



# PQSoft Case Study

## High Neutral-to-Ground Voltages

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Author:	Electrotek Concepts, Inc.	Access Level	PQSoft Subscriber

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Miscellaneous2			
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### Abstract:

An office complex was experiencing continual operational problems with some of their electronic equipment not protected by power conditioning equipment. The equipment would periodically exhibit strange behavior.

An infrared heat detector was used to locate loose wiring connections, and once these connections were fixed, the neutral-to-ground voltages disappeared as well as the equipment problems.

This case presents the results of measurements and analysis of electronic equipment problems.

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**RELATED STANDARDS**

IEEE Standard 1159

**GLOSSARY AND ACRONYMS**

CVT                                      Constant Voltage Transformer  
CBEMA                                    Computer and Business Equipment Manufacturers Association

## PROBLEM STATEMENT

An office complex was experiencing continual operational problems with some of their electronic equipment not protected by power conditioning equipment. The equipment would periodically exhibit strange behavior.

### What's Been Done So Far

The facility engineer has contacted the utility and the utility could not correlate any of the equipment problems with any power system faults or other events. He concludes that the problem must be internally generated.

## DEVELOP MONITORING PLAN

A thorough monitoring plan was developed to characterize both disturbance events and harmonic distortion levels, since the cause of the problems were unknown.

A disturbance analyzer was installed at the service entrance to determine if voltage variations such as sags or transients were causing the equipment problems. Figure 1 shows an example of disturbance event that was recorded. During the monitoring period, many neutral-to-ground impulses and surges were recorded at the service entrance. No voltage sags or other events were recorded.

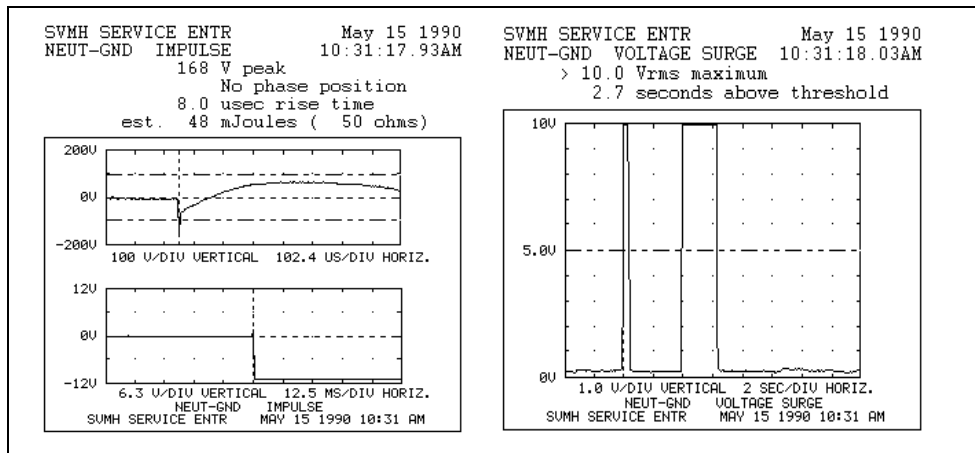


Figure 1 - Disturbance Monitoring Results

A spectrum analyzer was also installed at the service entrance to record harmonic distortion levels. Both the voltage and current distortion levels (Figure 2) were very low and should not be causing any equipment problems.

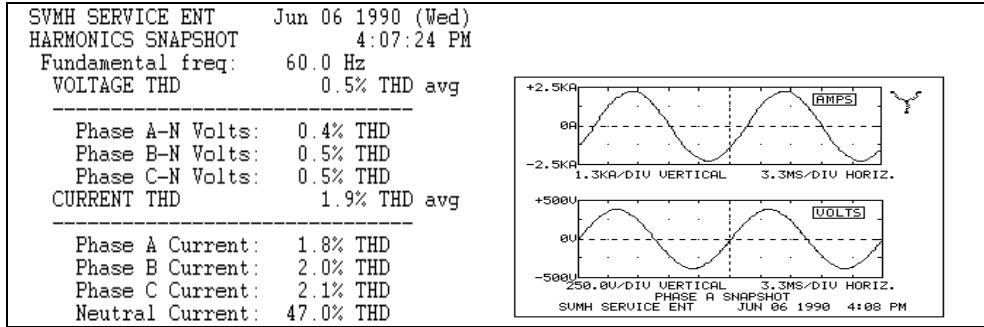


Figure 2 - Harmonic Distortion Results

## STUDY METHODOLOGY

Both harmonic distortion and voltage sags have been ruled out as possible causes of equipment problems. Determining the causes of the neutral-to-ground impulses and identifying possible methods to control these impulse levels will probably solve the equipment problems.

## SUMMARY

Over the years, vibrations, thermal stresses and building improvements lead to loose connections in wire terminations. On current-carrying conductors, loose connections lead to arcing and sparking and result in high frequency transients. On neutrals, loose connections result in abnormally high or low voltages and result in an unstable reference for highly sensitive electronics.

An infrared heat detector was used to locate loose wiring connections, and once these connections were fixed, the neutral-to-ground voltages disappeared as well as the equipment problems.

## REFERENCES

Grounding and Shielding in Facilities, R. Morrison and W. H. Lewis, John Wiley and Sons, Inc., 1990.