Power Quality Measurement Equipment II

Multimeters

After initial tests of wiring integrity, it may also be necessary to make quick checks of the voltage and/or current levels within a facility. Overloading of circuits, undervoltage and overvoltage problems, and unbalances between circuits can be detected in this manner. These measurements just require a simple multimeter. Signals used to check for these include

- Phase-to-ground voltages
- Phase-to-neutral voltages
- Neutral-to-ground voltages
- Phase-to-phase voltages (three-phase system)
- Phase currents
- Neutral currents

The most important factor to consider when selecting and using a multimeter is the method of calculation used in the meter. All the commonly used meters are calibrated to give an rms indication for the measured signal. However, a number of different methods are used to calculate the rms value. The three most common methods are

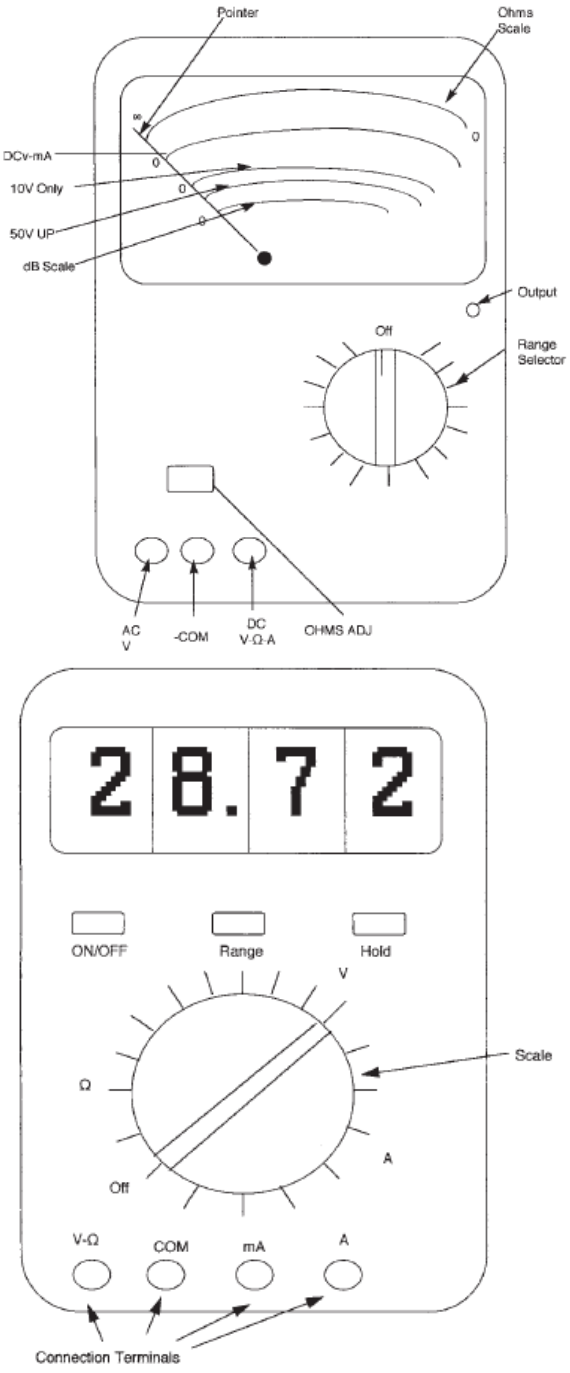

Figure 5.2 (a) Non digital multimeter **(b)** Digital multimeter (DMM)

Peak method

Assuming the signal to be a sinusoid, the meter reads the peak of the signal and divides the result by 1.414 (square root of 2) to obtain the rms.

Averaging method

The meter determines the average value of a rectified signal. For a clean sinusoidal signal (signal containing only one frequency), this average value is related to the rms value by a constant.

True rms

The rms value of a signal is a measure of the heating that will result if the voltage is impressed across a resistive load. One method of detecting the true rms value is to actually use a thermal detector to measure a heating value. More modern digital meters use a digital calculation of the rms value by squaring the signal on a sample by sample basis, averaging over the period, and then taking the square root of the result.

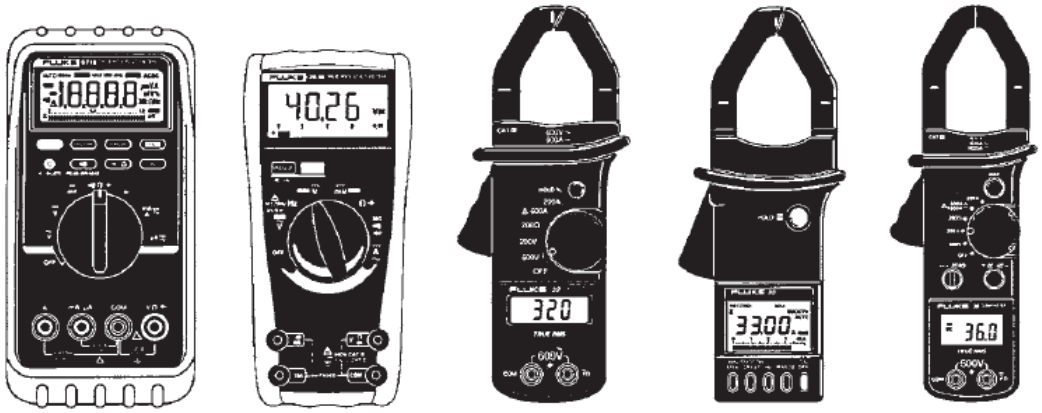

Figure 5.3 True rms digital multimeters

These different methods give the same result for a clean, sinusoidal signal but can give significantly different answers for distorted signals. This is very important because significant distortion levels are quite common, especially for the phase and neutral currents within the facility.

Figure 5.4 Graphical display multimeter

5.3.4 Digital Cameras

Photographs are extremely useful for documentation purposes. Those conducting the measurements often get distracted trying to get instruments to function properly and tests coordinated. They are rushed and fail to write down certain key data that later turn out to be important. Unfortunately, human memory is unreliable when there are dozens of measurement details to remember. The modern digital camera has become an indispendable tool when taking field measurements. It is a simple matter to take photographs to document the tests. The photographer can immediately tell if the shot failed and retake it with a different exposure. Typical items to record photographically during field measurements include

1. Nameplates of transformers, motors, etc.
2. Instrumentation setups
3. Transducer and probe connections
4. Key waveform displays from instruments
5. Substations, switchgear arrangements, arrester positions, etc.
6. Dimensions of key electrical components such as cable lengths

Video cameras are similarly useful when there is moving action or random events. For example, they may be used to help identify the locations of flashovers. Many industrial facilities will require special permission to take photographs and may place stringent limitations on the distribution of any photographs.

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