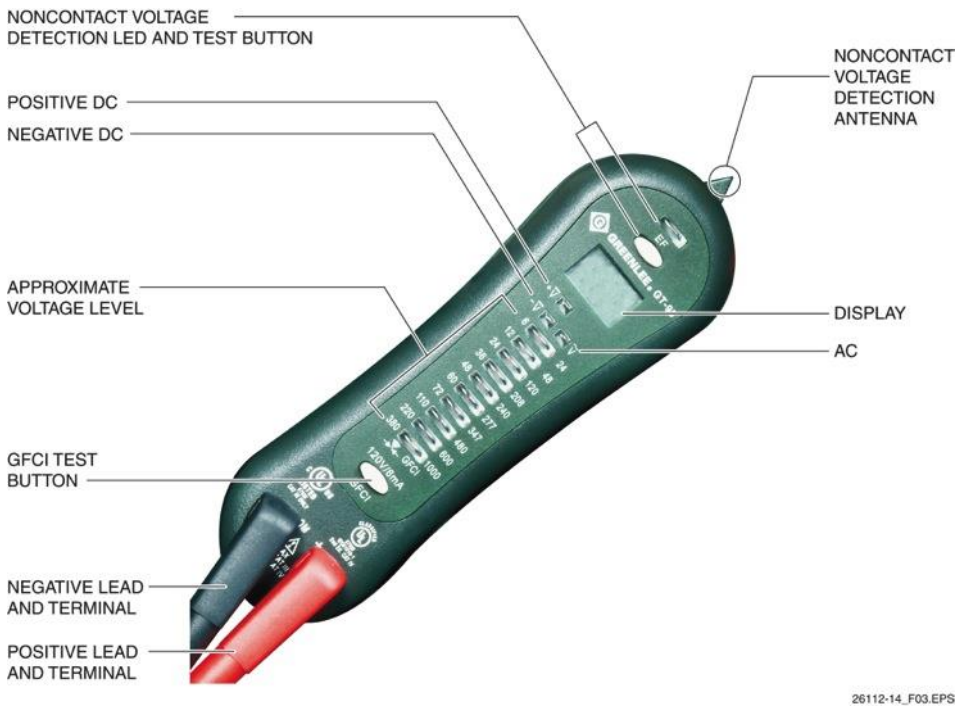
Performance Task

Have the trainees measure the voltage in the classroom from line to neutral and neutral to ground.

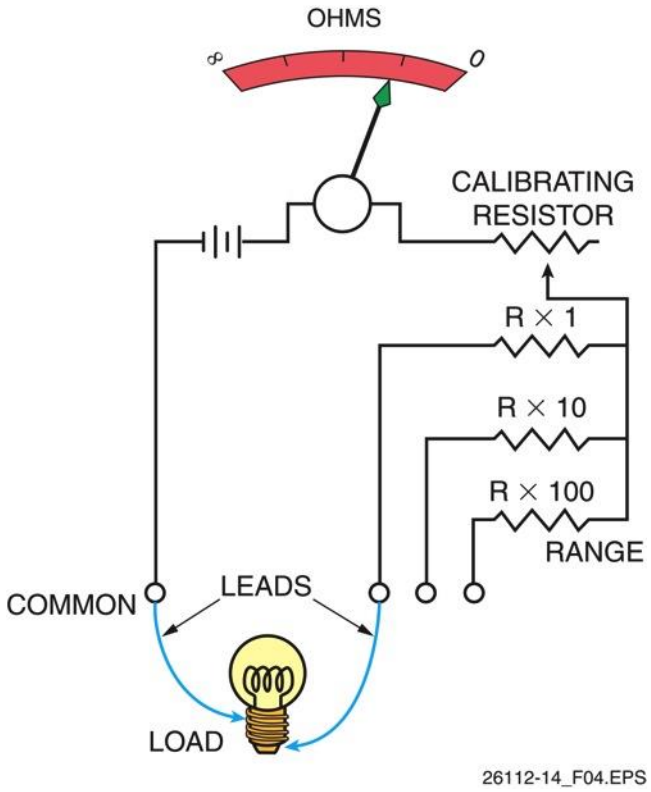
Multi-Function Voltage Tester

- Multi-function voltage testers provide additional features, such as digital readouts, GFCI test capability, and a noncontact test option.
- Always inspect meters before use and test the meter on a known energized source to ensure that it is operating correctly.



Ohmmeter

- Ohmmeters are used to measure resistance and are connected in series with the circuit to be tested.
- Always zero out an ohmmeter before making test measurements.



Performance Task

Have the trainees use an ohmmeter to measure the value of various resistors.

Ammeter

A clamp-on ammeter is clamped around a single conductor in order to measure current.

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Multimeter

- A multimeter or VOM (volt-ohm-milliammeter) is used to measure voltage, current, and resistance.
- Before using a VOM, you must select the proper voltage (AC or DC) and the value to be measured (volts, amps, or ohms).

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Digital VOM

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Clamp-On Multimeter

- Current clamps can be used with VOMs for measuring current above the milliamp range.
- Other features may include the ability to measure frequency, capacitance, and temperature. Some meters are also able to test diodes and transistors.

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Megohmmeter

- Large resistance values are measured using a megohmmeter.
- These meters are typically used to measure insulation resistance, such as in motor windings.
- Only qualified individuals may use test equipment. Always follow all safety precautions as well as the manufacturer's instructions for the meter in use.

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Hand-Crank Megohmmeter

Megohmmeters can be powered by alternating current, batteries, or hand cranking.

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Motor and Phase Rotation Testers

- The windings of a three-phase motor must be connected to the correct circuit phase in order to rotate properly.
- A motor rotation tester is used to identify the legs of a motor.

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Phase Rotation Tester

- A phase rotation tester is used to identify the phases of a circuit.
- A phase sequence is measured as clockwise or counter-clockwise rotation.

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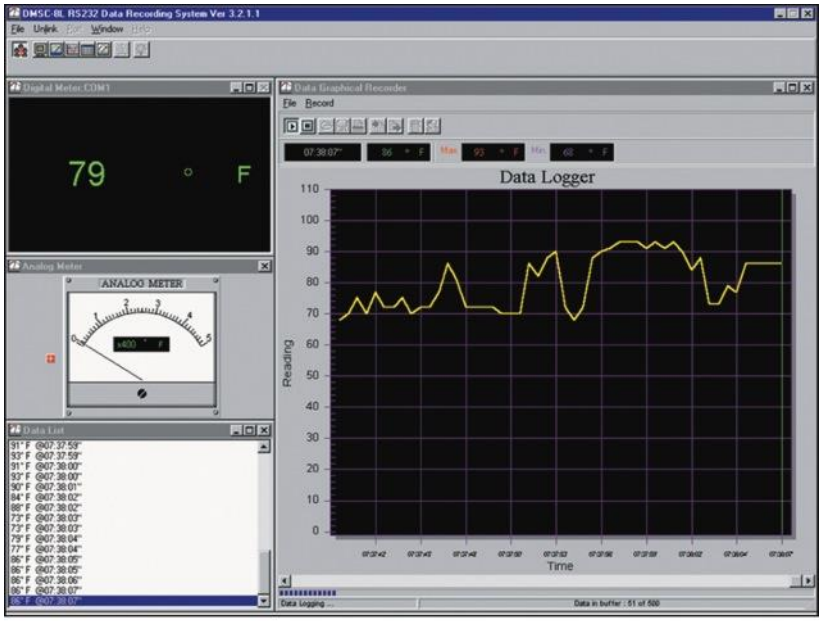
Recording Instruments

- Recording instruments are used to create a permanent record of various test measurements over time to determine such things as peak loads or voltage fluctuations.
- Some recording instruments upload data directly to computer systems to provide real-time data logging and graphing.



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Category Ratings; Safety

Safety systems are built into electrical test equipment to protect the user from transient voltage spikes. The potential for transients is divided into four overvoltage installation categories (CAT I, II, III, and IV).

Table 1 Overvoltage Installation Categories

Overvoltage Category	Installation Examples
CAT I	Electronic equipment and circuitry
CAT II	Single-phase loads such as small appliances and tools, outlets at more than 30 feet from a CAT III Source or 60 feet from a CAT IV source
CAT III	Three-phase motors, single-phase commercial or industrial lighting, switchgear, busduct and feeders in industrial plants
CAT IV	Three-phase power at meter, service-entrance, or utility connection, any outdoor conductors

Category Rating on a Typical Meter

Always select a meter rated for the highest potential exposure category.

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Wrap Up

3-2-1

3 – Write 3 important things learned during class

2 – Write 2 questions you have about the material

1 – Write 1 thought you had about the material

Next Session…

MODULE EXAM

Review the complete module to prepare for the module exam. Complete the Module Review as a study aid.