Power Quality Measurement Equipment IV

Harmonic Analyzers

Harmonic analyzers have several capabilities. They capture harmonic waveforms and display them on a screen. They calculate the *K* factor to derate transformers and the total harmonic distortion (THD) in percent of the fundamental. They also measure the corresponding frequency spectrum, i.e., the harmonic frequency associated with the current and voltage up to the fiftieth harmonic.

Figure 5.8 Hand-held harmonic analyzer

They display the harmonic frequency on a bar graph or as the signal's numerical values. Some measure single-phase current and voltage while others measure three-phase current and voltage. All of them measure the power factor (PF). The power factor provides a measurement of how much of the power is being used efficiently for useful work. Some can store data for a week or more for later transfer to a PC for analysis. This makes them powerful tools in the analysis of harmonic power quality problems.

Harmonic analyzers come as small hand-held units like the one shown in Figure 5.8 for on-the-spot power quality surveys or as larger power quality monitors for long-term or permanent installation. They offer the same retrieval capabilities that were described for the disturbance analyzers using floppy disks, pagers, or the Internet.

5.3.8 Flicker meter

Flicker meters measure flicker in terms of the fluctuating voltage magnitude and its corresponding frequency of fluctuation. Electric arc furnaces and arc wielding usually cause lights to flicker. How to convert the voltage and the frequency of fluctuation into a standard parameter that defines the flicker limit becomes a problem. The difficulty comes from correlating the frequency of the flicker to what the human eye detects. Flicker tests illustrate this problem.

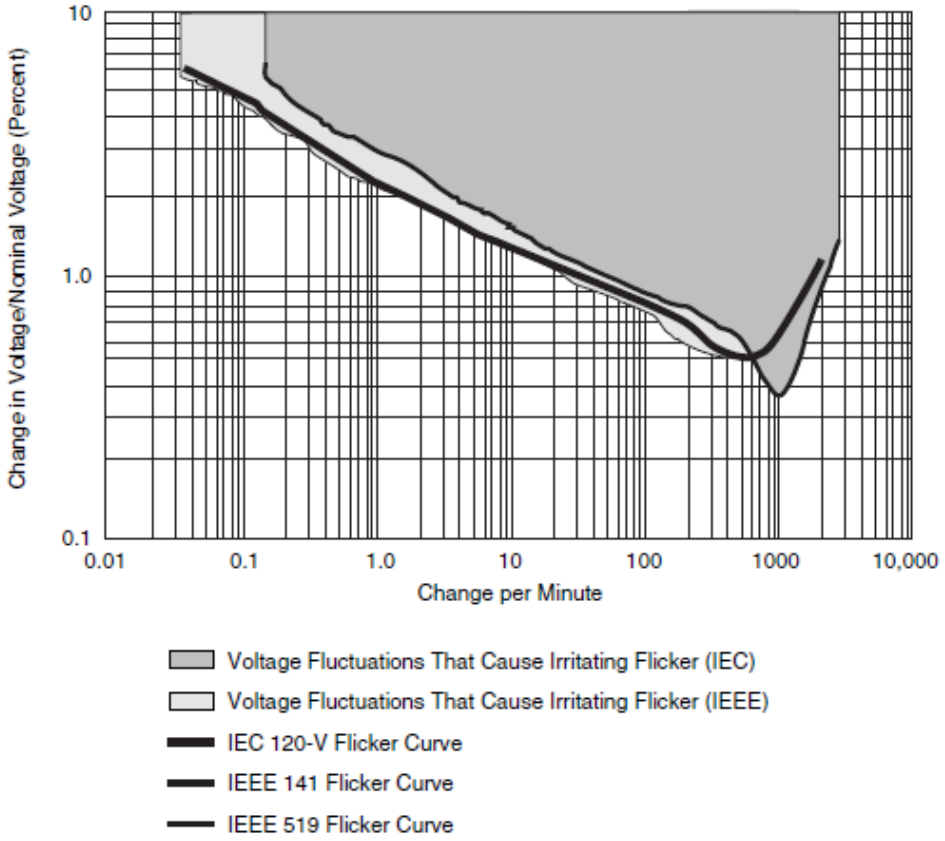

Figure 5.9 IEC and IEEE flicker curves for incandescent lights

Results of flicker tests depend on two variables. The first variable is the subjective reaction of the person involved in the test. The second variable is whether the flickering light is incandescent or fluorescent. The frequency range of fluctuations identified by the human eye varies from 1 to 30 Hz. Consequently, the subjectivity of the flicker tests makes it difficult to develop flicker standards. Presently, the power quality industry lacks an international standard on flicker. Many utilities have developed with their customers their own standards. Both the Institute of Electrical and Electronics Engineers (IEEE) and the International Electrotechnical Commission (IEC), have developed flicker curves for incandescent lamps, as shown in Figure 5.9.

The IEC has developed a flicker meter. Besides the IEC flicker meter, several instrument manufacturers sell flicker meters, like the one shown in Figure 5.10, commercially. They use software to convert the flicker voltage fluctuations into statistical quantities called *P*st and *P*lt. *P*st is the short-term flicker severity index, while *P*lt is the long term flicker severity index. Flicker meters take measurements automatically at 10-min intervals. A single *P*st is calculated every 10 min. A *P*st greater than 1 indicates that the flicker will irritate 50 percent of the people exposed to it. The *P*lt is a combination of 12 *P*st values. IEC Standard 1000-3-7 has set standards

for *P*st and *P*lt for medium voltage (MV) of less than 35 kV, high voltage (HV) of greater than 35 kV but less than 230 kV, and extra-high voltage (EHV) of greater than 230 kV.

Figure 5.10 Flicker meter

Source : http://nprcet.org/e%20content/Misc/e-Learning/EEE/IV%20YEAR/EE1005%20-%20POWER%20QUALITY.pdf