Knowledge Domain: Electrical Simple
Unit: Lighting/Indicators
Skill: Replacing Analog Meters

Tools and Parts Required:

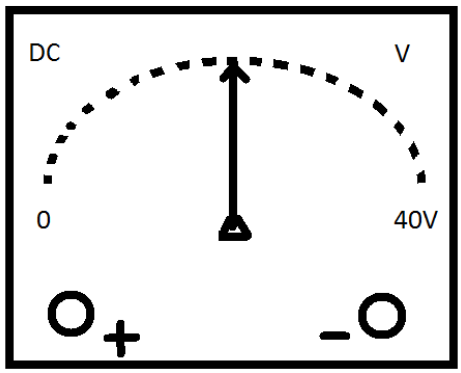
1) **Analog Meter that needs to be replaced**
2) **Variable voltage power supply**

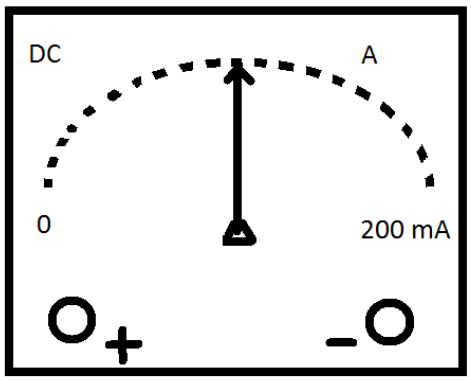
Introduction

An analog meter measures voltage and current in an electric circuit. An ammeter is an analog meter measuring current in an electric circuit. A voltmeter is an analog meter measuring voltage in an electric circuit. Analog meters use a scale and a pointer (needle) to indicate the current or voltage values.

Example

Below is a picture a voltmeter and an ammeter. (DC)





Identification and Diagnosis

Replace the analog meter when it stops working or indicates a voltage or amperage that is not correct. Replace the analog meter if the needle response very slowly. Aging slows down the pointer. The mechanism cannot easily be cleaned.

An analog meter display case might get dirty. Aging can also blur the scale of an analog meter. If the case is dirty or the scale is blurry, it is better to clean the meter than replace it. The scale can be replaced with a new piece of paper.

Procedure

1. Your instructor will give you an analog meter that needs to be replaced.
2. Determine whether the analog meter is a voltmeter or ammeter. A voltmeter will have letter 'V' on it. An ammeter will have letter 'A' on it. If there is no letter, measure the resistance. A voltmeter will have a very high resistance (more than 100k ohms). An ammeter will have a very low resistance (less than 1 ohm).
3. Determine whether the analog meter is used for AC measurements or DC measurements. Letters AC/ DC on the analog meter will give you this information.
4. If there is no letter, open the device in which the analog measure was installed.
5. For voltmeters, use a variable voltage supply and put DC voltages across the voltmeter meter.
6. Start by putting 100mV across the voltmeter and continue up to 1 or 2V.
7. If the meter moves, it is a DC volt meter (the most common). If the meter does not move, it might be AC.
8. For Ammeters, use the variable voltage power supply in a different configuration to control the
   number of amps being delivered. This will be a setting on the variable voltage power supply itself.
9. Start with 100 uA across the ammeter and go up to 1mA or 2mA.
10. If the meter moves, it is a DC volt meter (the most common). If the meter does not move, it might be AC.
11. Determine the range of the analog meter. The new analog meter should have the same range.

$$Range\ of\ an\ analog\ meter:$$

$$Maximum\ value\ on\ the\ scale\ of\ an\ analog\ meter - Minimum\ value\ on\ the\ scale\ of\ an\ analog\ meter$$

12. If there are no values on the analog meter, open the devices in which the analog measure was installed.
13. Turn the device on, and see what voltage/current is presented to the meter. Most Often minimum voltage and current will be zero and maximum when the device is on.
14. Use the formula in step 6 to calculate the range.
15. Determine lowest reading that an analog meter can measure. The lowest reading that the new analog meter can measure should be equal to or less than the value for the old analog meter.

$$Smallest\ reading\ of\ an\ analog\ meter = \frac{Range\ of\ an\ analog\ meter}{Number\ of\ divisions\ in\ the\ scale\ of\ an\ analog\ meter}$$

16. In some analog meters, you will find a value written as a unit of ohms per volt. This value is the internal resistance of an analog meter. Note down this value. The new analog meter should have the same internal resistance.

Exercise

1. Your instructor will give you the analog meter that needs to be replaced.
2. Follow the procedure above and determine the specification of the new analog meter.
3. If you cannot find the exact match for the original analog meter, try finding something with physically different size. You can even find a cheap digital meter for the replacement if the precision is still the same as the original analog meter.
4. Find out what the original analog meter was measuring.
5. Make a piece of paper which will describe the same and use it on the new analog meter.
6. Show your findings to your instructor.
7. Your instructor must verify your work before you proceed.

Preventative Maintenance and Calibration

Always calibrate every medical device before returning it to use.