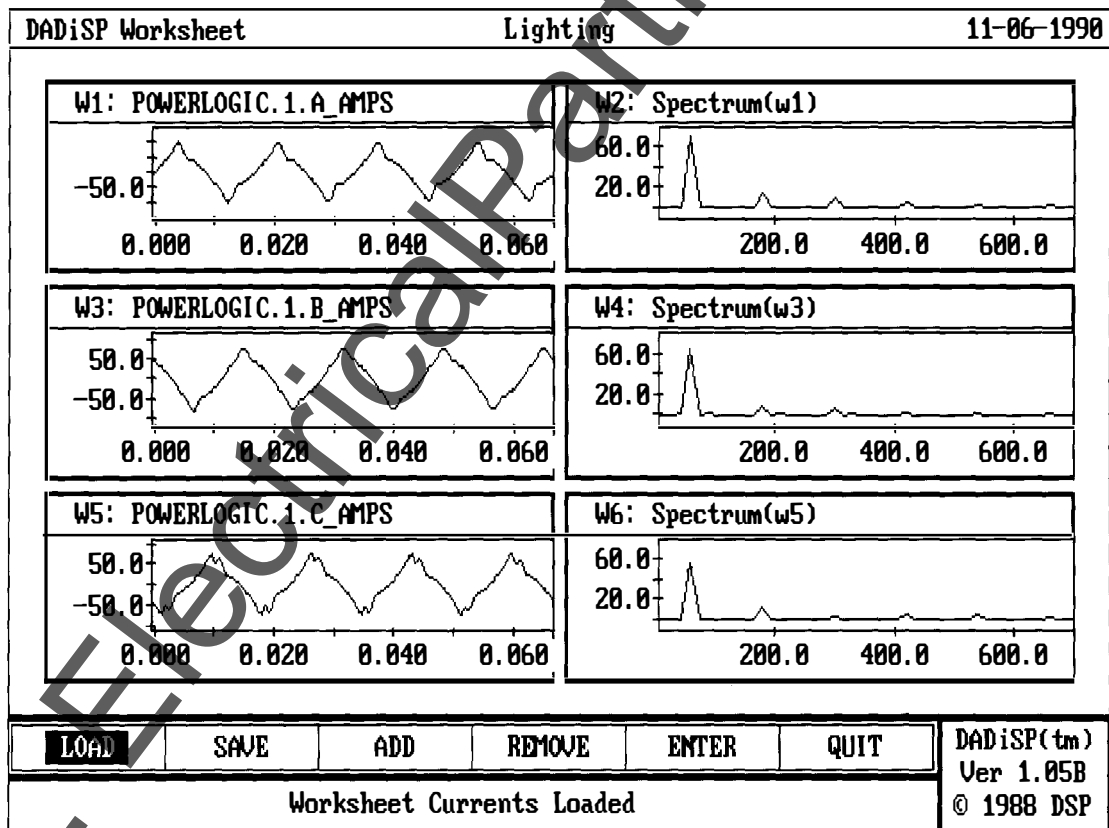


DESCRIPTIVE BULLETIN

Bulletin DB-107

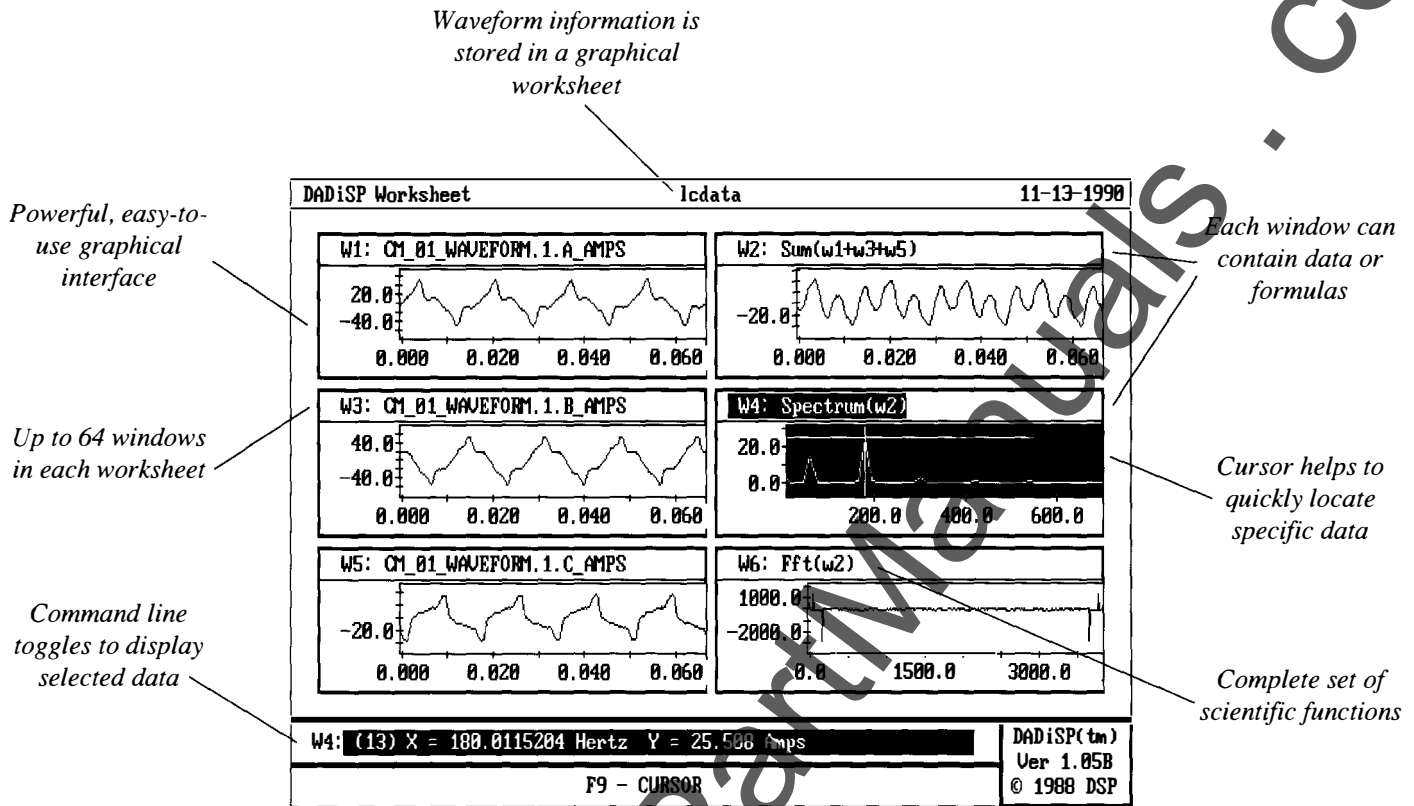
December, 1990

PowerLogic™ Waveform Analysis Software



SQUARE D COMPANY

Waveform Analysis Software



Solving Power Quality Problems Begins With the PowerLogic™ System

Waveforms of system voltages and currents are required to identify and solve power quality problems. The PowerLogic™ system not only provides complete waveform information via Circuit Monitors, it also provides powerful, personal computer based Waveform Analysis Software to allow extensive analysis including Fourier, spectrum, peak analyses and much more. With this easy-to-use software, waveforms can be analyzed to determine neutral currents, harmonic distortion levels, crest factors, and other system

information vital in solving power quality problems. The PowerLogic system provides a total system approach in identifying and solving power quality problems associated with modern electrical systems.

Friendly Worksheet/Spreadsheet Interface

The interface of the Waveform Analysis Software can be described as a graphics-based spreadsheet, or worksheet. Each waveform, or any series of discrete data points, is displayed in a graphical window, or cell. Up to 64 windows can be included in a single 'spreadsheet' complete with formulas, tables, and

more. Selection of colors, scaling, zooming, and other operational characteristics of the windows can be set by the user as desired.

Compatible With PowerLogic Application Software Series

Waveform information which has been captured using any of the PowerLogic Application Software packages may be directly imported into the Waveform Analysis Software. An instruction bulletin offering a complete set of step-by-step instructions for capturing waveforms and importing them into the Waveform Analysis Software is provided with the package.

DADiSP is a trademark of DSP Development Corporation. PowerLogic is a trademark of Square D Company.



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FEATURES

Fourier Transform and Related Functions

- Discrete Fourier Transform; Real & Imaginary
- Inverse Discrete Fourier Transform; Real & Imaginary
- Fast Fourier Transform (FFT); Real & Imaginary
- Inverse FFT; Real & Imaginary
- FFT; Magnitude & Angle
- Inverse FFT; Magnitude & Angle
- Convolution
- Auto-Correlation
- Cross-Correlation
- Hamming Window
- Hanning Window
- Kaiser Window
- Magnitude of Normalized FFT
- Power Spectral Density

Peak Analysis

- Find Minimum/Maximum of Signal
- Find First/Next Peak
- Find Previous Peak
- Find First/Next Valley
- Find Previous Valley
- Display Values of Nth Point
- Display Minimum/Maximum of Signal

Signal and Scalar Math

- Addition
- Multiplication
- Subtraction
- Division
- Exponentiation
- Averages (of N signals)
- Sums (of N signals)

- Concatenates signals
- Absolute Value
- Complex Roots (scalar)
- Complex Roots (signal)

Signal Display and Manipulation

- Compress Signal Horizontally/Vertically
- Cross-hairs On/Off
- Display Delta-x Value
- Delay Signal by N Points
- Expand Signal Horizontally/Vertically
- Turn Grid On/Off
- Solid or Dotted Grid
- Move Cursor by Time
- Move Cursor N Points
- Put Cursor on Time in Signal
- Move Cursor to Nth Point
- Plot Another Signal in Window
- Display Uninterpolated Signal
- Scales On/Off
- Scroll Display Left/Right/Up/Down
- Change Delta-x
- Set Horizontal/Vertical Units
- Expand Window to Fill Screen
- Shrink Window to Normal

Trigonometric Functions

- Operates in Degrees and Radians
- Sine
- Cosine
- Tangent
- Secant
- Cosecant
- Cotangent
- Arcsine
- Arccosine

- Arctangent
- Arcsecant
- Arccosecant
- Arccotangent
- Hyperbolic of all functions above
- Exponentials
- Common/Natural Logarithms
- Square Root
- Sine Function ($\sin(x)/x$)

Generated Signals

- Sine
- Cosine
- Tangent
- Secant
- Cosecant
- Cotangent
- Arcsine
- Arccosine
- Arctangent
- Arcsecant
- Arccosecant
- Arccotangent
- Hyperbolics of All functions above
- Square Wave
- Triangle Wave
- Exponential Signal
- Common Logarithmic Signals
- Natural Logarithmic Signals
- Square Root Signals
- Lines
- $\sin(x)/x$ Curves
- Signals from Tables
- Random Signals
- Hamming Window
- Hanning Window
- Kaiser Window

Macro Support

The Waveform Analysis Software provides several standard macros. Additionally, the user may develop custom macros to fit specific needs. Macros may call other macros ('nested') providing the flexibility to create virtually unlimited macro variations. Macros can be created and stored in standard ASCII file format. Any worksheet can access any standard or custom macro.

Simplify Analysis Using Command Files

Command files are standard ASCII files containing line-by-line commands to help automate many spreadsheet operations and analysis procedures. Command files can also be developed to guide users through the process of analyzing various operations of the program.

Windows Can Contain Data, Macros or Formulas

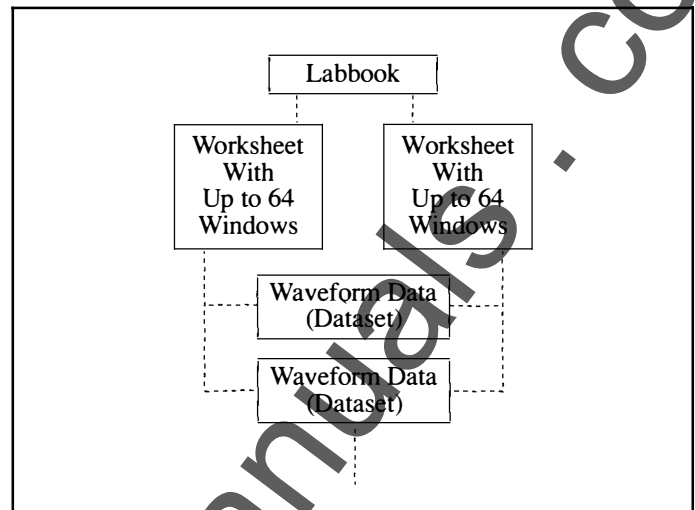
Each window in a worksheet can contain waveform data, a series of data points, various program functions and macros, or scientific formulas of varying complexity. Analysis of window information is performed by simple keyboard commands and the results placed in appropriate windows. Formulas ranging from simple to complex may be used to modify window contents, extract data from one window and place it in another, or create multiple waveforms in a window using overlays.



Waveform Analysis Software

Organize and Maintain Waveform Information

The waveform analysis software is a powerful tool for organizing and storing waveform information. Waveform data (datasets) for a particular piece of equipment, a feeder circuit or an area of the plant, can be stored in any number of 'worksheets'. Worksheets are maintained in a hierarchical manner via 'Labbooks' which can contain any number of worksheets. Each worksheet can be assigned a descriptive name and saved to disk for later access.



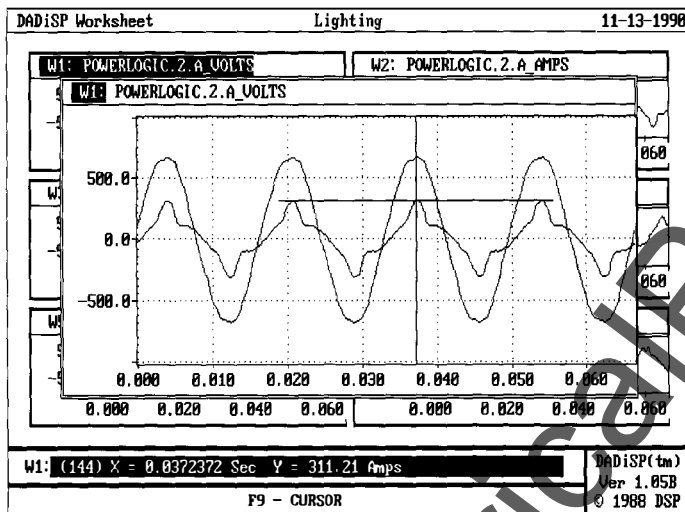
The waveform software is a powerful tool for organizing waveform data

Use Zoom and Cursor to Locate Key Data

Any window being displayed can be enlarged, or 'Zoomed', to offer enhanced viewing of the data. A user controlled cursor can be activated to determine the value of specific data in the windows. The Zoom and Cursor features are activated using keyboard function keys.

Overlay Waveforms

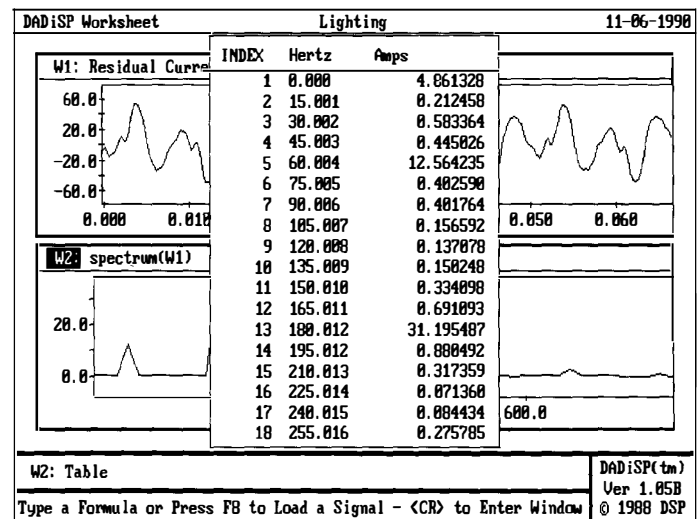
The waveform analysis software supports the overlay of one waveform over another, thereby allowing the user to analyze the displacement of voltage and current waveforms for a given circuit. In this manner, and through the use of Fourier functions, the user can determine and display phase relationships of harmonics in the system.



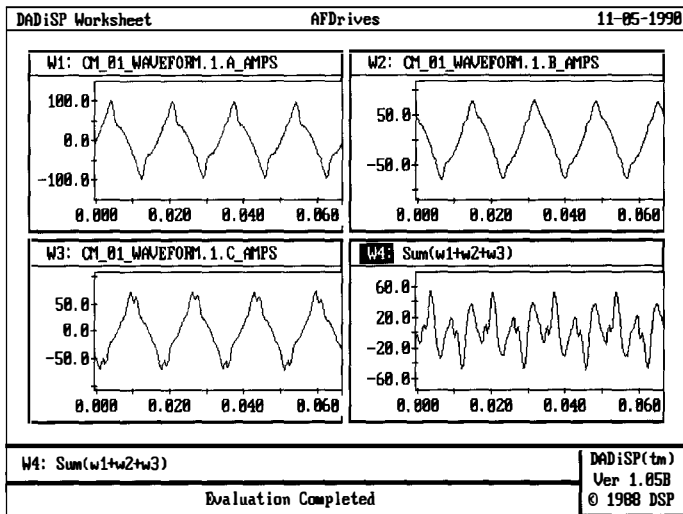
Use Zoom and Cursor to Locate Key Data

Display Window Data in Tabular Format

Information contained in an individual window or multiple windows can be displayed in tabular format by simple keyboard entry. The displayed data can be printed or used in other windows. Entries in the table can also be edited if necessary. Tabular data provides an easy means of viewing individual or key data points and offers an alternative to using the cursor to locate desired information.



Data Can Be Displayed in a Tabular Format



Neutral Current Can be Calculated from the Sum of the Phase Currents

Determine the Harmonic Distortion in Waveforms

As the number and size of non-linear loads in a system increases, distortion of the system waveforms will increase and problems with the system will result. The waveform analysis software, in conjunction with the PowerLogic System, helps analyze waveform distortion levels. Utilizing the 'SPECTRUM' function, the individual harmonic magnitudes for the waveforms are easily found, and the total harmonic distortion (THD) as defined in IEEE-519 may then be calculated.

Supplement Other PowerLogic Software and Workstations

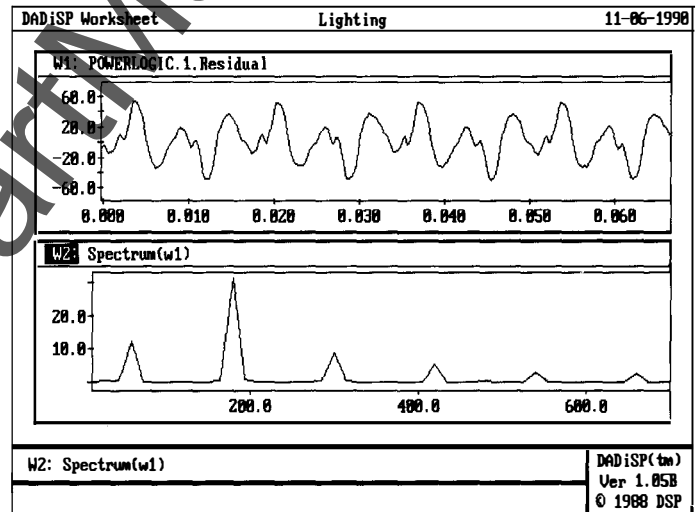
Combining PowerLogic Waveform Analysis Software with other PowerLogic Application Software, comprehensive waveform analysis capabilities can be achieved to help users identify and solve power quality problems. The Waveform Analysis Software can be provided pre-installed, along with other PowerLogic Application Software, on PowerLogic Workstations. Workstations can be configured with a variety of hardware and software and tailored to meet individual customer requirements.

Configuration and Training

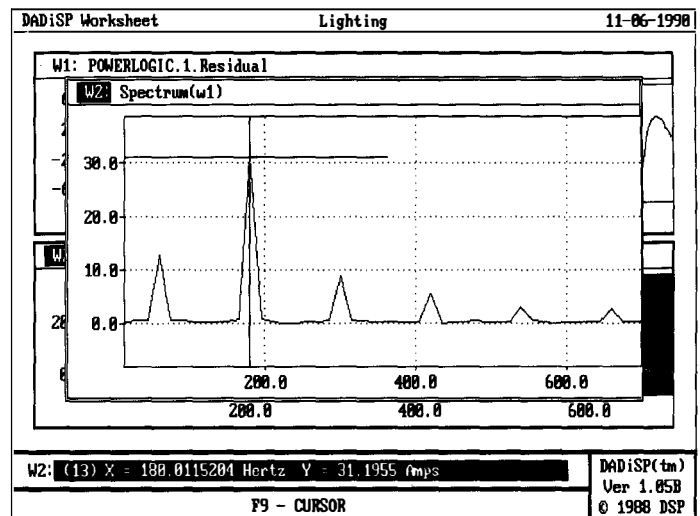
PowerLogic Application Engineering offers many support services including software configuration, hardware and software training, workstation configuration, and custom systems to meet your application requirements. For more information regarding these and other services, contact PowerLogic Application Engineering.

Calculate Neutral (Residual) Currents

Excessive neutral current in feeder circuits, transformers, and other equipment can lead to failure. The Waveform Analysis Software provides an easy means for calculating the neutral current from phase currents. The 'SUM' function allows any number of waveforms to be added. The rms value of the resultant waveform can then be determined using the 'RMS' function. Applying this to the circuits monitored by PowerLogic Circuit Monitors, neutral currents can be quickly calculated to determine if they are being over stressed.



Perform Spectral Analysis to Determine Harmonic Content



Zoom In and Use the Cursor to Determine Exact Harmonics Present

Waveform Analysis Software

Data File Support

In addition to the waveform files created using PowerLogic application software, the PowerLogic Waveform Analysis Software can import and export the following data file types:

- ASCII Files
- Lotus PRN Files
- 8-Bit Byte Data
- 16-Bit Integer Data
- IEEE 32-Bit Floating Point
- IEEE 64-Bit Floating Point

Printer/Plotter Support

The PowerLogic Waveform Analysis Software supports a wide variety of output devices including the following:

- Epson FX/MX printers
- Okidata printers
- Gemini printers
- HP Laserjet printers
- Diablo Ink Jet Color Printer
- Apple Imagewriter printer
- Hewlett Packard Plotters (HPGL)
- Houston Instruments Plotters

Computer Requirements

The minimum system requirements to run the waveform analysis software are:

- 80286 or higher, 100% IBM Compatible
- DOS 2.0 or higher
- 640k RAM
- 2 Floppy Drives or Hard Drive
- CGA Monitor

The following items are recommended for better performance:

- 80287, or 80387 Math Co-processor
- EGA Monitor (or better)

Ordering Information

Class 3080	Type DSP-105	Waveform Analysis Software
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For Further Information - Contact your nearby Square D sales office or call or write to:
Square D Company • PowerLogic • 330 Weakley Rd • Smyrna, TN 37167 • Ph (615) 459-8500



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