FINDING THE SOURCE of the FLICKERING LIGHTS

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Flicker is the perceived change in light output from a lamp, caused by the fluctuation of the supply voltage at an office, factory, or residential home. The source can be from short duration disturbances, such as spot welders and motor starts, or longer duration disturbances, such as electric arc furnaces. As little as a quarter of a percent voltage fluctuation at 9Hz can be perceived as light flicker. While flickering isn't a new power quality phenomena, it has been receiving more attention lately, as electric utilities continue to become more customer-service oriented. Since flicker generally does not interrupt a process or cause equipment failures, it hasn't received the attention that sags, harmonics and transients have. However, as businesses realize that their employees are their most valuable assets, keeping those "knowledge assets" running at full productivity is increasingly important.

Like analysis of sags, determining if the monitoring point is upstream or downstream from a flickering source is usually the first step in trying to find the source. It can be determined most times by examining the variation in the magnitude of the current change at the time that the voltage was fluctuating. If there is very little current change relative to the voltage change, then the disturber is probably upstream from the monitoring point. Conversely, a large change in current accompanied by the voltage fluctuation would point to the disturber being downstream from the monitoring point. The following case study illustrates this.

Case Study

The monitoring was done in the second floor of an end unit of an office-condo complex in the Washington DC area. The office space consisted of a reception and meeting area, two private offices, a kitchen area and a bathroom. Entire area was powered from a single three-phase 208/120V wye feed from transformer bank located right below and outside the office. A light flicker problem had been noticeable for a number of years. It was most visible in the bathroom and outside hallway.

The source was undetermined, though HVAC units on the roof were suspected. Monitoring was done for only a couple of minutes before the direction of the disturber was determined. The voltage of the one phase varied between 118.3 and 126.3Vrms, while the current varied 23.4-26.8 Arms. Other phase varied from 115.3V-123.3Vrms while the current varied 17.2-19.4 Arms. The load impedance was fairly constant (5 ohms phase A, 6 ohms phase B)

Source impedance was changing significantly (0.4-0.5 variation in ohms on both phases). There was very little change in current levels for the resulting voltage fluctuations. Hence, the disturber was in the direction of the source or voltage

supply side. Since the monitoring was being done at the breaker panel, the source of the flicker was determined to be upstream, or outside the building.

The graph shows the two voltages in the top of the timeplot, and the currents in the bottom of the same plot.

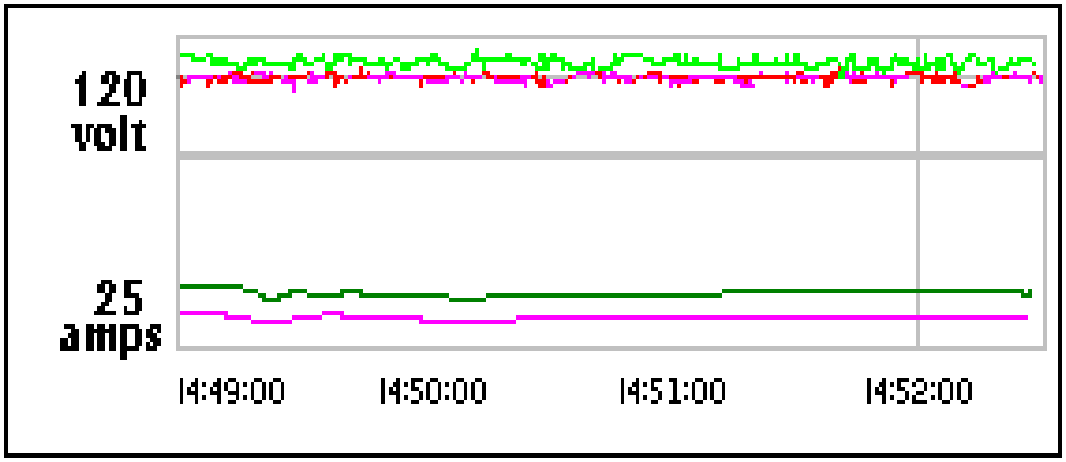

Figure 2 - Timeplot of Voltage and Current.

The waveforms of the voltage and current are shown below, with the voltage being the larger waveform. The variation in the voltage waveform is most apparent in the bottom half of the picture.

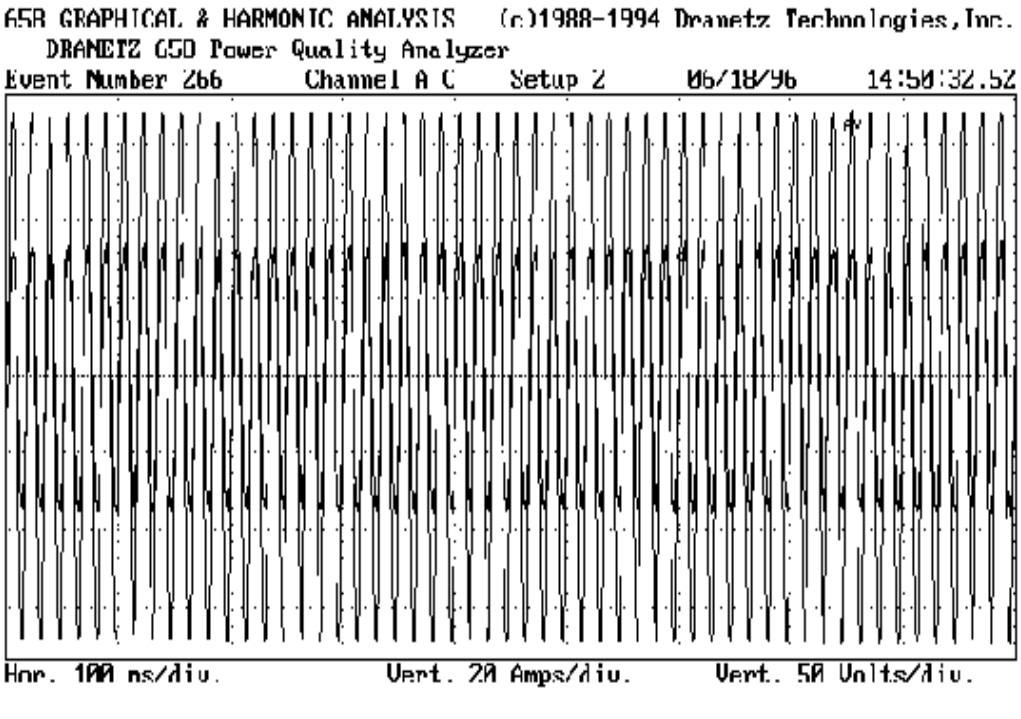

Figure 3. Voltage and Current Waveforms.