

# Industrial Power System Services

*Practical Experience  
to Support Plant Operations  
from Systems Engineering*

System Studies

On-Site Harmonic, Transient  
and Voltage Flicker Measurements

Power Verdict™ Series  
Analysis Software

Workshops

Harmonic and Voltage Flicker  
Measurement Equipment



**COOPER**

Cooper Power Systems

## SYSTEM IMPROVEMENTS

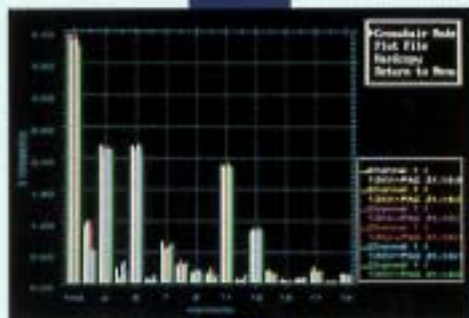
- ✓ OPTIMIZE DESIGN TO AVOID UNNECESSARY EXPENSE.
- ✓ SELECT PROPER EQUIPMENT RATINGS.
- ✓ INVESTIGATE EQUIPMENT FAILURES OR MISOPERATIONS.
- ✓ EVALUATE AND MODERNIZE EQUIPMENT IN THE OLD SYSTEM.
- ✓ ANALYZE THE EFFECT OF MODIFICATIONS OR ADDITIONS.

### NEW

- ✓ SPECIFY THE DESIGN AND OPERATION OF NEW POWER SYSTEM.



This Harmonic Spectrum Plot shows data captured during a field measurement. The V-MONITOR™ system is a powerful tool for doing on-site harmonic measurements.



You've seen similar action lists. We share your challenges in improving operating efficiency. As part of the Thomas A. Edison Technical Center, we work with Cooper Power Systems' product groups to provide power system studies to industry.

These studies ensure that the industrial power system equipment planned and installed is properly specified. Power system studies have an excellent cost/benefit ratio for both new installations and existing systems.

### HARMONICS

The V-HARM™ program will determine resonant frequencies, and harmonic voltage and current levels throughout your system. Harmonic mitigation techniques can be analyzed to bring distortion levels within guidelines established by IEEE-519 and other standards.

### FILTER DESIGN

Potentially damaging harmonics in a system can be eliminated by designing a properly tuned harmonic filter using the V-HARM program. Cooper Power Systems can supply the complete hardware package, making Cooper your single source supplier for system studies, filter specification and hardware.

### SWITCHING TRANSIENTS

The Transient Network Analyzer (TNA) is used for studying low frequency transients associated with energizing or de-energizing operations using analog simulations, and modeling systems where ferroresonance is suspected. High frequency transients are analyzed with digital tools such as the Alternate Transients Program or the Electromagnetic Transients Program.

### VOLTAGE FLICKER

New or existing systems should be analyzed where voltage flicker problems are suspected. Field measurements can also be performed to document system operations and identify problem areas. Corrective measures can then be examined to ensure that voltage flicker is below perceptible levels.

### SHORT CIRCUIT

Short Circuit studies are performed to calculate the available fault currents at various points on a network for the evaluation of protective devices and other equipment on the system.

### POWER FACTOR CORRECTION

Power Factor studies are performed to examine power factor correction requirements and determine voltage regulation.

## PROTECTIVE DEVICE COORDINATION

Coordination studies are required to select or verify fuse, circuit breaker and relay characteristics. Corrective measures are suggested where satisfactory coordination is not achieved. The V-PRO® package provides an extensive protective device database and an expert system to expedite the examination of complex systems.

## MOTOR STARTING

Motor-starting studies provide data to help you select the best starting method, the proper motor type, and the required system design for minimizing the impact of motor starting on your overall system.

## HARMONIC MEASUREMENTS

On-site harmonic measurements provide the data needed to verify digital system models for the design of filters or other harmonic mitigating measures. Sources of harmonics can be identified through line flows. System resonant frequencies, if present, can also be identified. The V-MONITOR, custom designed for power system harmonic data acquisition, storage and display, is normally used during field investigations.

## TRANSIENT MEASUREMENTS

On-site measurements of system transients may be needed to help determine the cause of equipment failures and/or verify the proper operation of new systems. Field test personnel provide rapid response in most emergency situations.

## PC SOFTWARE

The Power Verdict series of personal computer software provides a set of analytical tools that work from a common database if you would like to perform your own studies.

## POWER SYSTEM WORKSHOPS

Distribution Voltage Regulation, Overcurrent Protection, Over-voltage Protection, Harmonics, Power Quality, Capacitor Application and Distribution Analysis workshops are offered around the world. Cooper Power Systems' workshops are known for their technical content, unique hands-on demonstration equipment and practical presentation format.

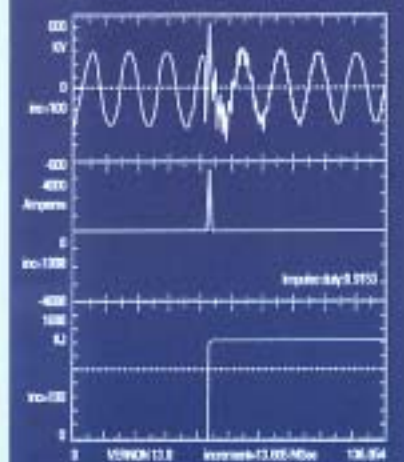
## MEASUREMENT EQUIPMENT

The V-METER II™, V-MONITOR II™, V-Flicker™ Measurement System, and the V-Flicker™ Meter are premium measurement tools that enable you to perform your own system tests.

Overvoltage  
during a restrike

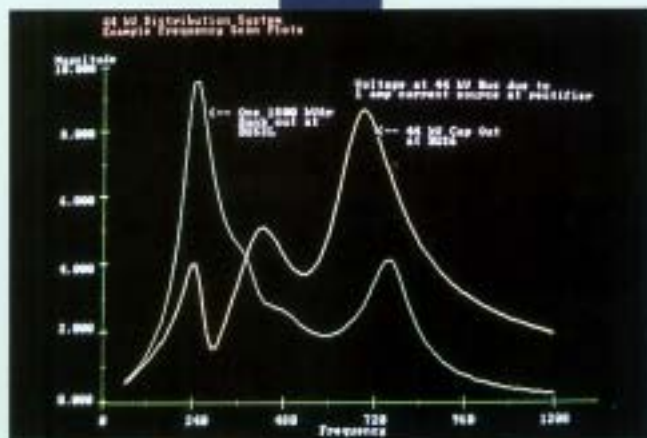
Arrester discharge  
current

Arrester energy

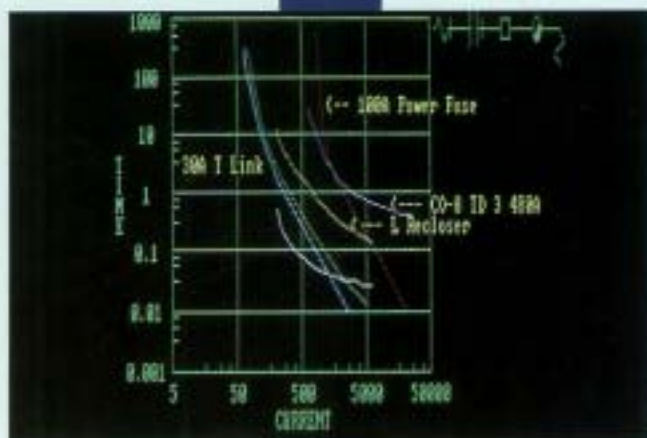


## TRANSIENT NETWORK ANALYZER

De-energizing 270 MVAR grounded wye capacitor bank (345 kV) restrike on phase A of circuit breaker



System frequency scan with and without a filter using the V-HARM program



Time-current characteristic curves generated with the V-PRO program quickly show coordination intervals



Ideally, Industrial Power System Studies should be performed prior to a system change or addition. In some cases, however, studies are performed to solve problems experienced by large power consumers. Contact the Systems Engineering Group at Cooper Power Systems for additional information.

SITUATION	STUDY	TYPICAL SOLUTION
<ul style="list-style-type: none"> <li>• Low power factor</li> <li>• Voltage problems</li> <li>• Demand penalties</li> <li>• High system losses</li> </ul>	<ul style="list-style-type: none"> <li>• Power factor correction</li> </ul>	<ul style="list-style-type: none"> <li>• Capacitor bank specification and installation</li> </ul>
<ul style="list-style-type: none"> <li>• Excessive voltage distortion</li> <li>• Capacitor failures and fuse misoperations</li> <li>• Transformer and motor heating below rated load</li> <li>• Excessive transformer noise</li> </ul>	<ul style="list-style-type: none"> <li>• Harmonic analysis and/or harmonic field measurements</li> </ul>	<ul style="list-style-type: none"> <li>• Filter specification and installation or system reconfiguration</li> </ul>
<ul style="list-style-type: none"> <li>• Excessive counts on surge arresters</li> <li>• Equipment failure</li> </ul>	<ul style="list-style-type: none"> <li>• Transient analysis and/or transient field measurements</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of malfunctioning switch or breaker</li> <li>• Specification of surge protection requirements</li> </ul>
<ul style="list-style-type: none"> <li>• Failure of protective device to interrupt fault current</li> </ul>	<ul style="list-style-type: none"> <li>• Short circuit study</li> </ul>	<ul style="list-style-type: none"> <li>• Specification of protective device ratings required</li> </ul>
<ul style="list-style-type: none"> <li>• Improper protective device operation</li> <li>• Unexplained circuit breaker operation</li> </ul>	<ul style="list-style-type: none"> <li>• Protective device coordination study</li> </ul>	<ul style="list-style-type: none"> <li>• Specification of device types, locations and settings</li> </ul>
<ul style="list-style-type: none"> <li>• System voltages or currents outside of ratings</li> </ul>	<ul style="list-style-type: none"> <li>• Power flow study</li> </ul>	<ul style="list-style-type: none"> <li>• Specification of equipment ratings for steady-state loads</li> </ul>
<ul style="list-style-type: none"> <li>• Excessive voltage drops during motor starting</li> <li>• Excessive motor starting time</li> <li>• Perceptible voltage flicker</li> </ul>	<ul style="list-style-type: none"> <li>• Motor starting study</li> <li>• Transient analysis and/or transient field measurements</li> <li>• Flicker Measurements</li> </ul>	<ul style="list-style-type: none"> <li>• Specification of system and/or motor starting requirements</li> <li>• Changes to SVC systems, modify filter systems</li> </ul>

#### INDUSTRIAL STUDIES

Harmonics/Filter Design  
 Transient Overvoltages  
 Power Factor Correction  
 Power Flow/Short Circuit/Stability  
 Protection Coordination  
 Motor Starting/Flicker  
 Ferroresonance

#### ON-SITE MEASUREMENTS

Harmonics  
 Switching Transients  
 Voltage Flicker

#### MEASUREMENT EQUIPMENT

V-METER II™ Portable Harmonics Meter/Controller  
 V-MONITOR II™ PC-Based Harmonics Monitor  
 V-Flicker™ Portable Measurement System  
 V-Flicker™ Rack-Mounted Meter

#### POWER EQUIPMENT YOU CAN DEPEND ON

Switchgear  
 Capacitors  
 Transformers  
 Voltage Regulators  
 Overcurrent Protection Devices  
 Overvoltage Protection Devices  
 Construction Materials  
 Technical Services  
 Local Support

#### WORKSHOPS

Power Quality  
 Power System Harmonics  
 Capacitor Application  
 Overvoltage Protection  
 Overcurrent Protection  
 Distribution Analysis  
 Transformer Application and Protection  
 Distribution Voltage Regulation  
 Symmetrical Components

#### PC SOFTWARE

V-HARM™ Harmonics Simulation  
 V-NET™ Network Fault Analysis  
 V-PRO® Overcurrent Device Coordination  
 V-CAP™ Capacitor and Regulator Application  
 V-BASE™ Power System Database Manager  
 V-FLOW™ Network Power Flow  
 V-GRAPH™ One-Line Diagram



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M15M894 © 1994 Cooper Power Systems, Inc.  
 Bulletin 91002 August, 1994 Supersedes 2.92  
 Printed in USA