License Agreement

THANK YOU FOR PURCHASING THIS PRODUCT. IT IS IMPORTANT THAT YOU CAREFULLY READ THIS NOTICE BEFORE OPENING THIS PACKAGE. BY OPENING THIS SEALED PACKAGE, YOU AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT AND CREATE A BINDING CONTRACT BETWEEN YOU AND RELIABLE POWER METERS ("RPM").

This Agreement may be terminated and you may be required to delete from your computer or server and/or return the Software in the event you fail to observe the terms of this Agreement.

License. RPM grants to you a nonexclusive, nontransferable license to use one copy of the enclosed software program (the "Software") and accompanying documentation in accordance with the following terms and conditions.

You may:

a. Use the Software under the following procedure specified for the version you licensed, as specified on (1) the packaging of the Software, (2) your Order Form, Lease and License Agreement or other signed agreement with RPM, or (3) your separate written agreement or receipt or invoice with the vendor of the Software (the "Governing Terms"):

(i) (if specified as a "stand alone" version) install the Software on a stand-alone computer or a network node from which node the Software cannot be accessed by another computer or user; or

(ii) (if specified as a "single user" version) install the Software on one or more stand-alone computer(s) or network node(s), provided that such Software shall be used by only one individual within your organization; or

(iii) (if specified as a "LAN" version) install the Software on a network server at one site only, which server provides access to multiple computers or users, up to the maximum number of computers or users specified in such Governing Terms;

b. Make one (1) copy of the Software solely for back-up purposes, reproducing in or on such copy all proprietary notices in or on the Software; and

c. Physically transfer the Software from (as applicable):

(i) one stand-alone computer or node to another stand-alone computer or node; or

(ii) one server to another server,

provided that the Software is used on only one computer, node or server at a time.

You may not:

a. Modify, translate, reverse engineer, decompile, disassemble, create derivative works based on, or copy (except for the back-up copy) the Software or the accompanying documentation, except and only to the extent permitted by applicable law;

b. Transfer, loan, rent, lease, distribute or grant any rights in the Software or accompanying documentation in any form without the prior written consent of RPM;

c. Remove any proprietary notices, labels or marks on the Software and accompanying documentation.

This license is not a sale. Title and copyrights to the Software, accompanying documentation and any copy made by you remain with RPM or its licensors, as the case may be.

Confidentiality. The Software contains confidential trade secret information belonging to RPM, and you may use the Software only pursuant to the license set forth herein. In addition, you may not disclose the Software to any third party.

Limited Liability. IN NO EVENT WILL RPM'S LIABILITY UNDER, ARISING OUT OF OR RELATING TO THIS AGREEMENT EXCEED THE AMOUNT PAID TO RPM FOR THE SOFTWARE. RPM SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY. WITHOUT LIMITING THE FOREGOING, RPM WILL NOT BE LIABLE FOR LOST PROFITS, LOSS OF DATA, OR COSTS OF COVER.

Limited Warranty. RPM warrants that:

(i) for a period of ninety (90) days from the date of delivery to you, as evidenced by a copy of your receipt; or

(ii) (for a rental license, if so specified in your Governing Terms) for the period of your rental, as specified in your Governing Terms,

the media on which the Software is contained and the documentation accompanying the Software will, under normal use, be free from defects in materials and workmanship. EXCEPT FOR THE FOREGOING, RPM MAKES AND YOU RECEIVE NO WARRANTIES OR CONDITIONS, EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, AND RPM SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. RPM's entire liability and your exclusive remedy under this warranty will be for RPM to, at its option, arrange for replacement of the media or refund your purchase price and terminate this Agreement.

Exceptions. SOME STATES DO NOT ALLOW THE LIMITATION OF INCIDENTAL DAMAGES OR LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. This agreement gives you specific legal rights, and you may also have other rights which vary from state to state.

U.S. Government Restricted Rights. Use, duplication or disclosure of the Software and accompanying documentation by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFAR 252.227-7013, Rights and Technical Data in Computer Software (June 1992), in subparagraphs (c)(1) and (2) of FAR 52.227-19 Commercial Computer Software - Restricted Rights (June 1992), or FAR 52.227-14, Rights in General Data Alternative III (June 1992), as applicable. Contractor/Manufacturer is Reliable Power Meters, Inc., 400 Blossom Hill Road, Los Gatos, CA 95032.

General. You will not export or reexport the Software in any form without the appropriate United States and foreign government licenses. The disclaimers, exclusions and limitations contained in this Agreement shall inure to the benefit of RPM's licensors. This Agreement will be governed by the laws of the State of California, without reference to conflict of laws principles or the provisions of the U.N. Convention on the International Sale of Goods. This Agreement is the entire agreement between us and supersedes any prior communications or advertising with respect to the Software and accompanying documentation. In the event any provision of this Agreement is held to be unenforceable, such unenforceability shall not affect the other provisions of this Agreement, which provisions shall remain in full force and effect. This Agreement is not assignable by you.

Reliable Power Meter's

Power Recorder System User Guide

September 10, 2001

© 1993 - 2001 Reliable Power Meters. All rights reserved.

Printed in the United States of America

Product # RPM-19-001-0001 REV C

FCC NOTICE **INFORMATION FOR THE USER**	This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense. The user may find the following publication prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TM Interference Problems" (Stock Number 004-000-00345-4). Available exclusively from the Superintendent of Documents, Government Printing Office, Washington, DC 20402 (telephone 202-512-1800).

FCC WARNING	Changes or modifications not expressly approved by the party responsible for compliance to Part 15 of the FC Rules could void the user's authority to operate the equipment.

INDUSTRY CANADA **ICAN CLASS A DIGITAL EQUIPMENT**	This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Industry Canada. Cet appareil numerique respecte les limites de bruits radioelectriques applicables aux appareils numeriques de Classe A prescrites dans la norme sur le materiel brouilleur : "Appareils Numeriques," NMB-003 edictee par le minstre des Communications du Canada.

WARNING	The Power Recorder System is for use by qualified personnel only. **Do not install the Power Recorder on a power line unless you are qualified to do so.** High voltages that can cause burns and lethal shocks are present during power monitoring. **To assure operator safety:** When making connections to power lines, always start by connecting the instrument power, which contains the safety earth ground, to a 3-prong grounded outlet. Use standard high-voltage, high-current safety precautions. Workers who open energized power panels are required to abide by the instructions of ANSI/NFPA 70E-1988 [B2] concerning appropriate protective equipment, as well as government regulations codified in ASHA CFR 1910 [B3] and 1926 [B4], and in ANSI C2-1990 [B1].

WARNING	In order to comply with FCC requirements, a single shielded and grounded power cord must be used to connect AC power to the unit. This is the type of power cord RPM supplies with the instrument.

CAUTION	Connections between peripherals of the computer equipment must be made with low voltage shielded computer data cables and compatible components must be used.

Trademark Information

Power Analysis System and Power Recorder are trademarks of Reliable Power Meters.

Microsoft is a registered trademark of Microsoft Corporation.

Windows is a trademark of Microsoft Corporation.

Technical Support

Reliable Power Meters is ready to assist you. For technical support or sales, contact Reliable Power Meters at:

Address: 400 Blossom Hill Road
Los Gatos, CA 95032-4511

Voice: 408-358-5100, M-F, 8 to 5 (PST).

Fax: 408-358-4420

E-mail support@ReliableMeters.com

Table of Contents

About this Guide ix
Conventions ix
Before You Begin x

Introducing the Power Recorder System 1
What's Included in the Power Recorder System 4
PC System Requirements 5
Registering the Power Recorder System Software 5

Installing the Power Recorder System Software 7

Power Recorder System Software Basics 9
Starting the Power Recorder System Software 9
The Power Recorder System Window and Toolbar 10
Opening the Sample Database 11
Using Icons and Windows 12
Getting Help 15
Power Recorder System Software Databases 17
Setting Up a New Site in the Database 22
Creating a New Location 24

Connecting and Linking to a Power Recorder 27
Using a Network Connection 27
Connecting a PC Directly to a Power Recorder 28
Using a Dial-Up Connection 29
Setting Up a TCP/IP Connection 33
Linking the PC to a Power Recorder 36
What Next? 38

Configuring the Power Recorder 39
Reviewing the Configuration Settings 39
Changing the Power Recorder Configuration 41
Specifying When Monitoring Should Take Place 41
What Next? 43

Installing the Power Recorder at a Facility 45
Select and Attach Appropriate Current Clamps to the Power Recorder 46
Selecting and Attaching Appropriate Voltage Probes to the Power Recorder 49
Putting the Power Recorder in Place 51
Connecting the Power Recorder to the Wiring 53
Wiring Diagrams 56
Finishing Up 58

Double-check these connections:....58
If necessary, lock the Power Recorder in place.....58
What Next?....59

Monitoring and Downloading Data....60
Monitoring Data....60
Downloading Data to the PC....65

Unlinking, Shutting Down, and Removing the Power Recorder...70
Unlinking a PC From a Power Recorder....71
Ending a Dial-Up Connection....72
Disconnecting the PC from a Power Recorder....73
Shutting Down the Power Recorder System Software....73
Disconnecting the Power Recorder from the Wiring....74

Using the Power Recorder System Software Tools: An Overview77
Using the Scope Tools to Inspect Real-Time Power....78
The Scope Tools....79
Pausing the Scope Sweep....80
Capturing Initial Conditions in the Database....81
Using the Analysis Tools....82
The Analysis Tools....83
Using Scope and Analysis Data in Reports....84
Changing the Colors in Graphs....86
Setting Preferences....88
Changing Multipliers....89
Changing Full Scale Settings....90
Setting the Demand Power Interval....91
Using the Phasors Tool to Verify Connections....92
Checking Phase Rotation....92
Changing Phase Rotation....93
Checking the Polarity of the Current Clamps....95
Reversing the Polarity....96

Appendices....97

Appendix A. Glossary....99

Appendix B. Background Materials....101

Appendix C. Updating the Power Recorder System Software....103
Requirements....103

Appendix D. Upgrading a Power Recorder with Additional Measurement Options....107

Appendix E. Event Tolerance Displays....109
Types of Graphic Presentation of Events....109
Tolerance Curves....111

Downloading Individual Events and Moving Between Events..... 112
Using the History Graph to Check for Events at Specific Dates and Times113
Saving Event Tolerance and History Data as Text..... 115

Appendix F. Summary Graphs 117
Minimum, Maximum, and Average..... 117
Using These Graphs in Other Documents 118

Appendix G. Dial-Up Networking Settings 121

Appendix H. International Color Codes 125

Appendix I. Power Recorder (PR) Specifications 127

Appendix J. Theory of Operation 131
Architecture..... 131
Computations 131

Index 135

About this Guide

This guide introduces the features of the Power Recorder System Software. It also provides detailed information about installing the Power Recorder at a facility, connecting it to power, and configuring it through a PC running the Power Recorder System Software.

When you're ready for detailed information about the software interface, commands, and features of the Power Recorder System, use the Power Recorder System Help facility. In the Power Recorder System software, press **F1** or use the Help menu. If you need more information about using the Power Recorder System Help facility, see page 15 of this guide.

Conventions

The screenshots in this guide show three-phase wye power. The Power Recorder System Software also measures single-phase power, split single-phase power, three-phase delta, and two and one half element. The screens you see on your PC will reflect the type of power you measure.

The screenshots were taken under Windows 95. If you use another version of Windows, your screens may look slightly different.

Throughout this guide, instructions for using the Power Recorder System Software tell you how to perform actions using the pointer and a mouse or a trackball and buttons. In many cases, you can also use the keyboard.

For example, when a menu or command name shows an underlined letter, such as File, you can choose the command by holding down the Alt key and typing the letter, like this: `Alt+F`.

Before You Begin

This guide assumes that you have some experience working with personal computers and the Microsoft® Windows™ interface. In particular, you should know how to:

- Choose commands from menus
- Double-click to start an application
- Minimize a window to an icon, restore the icon to its window, and maximize a window to fill the screen
- Move, resize, and close windows
- Press-and-drag to move objects

If you're new to Microsoft Windows, you can pick up these skills quickly and easily. See the Microsoft Windows manual that came with your PC. There are also some excellent training books and courses that can help you learn to use Microsoft Windows. Many are given at local PC distributors, community colleges, and high schools.

Introducing the Power Recorder System

The Power Recorder System combines a sophisticated power-monitoring unit (the Power Recorder) with a separate controller (a PC running the Power Recorder System Software) on which you can view and analyze the power at a facility.

The Power Recorder System is an extremely versatile tool that combines the functions of a variety of measuring instruments and adds unique new features which were previously unavailable in the industry. A number of upgradeable measurement options are available. Each Power Recorder can be customized to meet your needs. You can install the measurement options you need now and easily add other options through software upgrades as you need them in the future.

The Power Recorder System Software runs on a PC under Microsoft® Windows™. Color graphs and a graphical user interface make it easy to inspect data and quickly find the information you need.

You can perform immediate, real-time inspections

The Power Recorder System Software's oscilloscope tools let you inspect real-time power conditions and dynamically monitor the distribution system. It is important to verify the integrity of the steady state conditions before monitoring for transitory events.

When you want to inspect real-time conditions, you:

1. Install the Power Recorder at a facility.
2. Connect and link the PC to the Power Recorder. (There is no need to preset thresholds.)
3. Define the voltage and type of power being inspected.
4. Use the Scope tools in the Power Recorder System Software to inspect real-time waveforms, harmonics, impedances, and power parameters.

A snapshot of the oscilloscope waveforms is stored in both the Power Recorder and in the database on your PC, so you have a permanent record of the initial conditions and can view them later on the PC when it's no longer connected to the Power Recorder.

For more information about inspecting real-time conditions, see "Using the Scope Tools to Inspect Real-Time Power" on page 78.

You can analyze long-term power quality and flow

The Power Recorder contains 4MB of RAM and a hard drive large enough to easily store data collected over days, weeks, or months without worrying about changing paper or running out of recording media such as floppy disks or memory cards.

When you want to inspect monitored data:

1. Install the Power Recorder and leave it at a facility to record data over a period of time.
2. After data has been collected, connect and link the PC to the Power Recorder and download the data you want to analyze.

   Downloading is fast and easy. You can choose to retrieve events, event summaries, one or more long-range summaries, or all the data.

   If you're working with an individual Power Recorder, you can download data from it on-site, or you can take the Power Recorder back to your office before connecting it to a PC. If you have installed a network of Power Recorders, you can download over the network. You can even set up a dial-in connection to retrieve data over phone or ISDN lines, or over the Internet.
3. After you've downloaded the data, analyze it at your convenience. With the analysis tools in the Power Recorder System Software, you can display long-term power conditions such as power consumption and harmonic trends as well as capture transitory events and analyze disturbances.

For more information about inspecting monitored data, see "Using the Analysis Tools" on page 82.

The Power Recorder System's modular design gives you flexibility

Because the Power Recorder is independent of a PC and easily portable, you can make the best use of your equipment. Sometimes you'll want both a recorder and a PC at a facility to inspect power measurements prior to monitoring. Other times you may want to install a Power Recorder to collect data for a period of time, in which case you need the PC only to configure the recorder and to download data when you're finished monitoring. And in other cases you'll set up a network of Power Recorders that remain installed for continual monitoring.

Here are some of the ways you can work:

- Install a Power Recorder at a facility and connect it to a PC running the Power Recorder System Software to inspect real-time power conditions or check for wiring problems. You can examine the initial conditions before determining whether to monitor. If you decide to monitor, you can leave the Power Recorder installed and take the PC with you.
- Install a Power Recorder when you know at the start that you want to analyze the power over a period of days, weeks, or more. Then connect a PC to it when you're ready to download the data.
- Install a temporary network of Power Recorders to monitor power simultaneously throughout a facility. With a PC running the Power Recorder System Software as an integral part of the network, you can link to each of the recorders over the network.
- Use a PC with a modem as a communication controller for one or more Power Recorders. You dial in and link from an off-site PC running the Power Recorder System Software.
- Set up a PC as a polling station and automate the process of connecting and downloading data from one or several Power Recorders. Using the Polling/Annunciation upgrade to the Power Recorder System Software, you can also set alarms to alert you when out-of-tolerance events occur or when a recorder is no longer online. (For complete details, see the *Polling/Annunciation Software Guide*.)

For more information about individual and network connections to power recorders, see page 27.

Built-in safety features minimize monitoring hazards

Inspecting and monitoring power can be a hazardous process. The Power Recorder System is designed to reduce the hazards involved to a minimum.

- A number of interchangeable voltage probes and current clamps are available to provide safe, secure connections to a variety of contact points.
- The standard Power Recorder has built-in LEDs that give you immediate feedback when the instrument is receiving valid voltage and current signals. If you're using the Power Recorder model with the Hostile Environment Enclosure, these built-in LEDs are provided on the Current Interface Cable and the Voltage Interface Cable.
- Phase rotation and clamp polarity errors can be corrected through the Power Recorder System Software.
- As opposed to older instruments that required multiple wires for analog subtraction and addition, the Power Recorder uses digital addition and

subtraction, thus increasing safe use of the instrument by reducing the number of connections that have to be made.

What's Included in the Power Recorder System

A complete Power Recorder System includes the following:

- A Power Recorder
- A PC running the Power Recorder System Software

A number of different Power Recorder models are available to meet different needs. You can select models that have:

- A standard case or a Hostile Environment Enclosure
- A parallel port or an Ethernet port
- A range of measurement options (for details about specific models and measurement options, see the Reliable Power Meters Price List and brochure or contact your local representative)

All Power Recorder models includes the following:

- The Power Recorder with either Ethernet or parallel communications port
- Power Recorder power cable
- PC-to-recorder cable (Ethernet or parallel, depending on the communication port of the Power Recorder)
- For Ethernet units, a RPM-to-RJ45 cable and an RJ45 female-to-female interconnect with a short swap RJ45-to-RJ45 male cable
- Five Crocodile-type voltage probes (# 3601)
- For units with the Hostile Environment Enclosure, Voltage and Current Interface Cables
- For standard units, 10-foot long Voltage Interface Cables for connection

NOTE	Current clamps are not included as part of the standard package, but are available through Reliable Power Meters.

For further details about the models and for a list of optional accessories, see the Reliable Power Meters Price List.

Two optional software enhancements are available for the Power Recorder System Software:

- Polling/Annunciation Software
- Professional Report Writer Software

For more information, see the Reliable Power Meters Price List or contact your RPM Representative.

PC System Requirements

You may purchase a PC from Reliable Power Meters or you may provide your own.

The minimum recommended PC platform includes:

- Pentium-class processor
- 64 MB RAM
- 5 GB hard disk
- Microsoft Windows (current supported version)
- 10Base-T Ethernet adapter (for use with the Ethernet series of Power Recorders)
- SVGA Color display

NOTE	Reliable Power Meters assumes no responsibility for configuring or assuring the proper functioning of computers or PC Ethernet adapters. Reliable Power Meters recommends that users have their Ethernet PC card configured by their MIS department or local PC supplier.

Registering the Power Recorder System Software

Be sure to return the enclosed registration card to Reliable Power Meters. This tells us where to send information about software updates and lets us keep you up to date on enhancements to the Power Recorder System Software through technical bulletins.

Installing the Power Recorder System Software

You can install the Power Recorder System Software on any personal computer that meets the requirements listed on page 5.

NOTE	If you are upgrading to a new version of the Power Recorder System Software, follow the instructions in Appendix C.

To install the Power Recorder System Software

1. Start your personal computer and Microsoft Windows.
2. Insert the first installation disk in your diskette drive (usually A or B).
3. From the Program Manager, open the File menu and choose Run.
4. In the dialog box that appears, type:
   - **`A:\SETUP`** or **`B:\SETUP`**

   1. **Be sure to use the correct designator for the floppy drive in which you inserted the installation disk.**
5. Click **OK**.
6. Follow the instructions that appear on the screen, and swap diskettes when requested.

The Power Recorder System Software is installed on the hard drive of your computer and a program group named "RPM" is created.

Power Recorder System Software Basics

This section of the *Power Recorder System User Guide* tells you how to start the Power Recorder System Software and introduces you to the main elements and tools you'll use on the screen. It also includes instructions for opening database files and creating sites and locations in the Database Site Directory.

For an introduction to the main functions in the Power Recorder System Software—the Scope and Analysis tools, see "Using the Power Recorder System Software Tools: An Overview" on page 77.

Starting the Power Recorder System Software

Note: You need about 50 MB of disk space free on your hard drive in order to run the software.

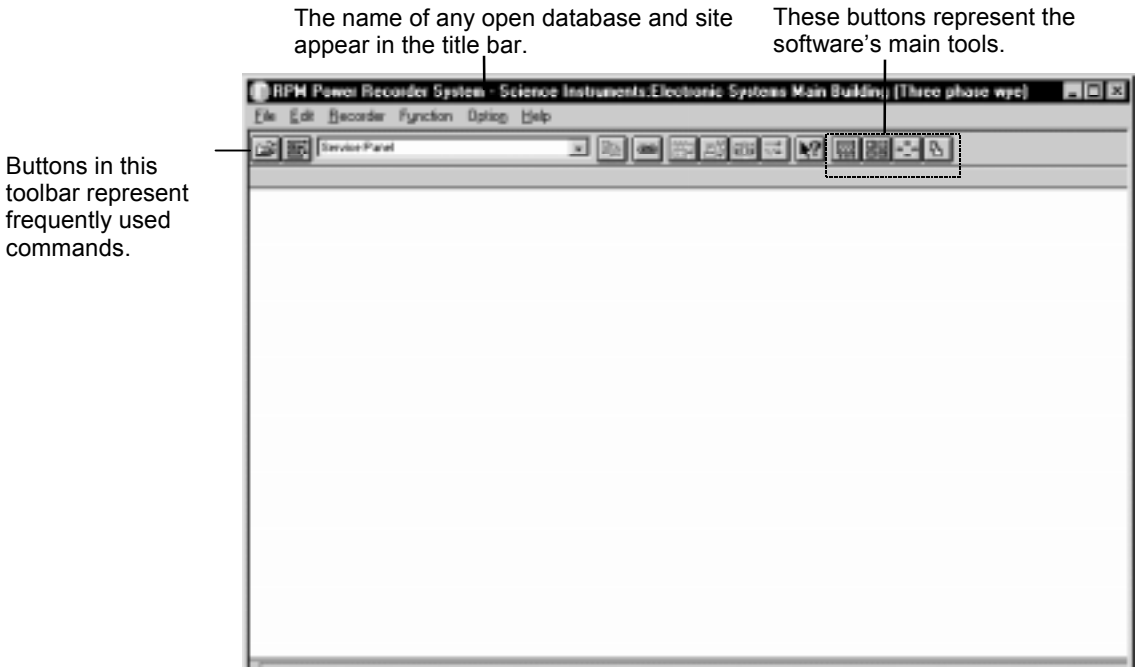
To start the Power Recorder System Software

1. Turn on your computer and start Microsoft Windows.
2. When the Microsoft Windows desktop appears, locate the Power Recorder System Software icon, point to it, and double-click.

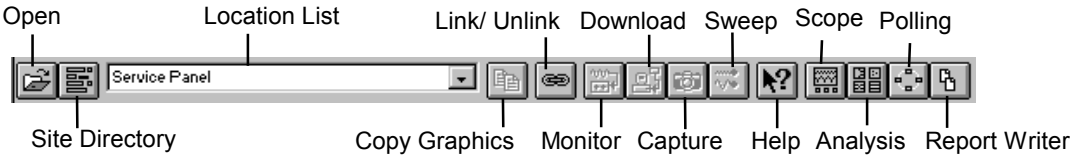
   Or click the **Start** menu, choose **Programs**, choose the folder in which you installed the software (typically Reliable Power Meters), and then select the Power Analysis Software icon.

   The main window opens and displays a new, untitled database, or the last database used on this computer, depending on the setting in Preferences. The initial setting is to open a new database.

The Power Recorder System Window and Toolbar



Each button in the toolbar represents one or more tasks you can perform. Most are also available as commands on one of the menus. [1]



To choose a command from the toolbar

▼ Move the pointer to the tool you want to use and click.

Some tools open dialog boxes, such as Open and Site Directory. Others display icons and diagrams for your use, such as Scope, Monitor, and Analysis. Moreover, some perform a command immediately, such as Copy, Sweep, and Help.

[1] Polling features are available only if you purchased and installed the Polling/Annunciation Software package. Report Writer features are available only if you purchased the Professional Report Writer Software package.

Opening the Sample Database

The Power Recorder System Software comes with a sample database. You can use it to see how the software works if you don't yet have a database that contains data you've monitored.

To open the sample database

1. Click the Open button in the toolbar.

2. Select the database SAMPLE.OMG from the list.

3. Click **OK**.

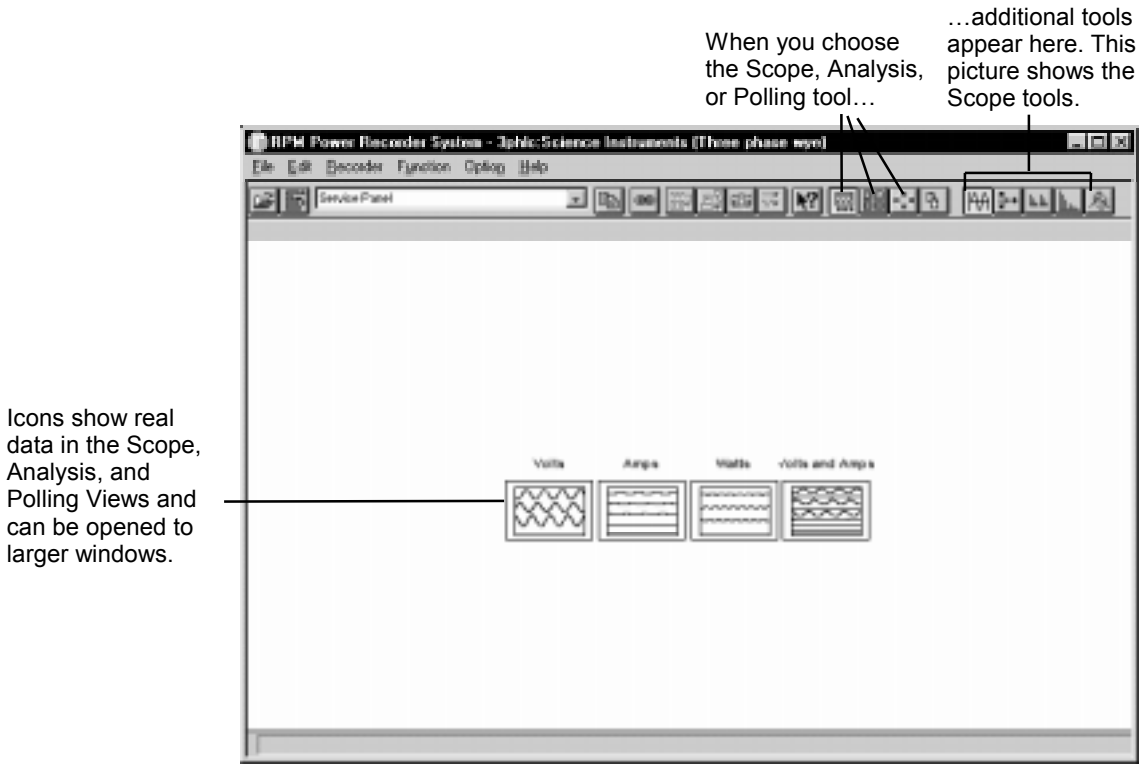
   The sample database opens.

   For complete information about working with databases, see page 17.

Using Icons and Windows

The Scope, Analysis, and Polling tools are actually collections of tools. When you click the buttons for these tools and Analysis, a series of additional tool buttons appear at the right, and small windows (called icons) appear in the window.

The icons are actually small-scale windows that present data about the power at a location. Each icon can be opened to a larger window by double-clicking it.

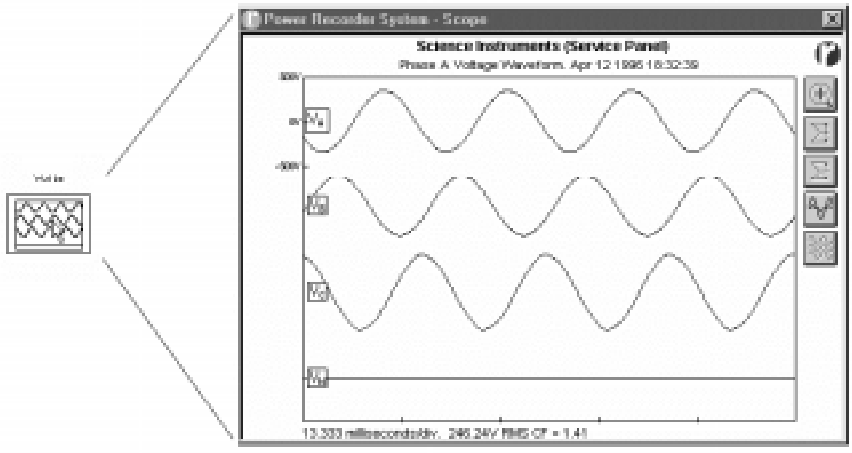


NOTE	To view information with the Power Recorder System Scope and Analysis tools, you must either be hooked up to an installed Power Recorder, or have previously monitored power conditions and downloaded them to a database on the computer. If you don't have your own data yet, you can use the demo database `SAMPLE.OMG` to see how these tools work. For details, see page 11.

To open an icon to a window

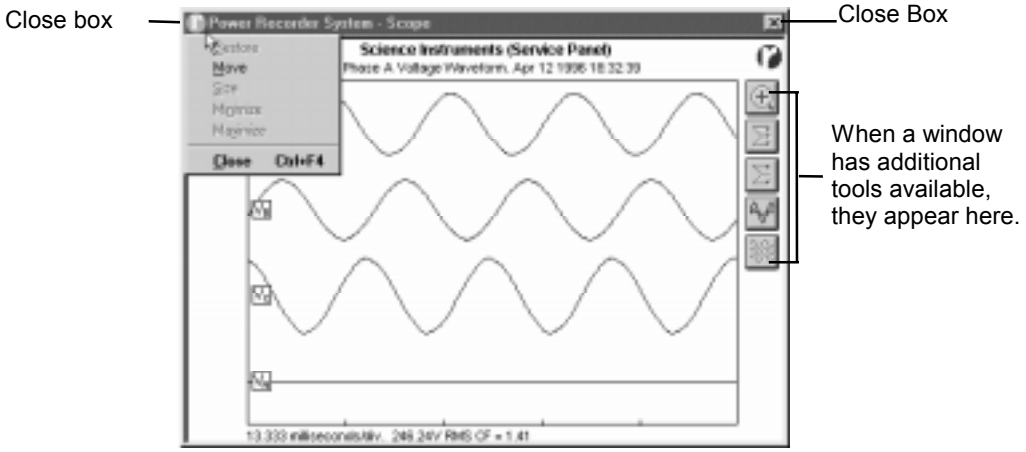
▼ Point to the icon and double-click to open it.

The icon opens to a window.



To close a window

▼ Double-click one of the Close boxes in the upper corners.



To open another window

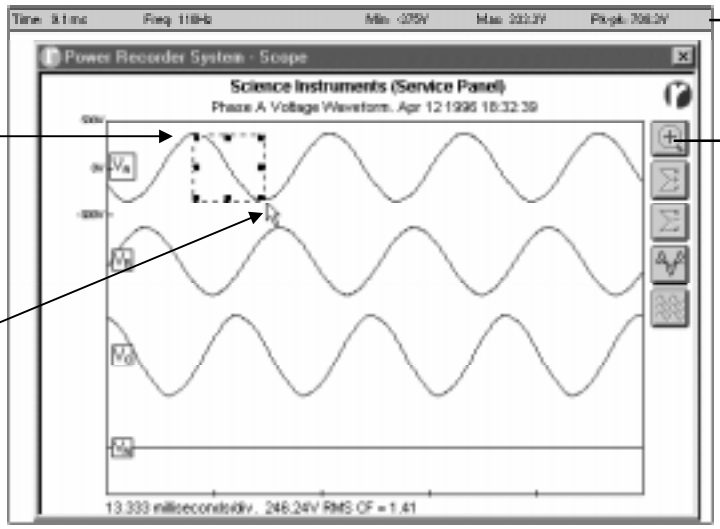
You can have a number of windows for the same tool open at the same time.

1. Point to the top edge of the first window and press and drag the window to a new location.
2. Double-click another icon to open its window.

To see more detail about the contents of a window

In many windows, you can see additional detail by magnifying some of the data in a window.

1. Select the data you want to see in more detail.



2. Click the Magnify tool to magnify the detail you selected.

   The contents of the window are replaced by a magnified view of the selection. The Magnify tool changes shape from a plus to a minus to indicate this window shows magnified information.

3. When you're finished, click the Magnify tool to return to the original view of the window.

Getting Help

While you're working in the Power Recorder System Software, you can get help at any time. You can see a brief description of each of the commands and buttons, ask for help about what's on the screen, or look up a topic you want to find more information on.

Note: The Power Recorder System Help contains more complete information than you'll find in this manual. If you are looking for information and you don't find it in the User's Guide, be sure to check the Help while you're using the software. You'll find detailed discussions about the contents of each Scope and Analysis window and each dialog box in the Power Recorder System Software.

To see a definition of a command or button

1. Click the Help button or press Shift + F1.

   The pointer changes to the help pointer shape.

2. Point to the button or command you want to know about.

   As you point to each button and command, a brief definition of it displays at the bottom of the screen.

3. To open the Help window and see detailed information about a button or command, click on the button or command with the help pointer.

   The Help window opens.

To get help about the active view or dialog box

▼ Press **F1** or click the Help button.

The Help window opens and displays information about the contents of the screen.

To browse through Help and find a topic

1. Choose **Contents** from the **Help** menu, or click the **Contents** button in the Help window.

   A window listing the contents for the Power Recorder System Help system appears.

   Each underlined item represents another topic.

2. Click the topic you want to view.

   You see a list of sub-topics or information about the topic you selected.

To learn more about using on-line Help

▼ Choose **How to Use Help** from the **Help** menu.

The Help window opens and displays information about using Help in Microsoft Windows.

Power Recorder System Software Databases

The Power Recorder System Software organizes information in a database. You can have one database, or many. Each database can contain information about the power at many different locations.

A Power Recorder System database is actually a collection of files, with one primary file that uses the database's name. The files associated with each database are stored together in a subdirectory.

Power Recorder System databases can be quite large. Data for one location can use as much as 25 MB if the monitoring session is particularly active, however data about most locations takes around 3 to 4 MB.

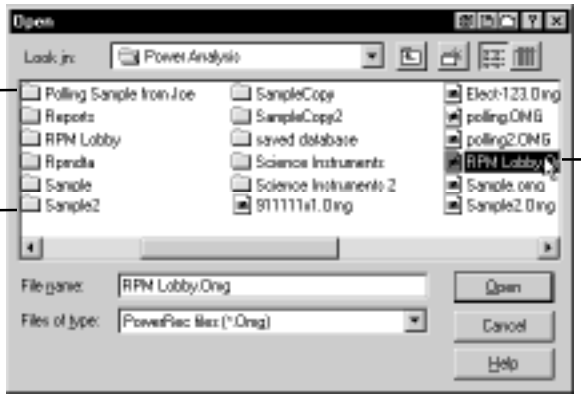
When you start the Power Recorder System Software, you can have it open a new, empty database, or you can have it automatically open the last database used, depending on the choice you set in Preferences.

As you use the Power Recorder System Software, you'll work with databases in a variety of ways. You can create a new database, open an existing one, save a copy of a database, create a compressed copy, delete a database, and even repair a database if it should become corrupted. The next few pages describe how to perform these tasks.

To open a different database

1. Click the Open button in the toolbar or choose **Open** from the **File** menu.

2. Select the database you want from the list.



Files associated with the database are stored in a subdirectory.

Click on a database to select it.

You can scroll through the existing files, change directories, or change drives to locate the database you want.

If you need help moving through directories and subdirectories, see your Microsoft Windows documentation.

3. Click **OK**.

   Only one database can be open at a time. If a database is already open, it is closed before the new one is opened.

To create a new database

▼ Choose **New** from the **File** menu.

If a database is already open, it closes before the new one is created.

You don't name the database now—you will be prompted for a name when you exit the software or close the database.

To have a new database open each time you start the software

1. Choose **Preferences** from the **Option** menu.
2. In the Preferences dialog box, unmark the **Use Last Database** box.

   When an "X" appears in the box, the last database used opens automatically when you start the Power Recorder System Software.
3. Click **OK**.

To save a copy of a database

You can save a copy of a database and specify a different name.

1. Choose **Save As** from the **File** menu.

   The Save As dialog box opens.
2. Type a name for the new copy of the database.
3. Change the directory or drive if you want to save the new database in a different location.
4. Click **OK**.

   A new copy of the database is saved.

To make a compressed copy of a database

You can compress a copy of the files in a database to make a version that takes 70% less space on disk (approximately a 3:1 ratio). This is useful when you want to archive the database to a set of floppies, when you want to move it to another computer, and when you need to free up hard disk space.

Note: You can only compress a closed database. If the database you want to compress is open now, close it before proceeding.

If you're archiving to floppies, you should have 3 to 4 high-density floppies ready before starting. The compression process erases and reformats the diskettes, so make sure that they do not contain data you want to keep.

1. Choose **Compress** from the **File** menu.

   The Compress Database dialog box opens.

2. Select the database you want to compress from the list. The database is named with the extension .OMG.

   You can change the directory or drive, if necessary, to find the primary database file.

3. Click **OK**.

   The Compress Database dialog box is replaced by the Destination Zip file dialog box.

4. Type the name you want the compressed copy of the file to have.

   If you don't change the name, the name of the original database is used with the extension ZIP.

5. Change the directory or drive if you want to save the compressed version of the file in a different location.

   You see the status of the compression as the new file is created.

6. If you want to free up disk space, you can delete the uncompressed database from your computer's hard drive.

   Be sure to use the Delete command in the Power Recorder System Software to delete the database. For details, see page 21.

To expand a database

You can expand the files in a database that has been compressed.

1. Choose **Expand** from the **File** menu.

   The Expand Database dialog box opens.

2. Select the database you want to expand from the list. The database is named with the extension .ZIP.

   You can change the directory or drive, if necessary, to find the compressed file.

3. Click **OK**.

   The Expand Database dialog box is replaced by the Destination Database dialog box.

4. Type the name you want the expanded database to have.

   If you don't change the name, the name of the compressed database is used, with the extension OMG.

5. Change the directory or drive if you want the expanded version of the database to be stored in a different location.

   The status of the expansion displays as the new files are created.

   To conserve disk space, you may want to delete the compressed version of the file (with the extension .zip).

To repair a database

You can repair the files in a database if they get corrupted. (Files may be corrupted if a system crash occurs on the PC while it is running and communicating with a Power Recorder.)

1. Choose **Repair** from the **File** menu.

   If **Repair** is dimmed on the **File** menu, choose **Close** and close the database that's now open. Then try again.

   The Repair Database dialog box opens.

2. Select the database you want to repair from the list on the left. The database is named with the extension .OMG.

   You can change the directory or drive, if necessary, to find the primary database file.

3. Click **OK**.

You see the status of the repair as errors are fixed in the database. When the repair is finished, a message tells you how many records were examined, and how many repaired. (Minor repairs may be made without being counted as repairs.)

4. Click **Done**.
5. In the Site Directory, select the site and location for which you want to view data and click **OK**.

To delete a database

If you want to delete a database from your computer, be sure to use the Delete command on the File menu while you are using the Power Recorder System Software. **Do not delete files through File Manager or DOS.** When you use the Delete command from within the Power Recorder System Software, all the files associated with the database are deleted at once.

You can only delete a database that is not presently open.

1. Choose **Delete** from the **File** menu.

   The Delete dialog box opens.

2. In the File Name list, select the primary file (`xxx.omg`) for the database you want to delete.
3. Click **OK**.
4. When you're asked to confirm that you want to delete the database, click **Yes** to delete it.

   All files associated with the database are deleted.

Setting Up a New Site in the Database

If you're measuring power at a new facility or a new building, start by creating a new **site** in the database.

A site represents a distribution system, or a portion of one, in a database. You can set up many different sites in the same database. And for each site, you can set up multiple **locations** where you plan to measure data. A location represents the actual panel or branch load where you physically connect the Power Recorder. Each time you link and download data from a Power Recorder you're given the chance to save the data as a new location.

Sites provide a way to organize information in the database—they let you group information about related locations.

Site information also becomes part of the Power Recorder configuration.

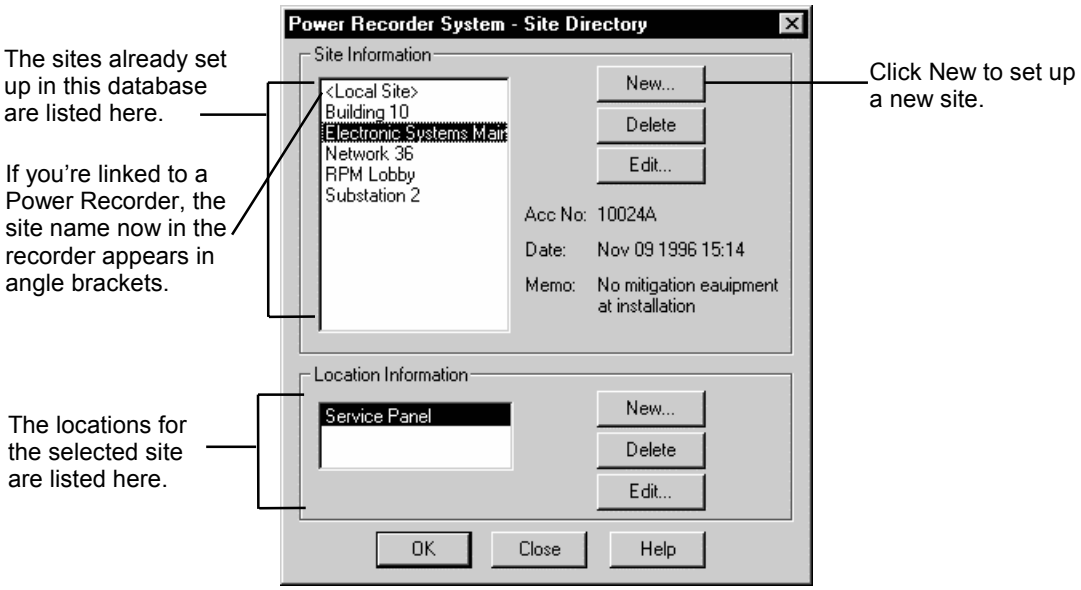
To set up a new site

1. If you're not connected to the Power Recorder, click the Site button in the toolbar.

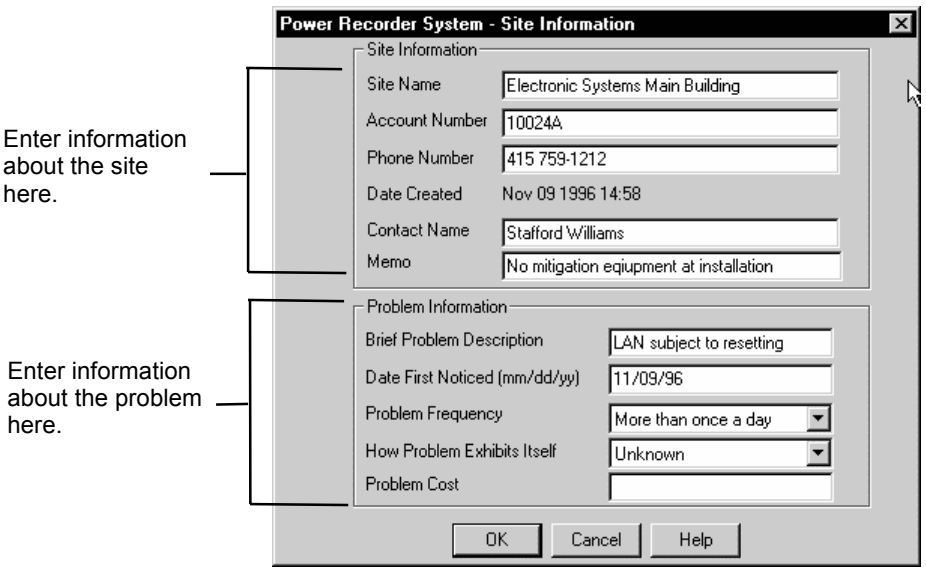
   If you are connected to the Power Recorder, open the Link dialog box (choose either **Link** or **Link Info** from the **Recorder** menu) and click **Edit**.

   The Site Directory opens.

2. Click **New** in the Site Information area of the Site Directory.



3. In the Site Information dialog box that appears, enter information about the site.



   The Site Name is required. Account Number, Phone Number, Contact name, and Memo are optional. Use them to keep track of information you want to associate with this site.

   The date is inserted automatically to record when the site was created.

   Press Tab to move from one field to the next; Shift-Tab to move back a field.

   If you have questions at any time about what to enter, click **Help** while the dialog box is open.

4. Enter information about the problem.

   This information is for your recording and reporting purposes. None of it is required in order for the Power Recorder to monitor data.

5. When you've finished, click **OK** to return to the Site Directory.

   The new site is created and listed in the Site Directory where it is automatically selected.

   Before you can use this new site, you must create at least one location in it so that you can link to the Power Recorder and finish configuring it.

Creating a New Location

When you enter location information, you specify the power type and other information needed to present data correctly. This becomes part of the Power Recorder configuration.

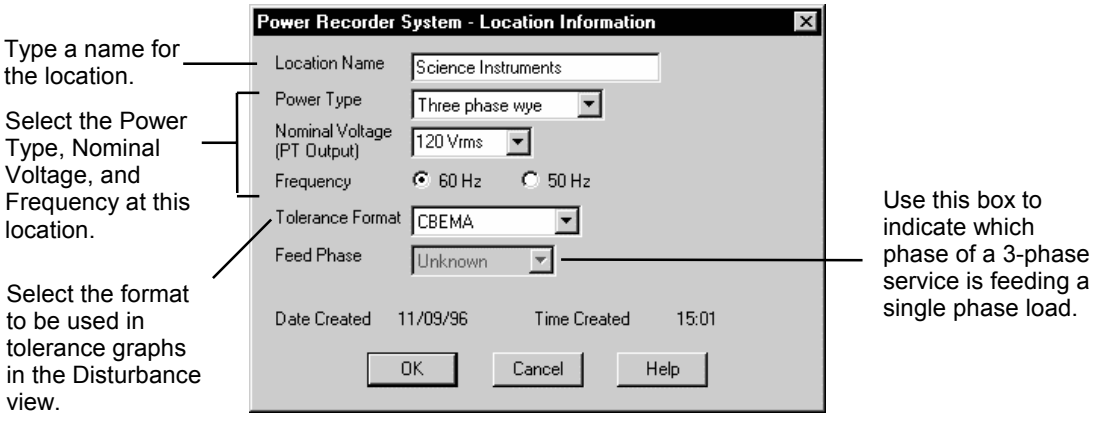
You can create multiple locations for one site when you want to compare power at different locations or check for problems at a site. For example, if you want to characterize a distribution system you would measure power at the service panel and at several different locations in the same building.

You can also have multiple locations in a site for data downloaded from the same physical location at different times. When you unlink from a Power Recorder, you're given the chance to save downloaded data to a new location.

To create a new location

1. In the Site Directory (shown on page 22), select the site to which you are adding the location.
2. Click **New** in the Location Information area.

   The Location Information dialog box appears.
3. Fill in the Location Information dialog box.



The location name and power type are required.

The date and time are inserted automatically to record when the location was created.

If you have questions at any time about what to enter, click **Help** while the dialog box is open.

4. When you've finished, click **OK** to return to the Site Directory.

   The new location is created and listed in the Site Directory, where it is automatically selected.

Connecting and Linking to a Power Recorder

When you want to communicate to a Power Recorder, you first establish a connection and then link to it through the Power Recorder System Software. You can connect to a Power Recorder in a number of different ways. Your connection may be:

- A network connection, over a local area Ethernet network
- A direct connection by cable from your PC to a parallel or Ethernet Power Recorder
- A dial-up connection over a phone line
- A TCP/IP connection, over the Internet or other Wide Area Network

This section describes how to connect to a Power Recorder in the above ways, and how to establish a link once you are connected.

Using a Network Connection

When both the PC running the Power Recorder System Software and one or more Power Recorders are on the same Ethernet network, you can connect to a Power Recorder through the network.

To make sure a Power Recorder is connected correctly on a network, start the Power Recorder System Software from a PC on the network and choose the **List Recorders** command from the **Recorders** menu. A dialog box lists all the Power Recorders that the software can identify. (See page 32.) If the recorder you want to use is listed, you can link to it.

Power Recorders can be added to an Ethernet network when they are located within 100 meters of an Ethernet hub, allowing them to communicate over 10Base-T Ethernet with RJ45 cable.

If you need to verify your network settings, use the Network Control Panel. Make sure that the Client for Microsoft is installed with file sharing enabled, that the 10Base-T Ethernet Adapter has been installed, and that you have associated the NetBEUI protocol to the 10Base-T Adapter.

Note: Setting up networks is a complex topic, beyond the scope of this manual. If you need assistance setting up a network of Power Recorders, contact your network administrator. RPM's Technical Support can assist you in adding Power Recorders to an existing network.

Connecting a PC Directly to a Power Recorder

You can connect directly via cable from a PC to either an Ethernet Power Recorder or to a parallel Power Recorder.

To connect to a parallel recorder, you need the parallel PC-to-Recorder cable that comes with a parallel recorder.

To connect to an Ethernet recorder, you need a special 2-foot Ethernet cable from RPM, an RJ45 female-to-female connector, and a 10-foot Ethernet PC-to-Recorder cable. All of these cables are provided with the Power Recorder.

To connect a PC directly to a Power Recorder

1. **If you're using a parallel recorder:**

   - Plug the connector at the end of the parallel PC-to-Recorder cable into the parallel port (LPT1) on the PC.
   - Plug the other connector end of the PC-to-Recorder cable into the port on the Power Recorder panel.

   If you're using an Ethernet recorder:

   - Plug one end of the 2-foot Ethernet cable into the Ethernet port on the PC. (This cable swaps one pair of the communication cable and must be used when connecting a PC directly to an Ethernet Power Recorder.)
   - Attach the RJ45 female-to-female connector to the other end of the RJ45 cable.
   - Plug the RPM connector end of the 10-foot Ethernet PC-to-Recorder cable into the port on the Power Recorder panel.
   - Plug the other end of the Ethernet PC-to-Recorder cable into the female-to-female connector.
   - Make sure the Power Recorder is plugged into a power source.

2. Turn on your PC and start the Power Recorder System Software.

   You're ready to link to the recorder through the Power Recorder System Software. (See page 36.)

Using a Dial-Up Connection

Under Window you can connect to a Power Recorder by using a modem to dial a computer connected to a Power Recorder via Ethernet on a LAN (local area network). The LAN can be as small as one PC and one Power Recorder, or it can be a much larger network.

In order to use a dial-up connection, a PC on the network must be set up as a Remote Access Server (referred to under Windows as a Dial-Up Server), and the Microsoft Dial-Up Adapter must be installed on the PC you are dialing from. If you're not certain whether your computer has the Dial-Up Adapter installed, look in the Network Control Panel. If you don't see it, or if you need more information, see the topic "Dial-Up Networking" in Windows 95 online help or see the Windows NT documentation. You should also sure that the Dial-Up Networking settings match the ones in your Network Control panel. (For details, see Appendix G. Dial-Up Networking Settings.)

You can also dial-up your Internet Service Provider and access Power Recorders which have an IP address and are connected to the Internet. You must first record a Remote Name for the recorder in the Power Recorder System Software. For details, see "To associate a Remote Recorder with a TCP/IP address" below.

To set up a computer as a Dial-Up Server on the network

1. On the computer which will be the Dial-Up Server, open the Dial-Up Networking folder.

   (In Windows 95, double-click the My Computer icon to see the folder for Dial-Up Networking. Then double-click the Dial-Up Networking folder to open it.)

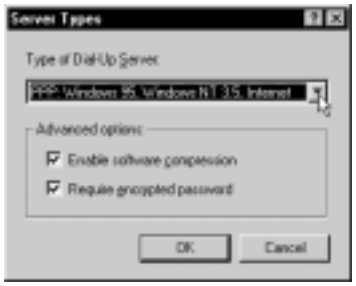
2. In the Dial-Up Networking window, choose **Dial-Up Server** from the **Connections** menu.

The Dial-Up Server dialog box appears.

3. In the dialog box, select Allow Caller Access.

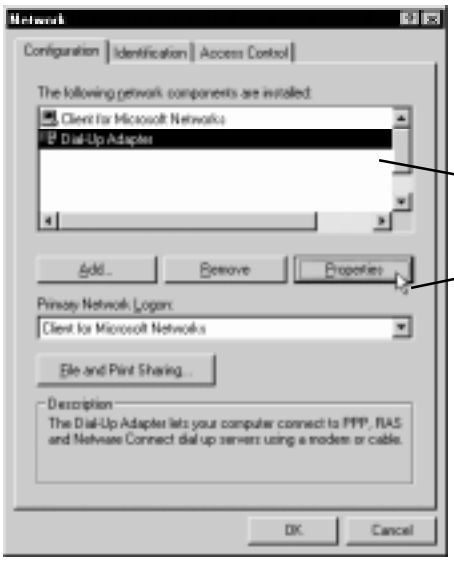
4. Click the **Server Type** button.

5. In the Server Type dialog box, select **PPP** as the type of dial-up server.



6. Click **OK**.

7. Open the Network Control Panel and make sure your network settings support dial-up networking.



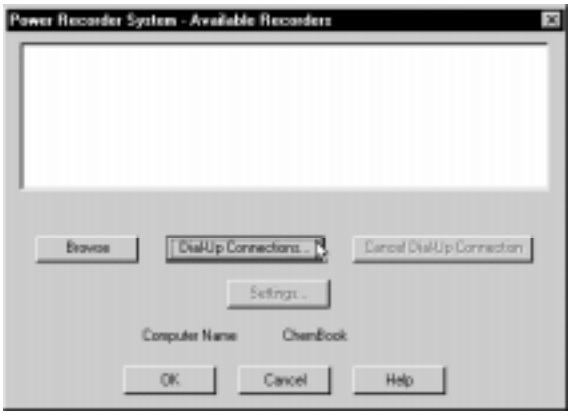
The Dial-Up Adapter and appropriate protocols must be installed on the server. If the Dial-Up Adapter doesn't appear in the list, you need to install it. Use the Add/Remove Programs Control Panel and the Windows Setup tab to help you install the adapter. (You may need your Microsoft Windows CD.)

To dial into a network that already has a Dial-Up Server

You can make a dial-up connection from the Windows desktop or from within the Power Recorder System Software. The steps below describe how to do so from within the Power Recorder System Software.

1. Start the Power Recorder System Software.
2. Choose **List Recorders** or **Link** from the **Recorders** menu.

   The Available Recorders dialog box opens.



3. Click **Dial-Up Connections**.

   The Dial-Up Connections dialog box opens.

4. If you see the connection you want to make, select it and click **Connect**.

5. If you don't see the connection you want to make, you need to set it up.

   In the Dial-Up Connections dialog box, click **New Connection**.

   You see the same dialog box you would see if you were creating a connection starting in the Dial-Up Networking window.

   Complete the screens that appear, entering a name for the connection and the number you will dial to make it.

   When you're finished, the name of the new connection appears in the Dial-Up Connections dialog box. Select it and click **Connect**.

After you establish the dial-up connection, Power Recorders on that network appear in the Available Recorders dialog box.

If the connection doesn't go through after you click **Connect**, you may need to check the properties of your dial-up connection in the Network Control Panel.

Setting Up a TCP/IP Connection

If you're running Windows 95 or Windows NT 3.51 or later, you can use a TCP/IP connection to connect to a Power Recorder. This allows you to connect over the Internet or other Wide Area Networks (WAN).

A TCP/IP connection has two requirements:

- An IP address must be assigned to the Power Recorder.

  Once an IP address is associated with a Power Recorder, it remains with that recorder unless it is explicitly changed. The IP address must be a unique IP address not used for any other equipment on the Internet.

- A remote name must be assigned in the Power Recorder System Software that associates the Power Recorder's serial number with the IP address.

  This must be done in each installed version of the Power Recorder System Software that will access the Power Recorder using TCP/IP.

To assign a TCP/IP address to a Power Recorder

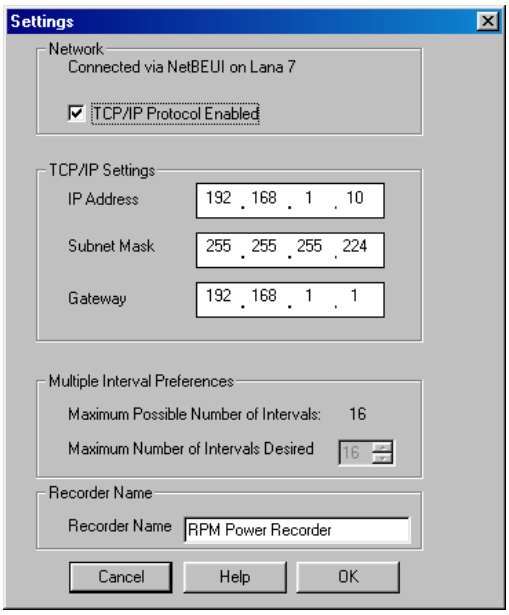
TCP/IP settings must be assigned to a Power Recorder over a local network before they can be used to connect to it over the Internet.

1. If you do not already know the unique IP address to be given to the recorder, get it from your system administrator.
2. Install the Power Recorder on your local network.
3. If you are using a single Power Recorder with an Ethernet connector, connect it to your PC. The recorder and PC form a local network.
4. Start a PC that contains the Power Recorder System Software, and start the software.
5. From the **Recorder** menu, choose **List Recorders**.

   The software automatically browses the network for recorders and lists the ones it finds in the dialog box, by serial number.
6. In the list of Available Recorders, select the Power Recorder to which you want to give an IP address.

7. Click the **Settings** button.

   The Connection Settings dialog box appears.



8. Enter the TCP/IP settings in the dialog box and click **OK**.

   The settings are copied into the Power Recorder.

   Be sure to enter an IP address and Subnet Mask. These allow you to use a TCP/IP connection over your Local Area Network.

   The Gateway is also necessary in order to communicate with computers and networks beyond your local area network, such as through the Internet or other Wide Area Network.

   Caution: If you enter the wrong TCP/IP settings, the Power Recorder will not be able to be accessed through the IP address. You can return to this dialog box to check or change the settings when you are linked to this recorder.

To associate a remote Power Recorder with a TCP/IP address

Before you can access a Power Recorder using TCP/IP, you must associate it's serial number with an IP address in the Remote Names dialog box in the Power Recorder System Software. After you create this association, the software will recognize the IP address when it browses for available Power Recorders on a Wide Area Network.

To complete this procedure, you need to know the IP address of the Power Recorder.

1. In the Power Recorder System Software, choose **Remote Names** from the **File** menu.

   The Remote Names dialog box appears.

2. Enter the serial number of the Power Recorder in the Remote Name field.
3. Enter the IP address in the TCP/IP Address field.
4. Click the **Add** button to add the Remote Name to the list.
5. Click **Close** when you are finished.

TROUBLE-SHOOTING TIP	If you have trouble establishing a TCP/IP connection, you can test it with the Microsoft Ping Utility. If you cannot "ping" the recorder outside of the software, you should recheck your network settings. If you're running under Windows NT and your TCP/IP connections don't work, open the Network Control Panel. On the Protocols tab, select the TCP/IP protocol and click **Properties**. Then select the WINS Address tab and make sure the box Enable LMHosts Lookup is marked. This setting allows Remote Names to be handled under Windows NT.

Linking the PC to a Power Recorder

Linking establishes communications between the PC and the Power Recorder.

You link whenever you want to:

- Configure the Power Recorder or check the present configuration settings in the Power Recorder.
- Inspect real-time data about the power with the Scope tools.
- Download data collected by the Power Recorder during the monitoring period.

NOTE	If you plan to download and save data in the PC, or if you want to use configuration settings you've already entered in the Site Directory, make sure the database you want to use is open. (See page 17.)

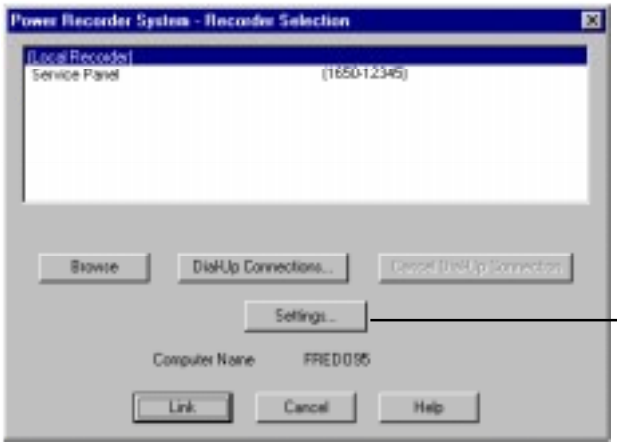
To link the PC to a Power Recorder

1. Click the Link button in the toolbar or choose the **Link** command from the **Recorder** menu.

   The software looks for Power Recorders in this order: first, it looks on any local area network, then it checks the list of Remote Names and establishes any TCP/IP connections, and finally, it looks for a parallel connection.

   If it finds only a connection to a parallel Power Recorder, the Link dialog box shown in step 4 appears.

   If it identifies any other Ethernet Power Recorder(s), whether over a network, through an established dial-up connection, or through a TCP/IP connection, it displays all available Power Recorders in the Recorder Selection dialog box.



You can use this button to check or change the network or Internet settings of a Power Recorder. For more information, see " Setting Up a TCP/IP Connection" on page 33.

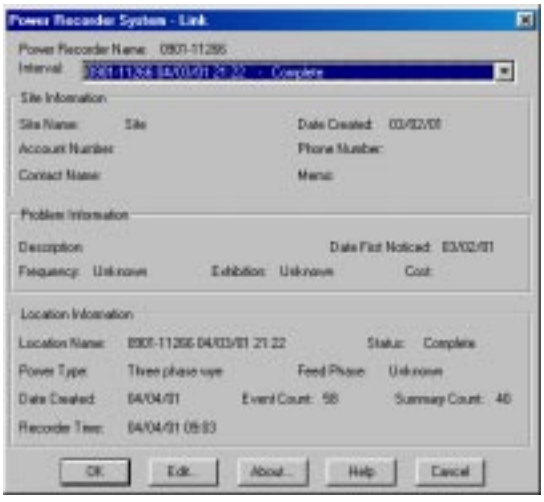
2. If you want to dial up a Power Recorder on a remote network that's not now shown in the list, click **Dial-Up Connections** and select the appropriate connection to use.

   The Power Recorder System Software dials the connection you indicated and contacts the appropriate Power Recorder.

   After the connection is made, you are returned to the Recorder Selection, and the name(s) of the Power Recorder(s) appears in the list.

3. In the List of Recorders, select the Power Recorder you want and click the **Link** button.

   The Link dialog box opens and shows information about the Power Recorder.



4. If you need to configure a Power Recorder or set or change monitoring settings, turn to the next section, "Configuring the Power Recorder."

5. Click **OK** to complete the link.

What Next?

Once you're linked to an installed Power Recorder, you can use the Scope and Analysis tools to view real-time power and download data. (For details, see "Using the Power Recorder System Software Tools: An Overview" on page 77.) Or, if the Power Recorder was previously installed and has been collecting data over a period of time, you can download it now. (See "Downloading Data to the PC," on page 65.)

Configuring the Power Recorder

A Power Recorder must be configured for the specific location where it is installed. Configuring the Power Recorder sets the nominal voltage, power type, feed phase (for single-phase power), and specifies information about the site and location you're monitoring. It also lets you see whether the Power Recorder already contains data from a previous installation so that you can reset it if you want.

Configuration requires the use of a PC with the Power Recorder System Software installed.

This section describes how to configure the Power Recorder, including how to:

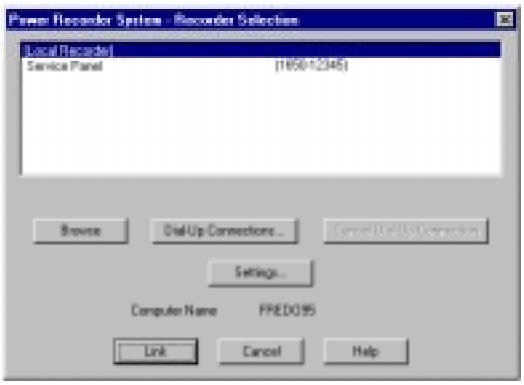
- Review the current configuration settings. (See below.)
- Make any changes to the configuration. (See page 41.)
- Specify when monitoring should take place. (See page 41.)

Instructions for installing the Power Recorder at a facility begin on page 45. If you prefer, you can install a Power Recorder before configuring it.

Reviewing the Configuration Settings

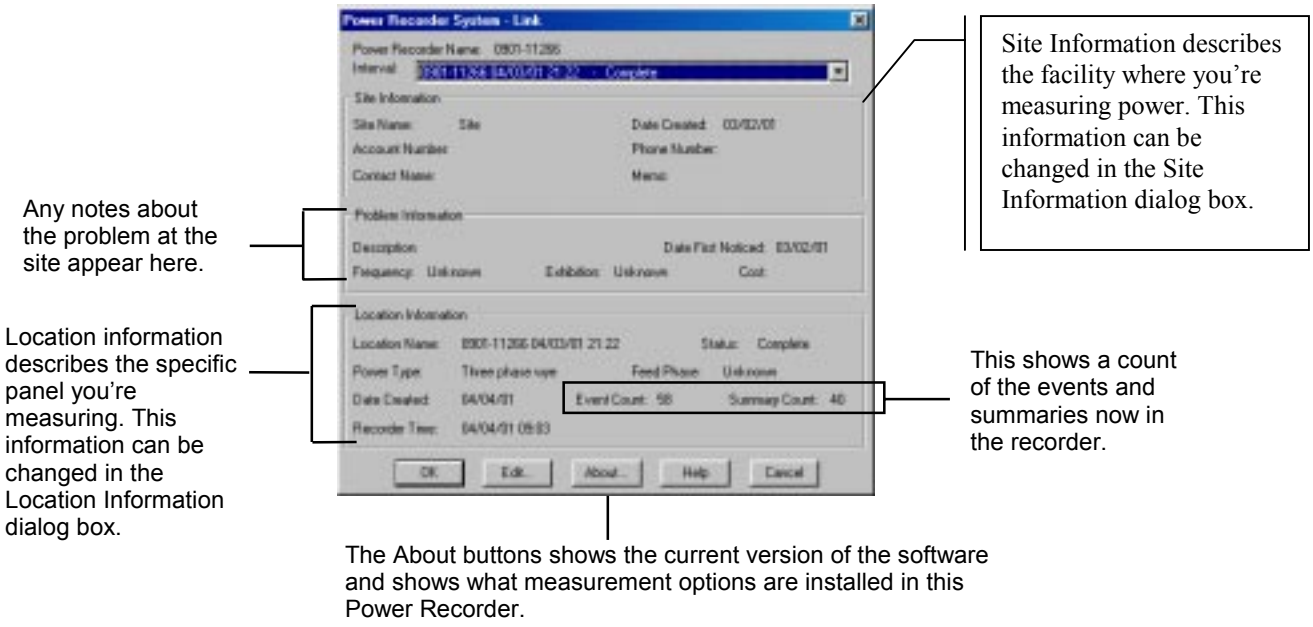
To review configuration settings in a Power Recorder

1. Click the Link button in the toolbar or choose the **Link** command from the **Recorder** menu.



2. In the List of Recorders, select the Power Recorder you want and click the **Link** button.

   The Link dialog box opens and shows the configuration settings now in the Power Recorder. (If you need more details about the linking process, see page 36.)



3. Approve or change the configuration.

   You must make sure the Power Type is correct. Other changes can be made now or later.

   - If the configuration settings are accurate, click OK to accept them and complete the linking process.
   - If you want to change the configuration settings, click Edit to open the Site Directory. Then go on to "Changing the Power Recorder Configuration" below.

NOTE	If the configuration shows that the Power Recorder contains data and you want to delete it in order to begin measuring at a new location, you must *reset* the Power Recorder. To do so, click **OK** in the Link dialog box to establish a link to the Power Recorder. Then choose **Monitor** from the **Recorder** menu. In the Monitor dialog box, click **Reset**. If you want to make changes to the configuration after resetting the monitor, choose **Link Info** from the **Recorder** menu to return to the Link dialog box.

Changing the Power Recorder Configuration

When the configuration settings in the Power Recorder aren't correct, you can easily change them. You can:

- Make changes to the present configuration settings in the Power Recorder, either to set the correct power type or to make minor changes like correcting the spelling or adding a contact name or phone number.
- Set up a new site or location and use it to configure the Power Recorder.
- Select existing site and location settings in the database on the PC and use them to configure the Power Recorder.

To make changes to the configuration settings in the Power Recorder

1. In the Link dialog box, click **Edit**.

   The Site Directory opens. The configuration now in the Power Recorder is represented in the Site list by a name with angle brackets around it, like this: <Computer Site>.

2. To make changes to the existing settings, click **Edit** for the Site Information or for the Location Information and enter any changes you want to make.

   To set up a new site or location, click the **New** button next to Site Information or Location Information.

   For details about entering and changing site information, see page 22. For details about entering and changing location information, see page 24.

3. When you're finished, click **OK** in the Site Directory to return to the Link dialog box.

Specifying When Monitoring Should Take Place

The last step in configuring the Power Recorder is to specify when monitoring should take place, and for how long.

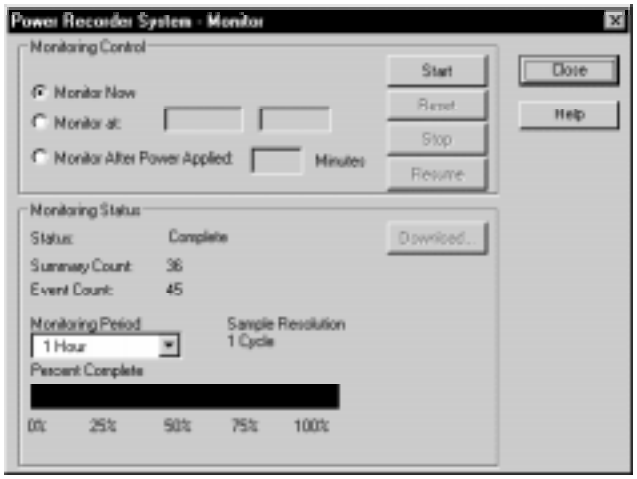
If the Power Recorder is currently installed, you can have it begin monitoring now, or you can arm the Power Recorder to begin monitoring at a specific time.

NOTE	The steps below tell you how to specify when monitoring should occur. For more about starting, stopping, and controlling monitoring, see "Monitoring Data" on page 60.

To specify when monitoring should take place

1. Choose **Monitor** from the **Recorder** menu, or click the Monitor button.

   The Monitor dialog box opens.



2. Select one of the Monitoring Control options to indicate when monitoring should begin:

   If the Power Recorder is presently installed and you want to begin monitoring, select **Monitor Now**. (This is the default setting.)

   If the Power Recorder is not yet installed, select one of these:

   Select **Monitor at:** and enter a specific date and time.

   Select **Monitor After Power Applied:** and enter the number of minutes after power is applied to the Power Recorder when monitoring should begin.

NOTE	If you select **Monitor After Power Applied**, you must disconnect power from the Power Recorder and then reapply the power before monitoring will begin. This is required even if the Power Recorder is already installed and connected to the wiring.

3. In the Monitoring Period box, select how long the monitoring should continue.

4. Click **Start** to accept the settings you entered in this dialog box.

NOTE	You must click **Start** in order for any of the Monitoring Control Settings to be sent to the Power Recorder.

If you selected **Monitor Now,** monitoring begins immediately.

If you selected **Monitor at** or **Monitor After Power Applied,** *Armed* appears as the Monitor Status.

5. When you have finished, click **Close**.

6. If appropriate, click the Unlink button in the toolbar or choose **Unlink** from the **Recorder** menu.

If you'll be disconnecting the PC from the Power Recorder now, be sure to unlink the two first. For details, see page 71.

What Next?

If you haven't yet installed the Power Recorder at the facility, you can do that now.

If the Power Recorder is already installed, you can use the Power Recorder System Software to check the connection to power and to view and measure waveforms, harmonics, power vectors, impedances, and phase rotation. (See "Using the Power Recorder System Software Tools: An Overview" on page 77.) Or, if the Power Recorder has been collecting data over a period of time, you can download it now. (See "Downloading Data to the PC," on page 65.)

Installing the Power Recorder at a Facility

To install the Power Recorder at a facility, you follow the basic steps listed here. Each of these steps is described in detail on the next pages.

CAUTION	To assure proper grounding of the Power Recorder case, it is important to follow the sequence shown below.

1. Select and attach appropriate current clamps to the Power Recorder. (See page 46.)
2. Select and attach appropriate voltage probes to the Power Recorder. (See page 49.)
3. Put the Power Recorder in place and plug the power cord into a properly grounded receptacle. Start by connecting the power cord to the Power Recorder panel and then to the instrument power; then observe the power-up sequence of the LEDs. (See page 51.)
4. Connect the Power Recorder to the wiring, starting by first connecting the ground probe to the distribution system ground, then connecting the neutral probe to neutral, and then connecting the current clamps and the voltage probes. (See page 53.)

   Note: The ground wire is isolated from the instrument power cord ground.

   You'll find diagrams of the wiring for various power configurations on page 56.
5. Check to see that the connections are established correctly. (See page 58.)

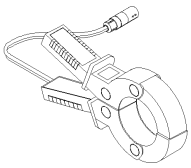
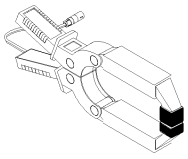
BEFORE YOU LEAVE AN INSTALLED POWER RECORDER	In addition to being physically installed at a facility, the Power Recorder also needs to be ***configured*** to measure and store data about a particular site and location. If you haven't yet configured the Power Recorder, follow the steps starting on page 39.

Select and Attach Appropriate Current Clamps to the Power Recorder

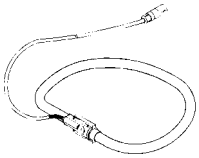
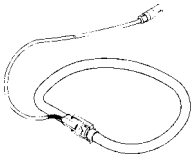
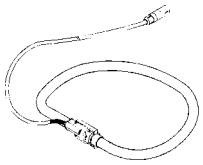
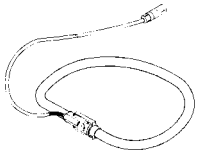
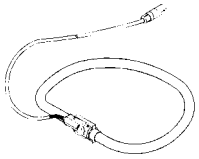
1. Select the current clamps you want to use.

Choose the clamps that are in the range of current you're expecting, and that will fit in the physical space around the wires. The table below provides guidance to help you select the best clamps to use.

Choose one clamp for each phase, one for neutral (if appropriate), and one for ground.

Current Clamp	Current Range and Opening Size	Uses
5 Amp (#3005 and #3005R*)	0.1 A to 5 Amps RMS Cable diameter 0.78"	Measuring very low currents, such as when connecting to ground conductors. Connecting to a current transformer (CT).
40 Amp (# 3014 and # 3014R*)	0.1 A to 40 Amps RMS Cable diameter 0.78"	Measuring moderate currents such as single-phase branch circuits.
 **1000 Amp (# 3100 and # 3100R*)**	1 to 1000 Amps RMS Jaw opening 2.0" diameter	Fits most applications. Useful in most cases, except when the space is inadequate
 **3000 Amp (# 3300 and # 3000R*)**	1 Amp to 3000 Amps Jaw opening 1.97" x 5.31"	Connecting to high currents with busbars or large wires.

* The "R" version of this clamp includes a 10-foot interface cable required to connect this clamp to the standard model Power Recorder.

Current Clamp	Current Range and Opening Size	Uses
 **100 Amp (# 3110)**	2 Amp to 100 Amps Flexible current transformer, 24” long.	Getting around cable bundles and large busbars.
 **1000 Amp (# 3210)**	20 Amp to 1000 Amps Flexible current transformer, 24” long.	Getting around cable bundles and large busbars.
 **1000 Amp (# 3212)**	20 Amp to 1000 Amps Flexible current transformer, 48” long.	Getting around cable bundles and large busbars.
 **5000 Amp (# 3310)**	100 Amp to 5000 Amps Flexible current transformer, 24” long.	Getting around cable bundles and large busbars.
 **5000 Amp (# 3312)**	100 Amp to 5000 Amps Flexible current transformer, 48” long.	Getting around cable bundles and large busbars.

2. Attach the current clamps to the Power Recorder.

If you're using a standard Power Recorder with flexible clamps, you attach the clamps directly to the recorder.

- Attach each clamp to the appropriate color-coded connection on the front panel of the recorder. You'll feel the self-locking ends snap into place when the connection is made, and the arrows on the clamp and the connectors will line up.

If you're using a standard Power Recorder with rigid style clamps, use the 10-foot interface cable that came with the clamp.

- Connect the interface cable to the appropriate connection on the front panel of the recorder, and then connect the other end of the cable to the clamp. You'll feel the self-locking ends snap into place when the connections are made.

Color[2]	Phase	Single-phase	Split Single-phase	3-phase Wye	3-phase Delta	2 ½ Element	2-Element[3]
Black	A	X	X	X	X	X	X
Red	B		X	X	X		
Blue	C			X	X	X	X
White	Neutral	X	X	X			
Green	Ground	X	X	X			

If you're using a Power Recorder in a Hostile Environment Enclosure, you use a Current Interface Cable to attach the clamps to the recorder.

- Start by plugging the end of the gray Current Interface Cable into the gray port on the end of the Power Recorder.
- Attach each clamp to the appropriate color-coded lead for the phase or wire to which you'll connect. You'll feel the self-locking ends snap into place when the connection is made, and the arrows on the clamp and the lead connectors will line up.

[2] These color codes are used throughout the United States. For color codes used outside of the United States, see Appendix H. International Color Codes.

[3] Attach the third clamp around the black and blue wires. In cases where only two currents are available, the third current can be obtained by putting a clamp around the two existing currents. The residual current equates to the missing current.

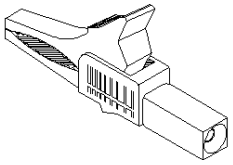
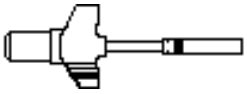
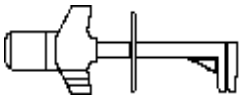
Note: If you're using flexible current transformers (Flexi-CTs) with the Hostile Environment Enclosure, you must use Reliable Power Meter's Flexi CT Pod Adapter, model number 3533.

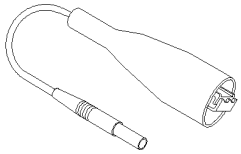
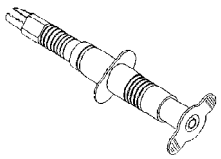
Selecting and Attaching Appropriate Voltage Probes to the Power Recorder

1. Select the voltage probes you want to use.

The probe you choose will depend on the type of wire or lug to which you are connecting. The table below provides guidance to help you select the best probes to use.

Choose one probe for each phase, one for neutral (if appropriate), and one for ground.

Voltage Probe	Uses/Comments
 **Crocodile-type voltage probe (# 3601)**	Supplied with the Power Recorder. Universal probe, can be used in most situations. Suitable for rectangular/round cross sections to 3/4" wide.
 **Syringe Stud-type voltage probe (# 3605)**	Use this probe when you have accessibility to a stud sizes up to 3/8". Provides secure, captive contact to the stud. (This optional probe can be purchased through Reliable Power Meters.)
Threaded Stud-type voltage probe (# 3606)	Use this probe to connect to studs of 3/8" or 1/2" diameter. (This optional probe can be purchased through Reliable Power Meters.)
 **Side-clamp voltage probe (# 3607)**	Connecting to flat busbar services. Adjustable jaw for conductors up to 3/8" diameter. (This optional probe can be purchased through Reliable Power Meters.)

Voltage Probe	Uses/Comments
 **Battery-type voltage probe (# 3602)**	This is a general-purpose probe that can be used in a variety of circumstances. (This optional probe can be purchased through Reliable Power Meters.)
 **Plunger type voltage probe (#3608)**	Use this probe when you are connecting to a set screw head or a machine screw. Crocodile jaw for screws up to 3/8" diameter. (This optional probe can be purchased through Reliable Power Meters.)
 In-line fuse holder (#3641)	Use this when you are required to use a fused probe. This fuse holder has a replaceable 28 mm, 0.25 amp 200,000 AIC fuse, for use with any of the voltage probes listed above. (This optional fuse holder can be purchased through Reliable Power Meters.)

3. Attach the voltage probes to the Power Recorder.

If you're using a standard Power Recorder:

- Slide the connector on the color-coded voltage lead into the connector on the Power Recorder.
- Slide the other end of the voltage lead onto the probe you selected.

Color[4]	Phase	Single-phase	Split Single-phase	3-phase Wye	3-phase Delta	2 ½ Element	2-Element
Black	A	X	X	X	X	X	X
Red	B		X	X	X		X
Blue	C			X	X	X	X
White	Neutral	X	X	X			
Green	Ground	X	X	X	X	X	

If you're using a Power Recorder in a Hostile Environment Enclosure, you use a Voltage Interface Cable to attach the voltage probes to the recorder.

- Start by plugging the end of the orange Voltage Interface Cable into the orange port on the end of the Power Recorder.
- Slide the connector on the end of the voltage probe into the lead on the cable.

Putting the Power Recorder in Place

1. Position the Power Recorder within ten feet of the monitoring location.

   The Power Recorder can be set on the floor or a table, or it can be attached to a pole or another surface. If necessary, secure the Power Recorder to a pole or other mounting surface. (RPM has optional mounting brackets-product # 4008-and a security cable to assist you in mounting and securing the unit.)

2. Plug the Power Recorder into a power source.
   - Connect the power cord to the Power Recorder panel.
   - Then connect the power cord into a properly grounded wall outlet.

CAUTION	Be sure to plug the power cord into the Power Recorder panel BEFORE connecting it to an outlet.

3. Plug the power cord into a properly grounded wall outlet.

[4] These color codes are used throughout the United States. For color codes used outside of the United States, see Appendix H. International Color Codes.

If the Power Recorder has been *armed* to begin monitoring a certain amount of time after power is applied, that time begins when you plug the Power Recorder into a power source. (For more about arming the monitor, see "Specifying When Monitoring Should Take Place" on page 41, or "Monitoring Data" on page 60.)

4. Observe the Current and Voltage LEDs.

   If you're using a standard Power Recorder, these LEDs are on the panel of the recorder. If you're using a Power Recorder with a Hostile Environment Enclosure, the LEDs are on the pods of the Interface Cables.

   All LEDs should flash ON, then OFF, and then each should turn ON and OFF in sequence. The LEDs will then remain on if you make a secure connection and there is significant voltage and current.

Connecting the Power Recorder to the Wiring

After you've assembled the clamps, probes, and interface cables (if appropriate), and have attached them to the Power Recorder, you're ready to connect the clamps and probes to the wiring. (Wiring diagrams are provided on page 56.)

1. Install the current clamps around the appropriate conductors.

SAFETY TIP	Examine the conductors you're about to connect to and determine whether you should attach the current clamps to the phase wires before you connect the voltage probes. Because they are clamped around wires, current clamps are usually more secure than voltage probes. In most cases, you should install the current clamps first. If, however, it will be easier or safer to attach the voltage probes first, you can do steps 4 and 5 before completing steps 2 and 3.

Use the color-coding on the leads to help you install the clamps around the correct phase wires.

Connect this color lead…[5]	…to the clamp or probe you'll connect to
Black	Phase A
Red	Phase B
Blue	Phase C
White	Neutral
Green	Ground

CAUTION	Make sure the current clamps and voltage probes are paired correctly. The leads for the current clamp and voltage probe of the same color should be attached to the same phase wire or busbar.

[5] These color codes are used throughout the United States. For color codes used outside of the United States, see Appendix H. International Color Codes.

2. Check the range light (LED) for each clamp.

The connection panel on the Power Recorder or the pod at the end of the Current Interface Cable contains range lights for each lead. When you connect to power, the range light will indicate whether the amount of current in the line is between 5% to 90% of the range that can be measured by the clamp.

If the range light is steady ON, you know the clamp you've selected is presently within the range of the measured current.

If the range light is blinking, the current may be beyond the range that this current clamp can measure. Consider a different current clamp with a higher range.

If the range light is OFF, first check to make sure that the Power Recorder is plugged in. If it is plugged in and the panel is under normal load, you may need a clamp that can measure lower ranges.

If the range light is OFF and you are measuring ground or neutral current, the current may not be registering. Use the most sensitive clamp you have. If the range light remains off, you can use the Waveforms tool in the Power Recorder System Software to check for current. (With the PC linked to the Power Recorder, open the Amps window in the Waveforms view. Select the ground or neutral current trace; draw a small selection rectangle around the trace, and click the Magnify tool to zoom in and inspect the current trace.)

3. Connect the voltage probes to the phase conductors.

Use the color-coding on the leads to help you connect the probes to the correct phases, neutral, and ground. (See the table above, in step 1.)

SAFETY TIP	Make sure the voltage probes and current clamps are paired correctly. Calculations are made in pairs and cannot be changed after data is recorded. The leads for the voltage probe and current clamp of the same color should be attached to the same phase wire or busbar. Although incorrectly-paired probes and clamps cannot be compensated for after the data is collected, inadvertently connecting a voltage probe and current clamp pair to the wrong phase can be compensated for prior to collecting data. In such a case, you don't have to physically change the position of the probe and clamp. The Power Recorder still collects all the data it needs, and you can use the Scope Phasors tool to make sure connections are accurate and make any necessary changes electronically. (For details, see page 92.)

4. Check the LED for each phase to make sure a connection is established.

The connection panel on the Power Recorder or the pod at the end of the Voltage Interface Cable is equipped with LEDs for each phase that indicate when a connection is established with the wire.

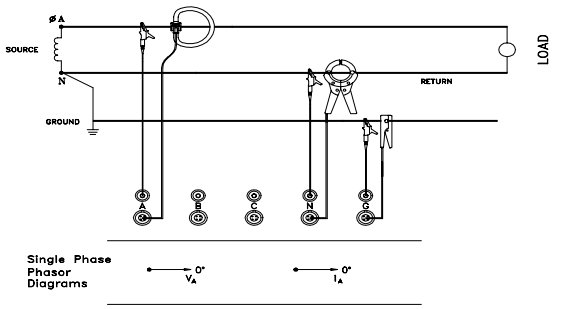
When the light is ON, you know that the connection is secure and that voltage is present.

When the light is OFF, check to make sure the Power Recorder is plugged in. Next check the connection between the probe and the line to make sure it is secure. If it is secure, there may be a problem with the probe: remove the probe and try another one. If the LED still does not light, there may be no voltage in the line. Use a voltmeter to check for voltage. (**Note:** You can link to the recorder and open the Phasor window to verify the correct pairing and rotation of the currents and voltages. If they are incorrect, use the tools in the window to swap connections and change polarity. For more information, see page 92.)

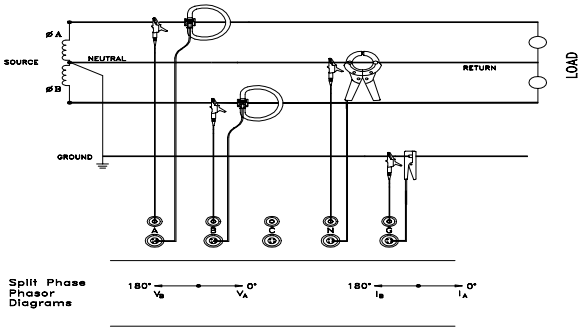
Wiring Diagrams

The wiring illustrations included here are for the standard power configurations that are selectable in the Power Recorder System Software.

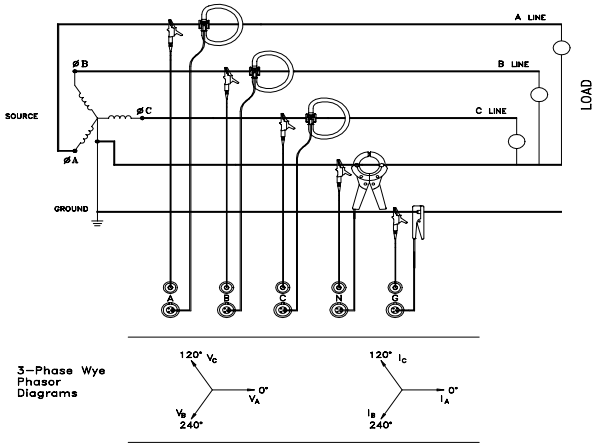
Single-Phase



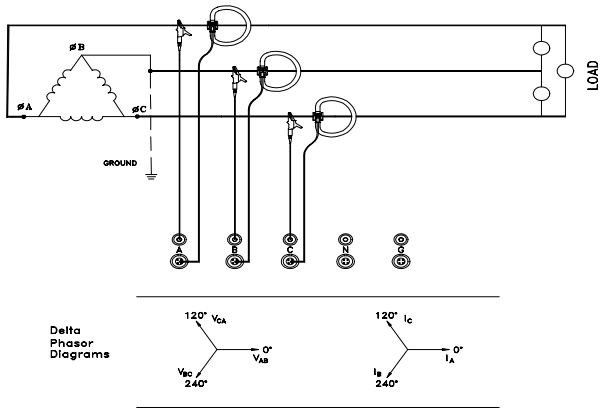
Split Single-Phase



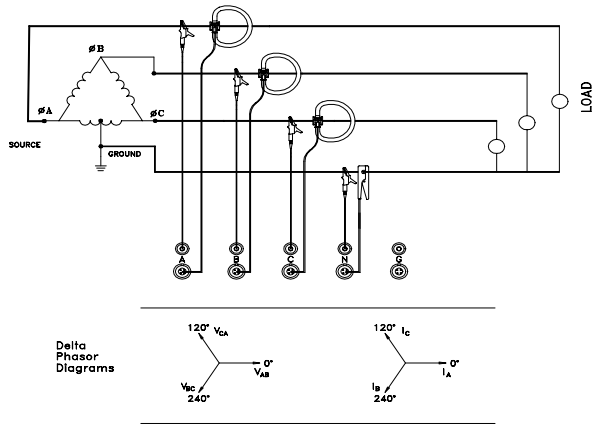
3-Phase Wye



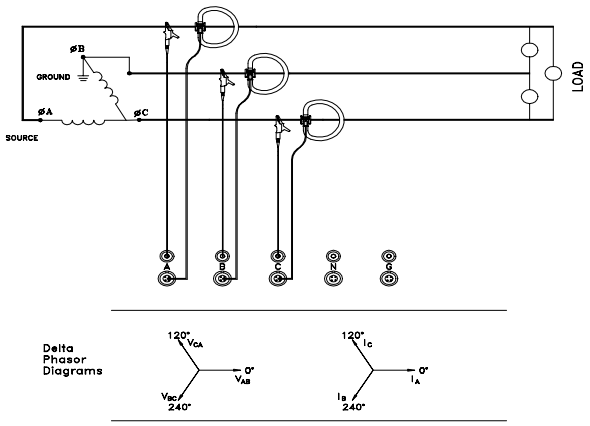
3-Phase Delta (Floating and Grounded)



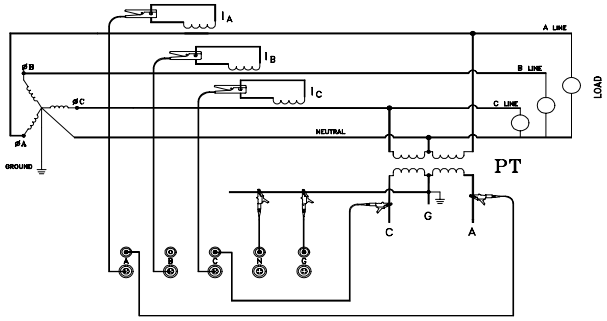
3-Phase Delta (High-Leg)



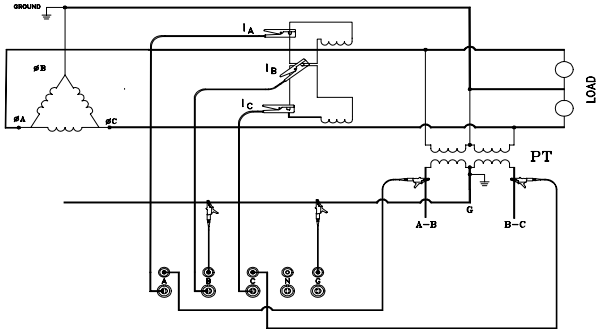
3-Phase Delta (Open Leg)



2 ½ Element



2-Element
(3 PT and 2 CT)



Finishing Up

Before you connect the recorder to a PC running the Power Recorder System Software, or before you leave the Power Recorder to accumulate data at the facility, double-check the connections.

Double-check these connections:

- Make sure the current clamps are secured and completely closed around the conductors and that the range lights (LEDs) on the Power Recorder or the Current Interface Cable are on.
- Make sure that the Voltage LEDS on the Power Recorder or the Voltage Interface Cable LEDs are on.
- Make sure that the voltage and current leads are paired correctly. For example, the black voltage lead and the black current lead should both be attached to the Phase A conductor.

If necessary, lock the Power Recorder in place.

If you'll be leaving the Power Recorder in an unsecured area on-site, it's a good idea to lock it in place. Reliable Power Meters offers a locking security

cable specifically created for use with the Power Recorder. For information, contact Reliable Power Meters and ask about item # 4006.

Warning	Make sure that you have tagged, labeled, and installed appropriate warning signs at the monitoring location. Individuals entering the area may be unaware of the high voltages involved in monitoring.

What Next?

If you have not yet configured the Power Recorder, if you want to observe and check the connections, or if you want to use the Scope tools to examine initial conditions, your next step is to connect and link the Power Recorder to a PC running the Power Recorder System Software. (For details, see "Connecting and Linking to a Power Recorder" on page 27 and "Configuring the Power Recorder" on page 39.)

If you know you're going to take long-term measurements, the Power Recorder has already been configured and armed, and you're confident about the connections to power, you don't have to connect to and link the Power Recorder to a PC running the Power Recorder System Software now. You can leave the Power Recorder on-site to collect data. Monitoring will start at the time you specified. (For more about monitoring and downloading data, see page 60.)

Monitoring and Downloading Data

This section describes some basic information you need to know when monitoring data over time and downloading data to your PC. It includes how to:

- Start and stop the monitoring of data while the Power Recorder is installed.
- Reset the Power Recorder to clear all data from it.
- Download information that's been collected and stored in the Power Recorder.

Monitoring Data

As a final step in configuring the Power Recorder, you used the Monitor dialog box to indicate when monitoring should occur. (See "Specifying When Monitoring Should Take Place" on page 41.)

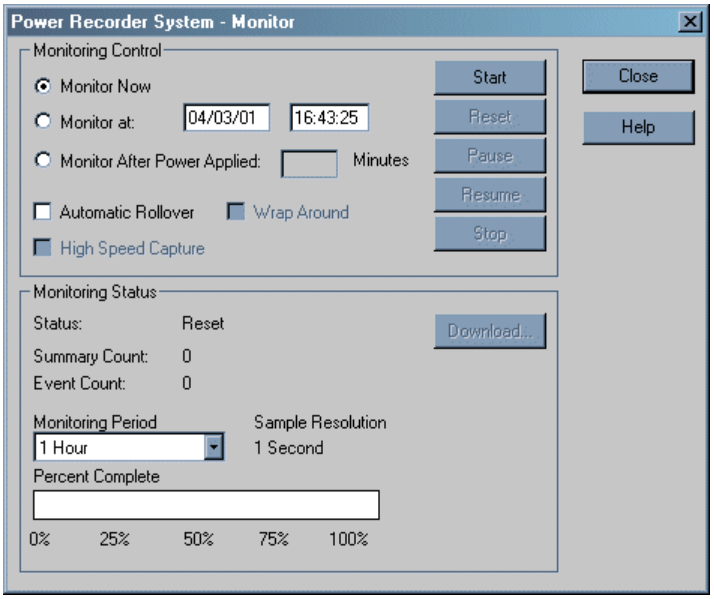
The steps below describe how to start, stop, or resume monitoring, and how to change when monitoring will occur.

Once monitoring begins, it continues until the monitoring period ends, you unplug the unit, or you use the Power Recorder System Software to stop the monitoring.

To start monitoring now

If a PC running the Power Recorder System Software is linked to the Power Recorder, you can start and stop monitoring through the software.

1. Choose **Monitor** from the **Recorder** menu or click the Monitor button.



   The Monitor dialog box appears.

2. If necessary, click **Reset** to clear existing data from the Power Recorder.

   You can tell when the Power Recorder contains data, because information about the data appears in the lower part of the dialog box. You'll see data in the Summary Count, Event Count, and Percent Complete fields.

   In most cases, you'll want to reset the box before continuing. If you paused the monitoring process and want to continue it without resetting, use the Resume button instead of the Monitor Now button. (See "To resume monitoring after pausing it" below.)

3. In the Monitor dialog box, click **Monitor Now**.

4. Click **Start**.

   The Power Recorder begins measuring and storing data.

   If the Power Recorder contains data and you didn't click **Reset**, a message asks you to confirm that you want to reset the Power Recorder and delete the existing data.

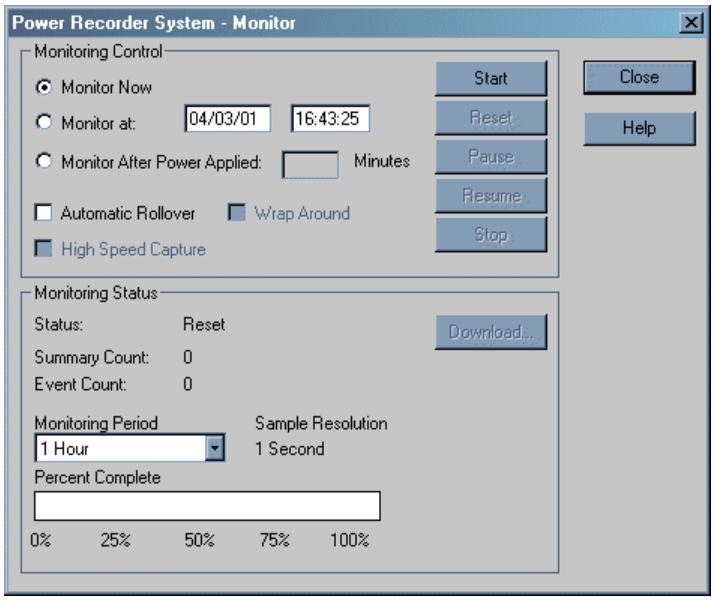
To stop or pause monitoring

1. If necessary, click the Monitor button to open the Monitor dialog box.

2. Click **Stop**.

   The Power Recorder stops monitoring until you start it again.

   The monitoring status appears as *paused* in the dialog box.



   Note: Although the monitoring stops, the monitoring period time clock continues. For example, if the monitoring period is one hour and you stop the monitoring after 15 minutes and resume it 15 minutes later, 30 minutes of the monitoring period will have elapsed, even though data was collected for only 15 of those minutes. There will be no data for the portion of the monitoring period during which monitoring was stopped. When you look at long-term summaries, you will see a blank portion for the paused period of the monitoring interval.

To resume monitoring after pausing it

1. If necessary, click the Monitor button to open the Monitor dialog box.

2. Click **Resume**.

   The Power Recorder begins monitoring again. The new data is collected and appears at the correct point in the monitoring session.

Note: If you want to remove the data from the Power Recorder that's been collected so far, you can click **Reset**. The monitoring session is then canceled, and you can begin it again.

To arm the Power Recorder or change the monitoring settings

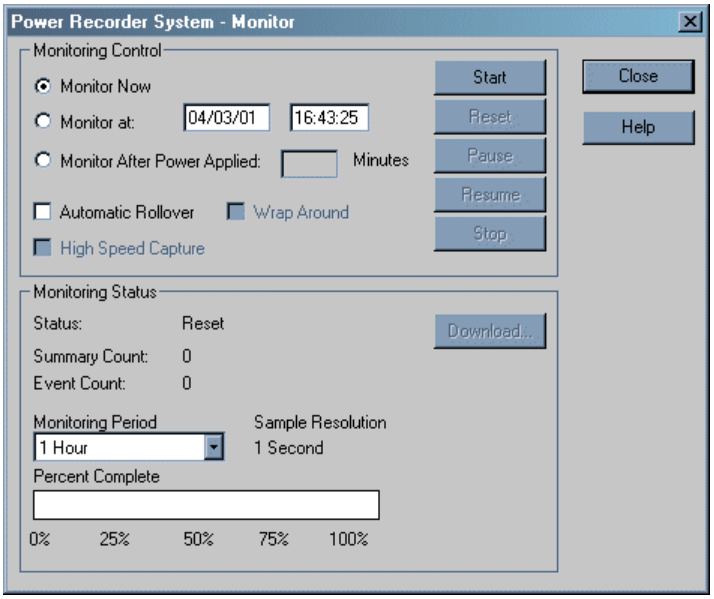
When you want monitoring to begin at some point in the future, you *arm* the Monitor by entering information in the Monitor dialog box.

You can arm the Power Recorder to begin monitoring at a particular date and time, or to begin monitoring a certain number of minutes after power is applied to the Power Recorder. This is usually the last step in configuring the recorder, and is described under "Specifying When Monitoring Should Take Place" on page 41.)

You can also change these monitoring settings when appropriate.

1. Choose **Monitor** from the **Recorder** menu, or click the Monitor button.

   The Monitor dialog box opens and shows the current settings.



2. In the Monitor dialog box, make any changes to the Monitor Control options that indicate when monitoring should begin:

   Select **Monitor at:** and enter a specific date and time.

   Or select **Monitor After Power Applied:** and enter the number of minutes after power is applied when monitoring should begin.

3. In the Monitor Period box, select how long the monitoring should continue.
4. Click **Start** to accept the settings you entered in this dialog box.

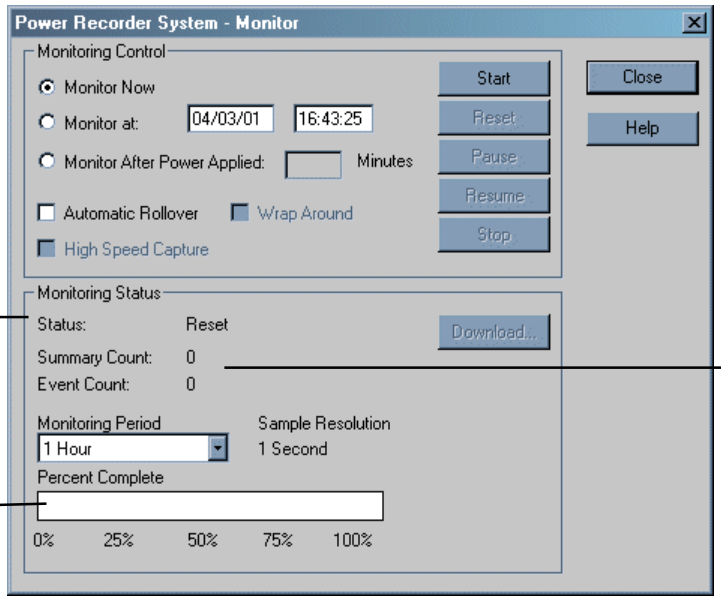
REMEMBER	You must click **Start** in order for any of the Monitor Control Settings to be sent to the Power Recorder. If you close the dialog box without clicking **Start**, the settings you entered are discarded. In addition, if you selected **Monitor After Power Applied**, you must disconnect the Power Recorder and then reapply the power before monitoring will begin.

To check the status of monitoring

You can check the status of monitoring at any time.

▼ Choose **Monitor** from the **Recorder** menu, or click the Monitor button.

The Monitor dialog box opens.



The Monitor Status shows if the recorder is *monitoring*, *stopped*, *complete*, *armed*, or *paused*.

This bar shows how much of the monitoring period has been completed.

When monitoring has begun, the number of summaries and events monitored appears here.

Downloading Data to the PC

You can download from the Power Recorder to a PC running the Power Recorder Software while the Power Recorder is installed at a facility, or you can remove the Power Recorder and download from it at another place, such as your office.

There are several different ways in the Power Recorder System Software to download:

- You can use the Download command to download some or all data from the Power Recorder.
- You can use the Download command to download the summaries first, and then use the Analysis tools to download a portion of the events.
- When you are checking to see if Monitoring is complete, you can use the Download button in the Monitor dialog box to download some or all data from the Power Recorder.
- When you're linked and you choose one of the Analysis tools, you are given the option to download data that's been collected since you last downloaded.

If you have the Polling/Annunciation addition to the Power Recorder System Software, you can use the polling features to automate the process of downloading from one or more Power Recorders. For details, see the *Polling/Annunciation Software Guide* or see "Using the Polling Software" in the online help.

NOTE	Make sure you have enough free space available on your hard disk before downloading (50 MB is recommended). Most Power Recorder System databases are 3 to 4 MB in size, but some can be as large as 25 MB.

As long as you are linked to a Power Recorder, additional data that you download is stored under the same location name in the database. When you unlink, that location in the database becomes closed—additional data cannot be merged with it. Downloading does not affect the data in the Power Recorder. Until you reset the recorder, you can relink and retrieve the data again, including additional data that has been monitored.

To download some or all of the data from the Power Recorder

1. Connect and link the PC running Power Recorder System Software to the Power Recorder.
2. Click the Download button in the toolbar or choose **Download** from the **Recorder** menu.

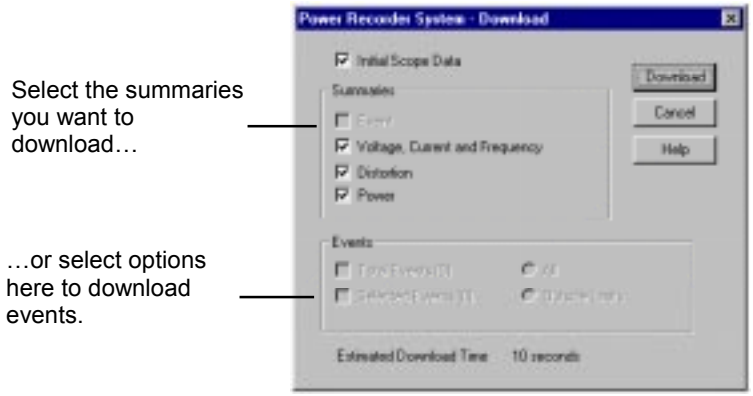
3. In the Download dialog box, select the type of information you want to download by clicking the appropriate boxes.

   You can select the types of summaries you want to download and specify whether you want to download events. If you select **Total Events**, indicate whether you want **All** events or those events that are **Outside Limits**.

   If you select **Event Summaries**, only the amplitude and location of the events are downloaded, while if you select **Events**, you will receive the data needed to display the events as graphs.

   If you want to download selected events, see "To select specific events and download them" below.

   In addition, you can specify whether to download the initial scope data. If you leave this box checked, you download the scope data as it appeared when monitoring started. If you uncheck this box, the Power Recorder System Software retrieves the scope data as it was when you linked to the Power Recorder.



As you select one or more options, the Power Recorder System Software determines how long it will take to download that data and gives you an estimate in the dialog box.

4. When you're ready to begin, click **Download**.

To download while checking the status of monitoring

Note: You can download before the end of the monitoring period without affecting the data in the Power Recorder.

1. Click the Monitor button to open the Monitor dialog.

2. If the monitoring is complete, or if you want to download the data that has been monitored so far, click **Download**.

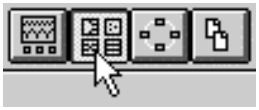
   The Download dialog box opens.

3. Select the types of data you want to download and click **OK**.

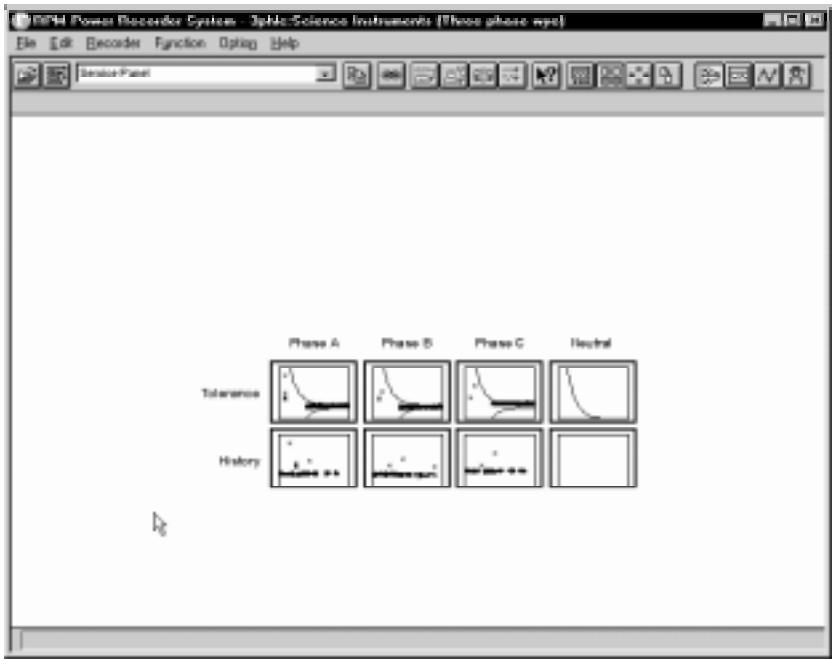
To select specific events and download them

If you don't want to download all of the events, you can download the event summaries first and then mark the events you want to download.

1. Use the Download tool or command and download summaries.
2. Click the Analysis button in the toolbar or choose **Analysis** from the **Function** menu.

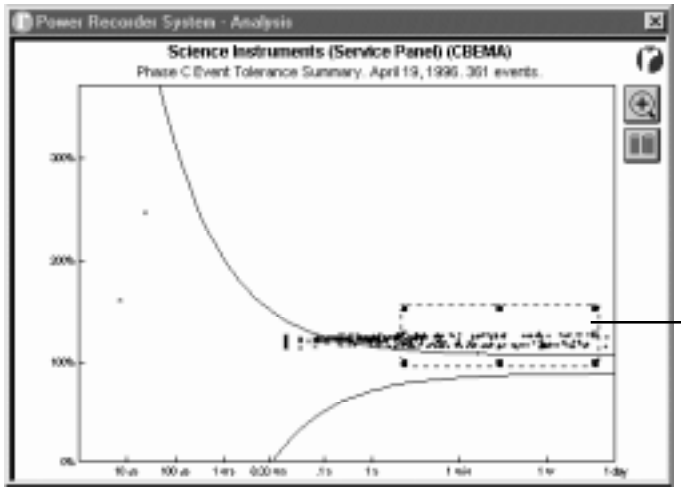


   The icons for the Tolerance and History windows appear in the Disturbance view.



3. Double-click the Tolerance or History icon of the window you want to open.

4. Draw a selection rectangle around the events you want to download.



Select the events you want to download.

5. Click the Download button in the toolbar or choose **Download** from the **Recorder** menu.

   In the Download dialog box, **Selected Events** is already marked, and the number of events you have selected is shown.

6. Click **OK** to download the selection.

7. If you want, repeat steps 3 through 6 to select additional sets of events.

To download individual events

You can download events one by one, as you view them.

1. Use the Download tool or command and download summaries.

2. Use the Analysis tools to open the Tolerance or History window that contains the events in which you are interested.

3. Double-click individual events you want to see.

   When you double-click an event, the Power Recorder System Software downloads data about it and displays it in another window. You don't have to use the Download tool or command.

   Any linked events are automatically downloaded, as well.

Unlinking, Shutting Down, and Removing the Power Recorder

As you work with the Power Recorder System, you may use an individual Power Recorder which you connect directly to a PC running the Power Recorder System Software. Or you may use a network of Power Recorders with a PC that's connected over the network. The procedures in this section tell you how to unlink a Power Recorder from a PC, how to disconnect them, if appropriate, and how to remove the Power Recorder from a facility when you're finished using it there.

This section includes information about:

- Unlinking a PC running the Power Recorder System Software from a Power Recorder, regardless of how they are connected.
- Ending a dial-up connection you initiated from with within the Power Recorder System Software.
- Shutting down the Power Recorder System Software.
- Disconnecting the Power Recorder from a facility.

Unlinking a PC From a Power Recorder

When you finish using the PC and Power Recorder System Software to configure the Power Recorder, inspect scope settings, or download data, you must unlink the PC and Power Recorder using a command in the software.

If you're directly connected to a Power Recorder, be sure to unlink through the software before physically detaching the PC-to-Recorder cable from either the Power Recorder or the PC. Until you unlink, any data you've downloaded has been placed in a temporary file on the PC. When you unlink, you tell the Power Recorder System Software whether to keep or discard that data. If you decide to save the data, it is moved from the temporary file into the open database. If you decide to discard it, the temporary file is deleted.

If you are measuring and recording data at several different locations with the same recorder, you must unlink and then establish a new link after you've moved the Power Recorder. If you are using the same PC with multiple Power Recorders, you must unlink and then establish a new link with the next recorder.

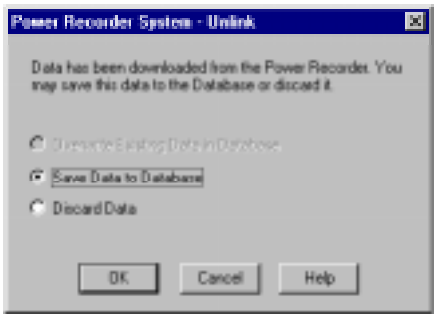
To unlink the PC from the Power Recorder

1. Click the Unlink button in the toolbar or choose **Unlink** from the **Recorder** menu.

   If you haven't downloaded any data, the communication link between the PC and the Power Recorder ends. You can disconnect the two.

   If you've downloaded data, the Unlink dialog box opens.

2. Select an option to indicate what to do with the data you downloaded.



   Overwrite Existing Data in Database. This option is available only when you've previously stored scope or analysis data for the site and location named in the configuration. If you want to replace any data

previously stored for that site and location with the new data, select the Overwrite option.

Save Data to Database. If this is the first time you've saved data for this location, selecting this option saves the data under the current location name. If you're already saved data for this location, this option lets you specify the name of a new location in which to store the data. Use this option when you don't want to overwrite existing data.

Discard Data. This option discards the data instead of saving it. The temporary file that has been holding the data is deleted and the database file remains unchanged.

3. Click **OK**.

   The communication link between the PC and the Power Recorder ends and the data is saved or discarded, as you indicated.

Ending a Dial-Up Connection

If you established a Dial-Up Connection through the Power Recorder System Software, you can end it through the software, as well.

If you established a connection outside of the Power Recorder System Software, end it as you normally end such a connection.

To end a Dial-Up Connection

1. Choose **List Recorders** from the **Recorders** menu.
2. In the List Recorders dialog box, select the recorder for which you want to end the dial-up connection.
3. Click **Dial-Up Connections**.
4. In the Dial-Up Connections dialog box, click **Cancel Dial-Up Connection**.

Disconnecting the PC from a Power Recorder

You can disconnect the PC from a direct connection to a parallel or Ethernet Power Recorder without exiting the software or turning off the PC. However, be sure you have used the Power Recorder System Software to unlink before physically disconnecting the two.

To disconnect the PC from a Power Recorder

1. Unplug the PC-to-Recorder cable from the Power Recorder panel.
2. Unplug the PC-to-Recorder cable or the RJ45 cable from the port on the PC.

Shutting Down the Power Recorder System Software

When you're finished using the Power Recorder System Software, exit the software.

To shut down the Power Recorder System Software

1. Choose **Exit** from the **File** menu.

   If you're working with a new database, you're asked to enter a name before closing it.

2. Type a name for the database and click **OK**.

   The database closes and the Power Recorder System Software quits.

Disconnecting the Power Recorder from the Wiring

WARNING	Use standard high-voltage, high-current safety precautions when disconnecting the Power Recorder from the wiring.

To disconnect the Power Recorder from the wiring

1. Remove the voltage probes from the wiring.
2. Disconnect the Voltage Interface Cable from the Power Recorder.
3. Remove the current clamps from the wiring.
4. Disconnect the Current Interface cable from the Power Recorder.
5. Unplug the Power Recorder from its power source.

Using the Power Recorder System Software Tools: An Overview

This section provides an overview of the main functions of the Power Recorder System Software Scope and Analysis tools, and tells you how to use the Phasors tool to verify connections.

These few pages provide only an introduction. More detailed information is available on-line as you work. When you want more information about the information the Power Recorder System Software displays in a window, how you can customize what you see, and how to work with the tools, press **F1** or choose a command from the Help menu.

NOTE	The specific scope and analysis measurements available from a Power Recorder depend upon what options are installed in that Power Recorder. For details about what measurements are available with each model and option, see the Reliable Power Meters Price List or brochure, or contact RPM Technical Suport. Note that your Power Recorder can be easily upgraded to add additional measurement capabilities. Instructions for installing measurement options are provided in Appendix D, "Upgrading a Power Recorder with Additional Measurement Options".

Using the Scope Tools to Inspect Real-Time Power

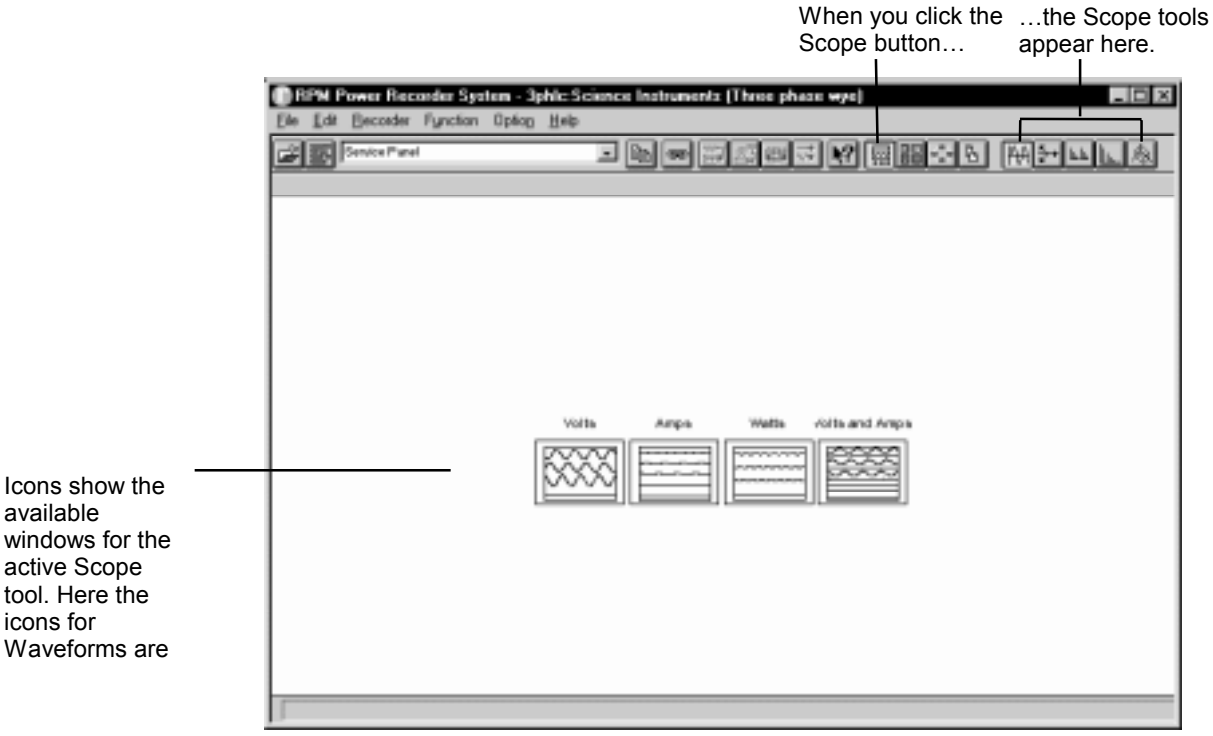
When you are linked to a Power Recorder, you can use the Scope tools to display real-time information for the location where the Power Recorder is installed. (If you're not linked, you can use the Scope tools to review scope settings you've previously saved in a Power Recorder System Software database.)

To inspect real-time power

1. Install the Power Recorder.
2. If necessary, connect a PC running the Power Recorder System Software to the installed Power Recorder.
3. Establish a link between the PC and the Power Recorder.

   For details, see "Linking the PC to a Power Recorder." on page 36.
4. Click the Scope button in the toolbar.

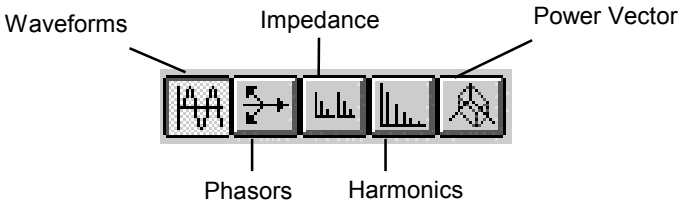
   The Scope tool buttons appear at the right of the toolbar. The Waveforms tool automatically activates, and icons for the Waveforms windows appear in the window.



Double-click an icon to open it to a window. For more about working with icons and windows, see page 12.

The Scope Tools

The Power Recorder System Software includes five Scope tools that let you assess real-time power conditions.



Waveforms displays oscillograph signals of the power. Four windows are available—one each for Volts, Amps, Watts, and one for Volts and Amps.

Phasors displays one window that shows phasor diagrams for voltages, currents, and line impedance. The Phasors tool is especially useful for checking whether the voltage probes and current clamps have been installed correctly. For details, see "Using the Phasors Tool to Verify Connections" on page 92.

Impedance displays fundamental and harmonic impedance from the location to the source, and to the load. When you've just installed the Power Recorder, it takes a few minutes to correctly calculate the impedance. Allow the impedance windows to refresh for approximately two minutes.

Harmonics displays the instantaneous peak values of the harmonics of each of the voltages and currents you're monitoring. You can examine the harmonics for each phase of voltage and current, as well as the harmonics on the neutral and ground voltage, harmonics on the neutral and ground currents, and flicker for each phase of voltage.

Power Vectors displays three-dimensional graphs of VA, VAR, watts, and distortion in the power you're monitoring. Both fundamental and total values are listed in this display.

For more information about the use of a particular Scope tool, activate that tool in the Power Recorder System Software and press **F1** to display the Power Recorder System Software Help.

Pausing the Scope Sweep

When you're linked to an installed Power Recorder, the Scope information refreshes about every four seconds so that what you see is what is occurring right now. You can temporarily halt updating on the screen in order to closely inspect waveforms or other information at the moment of capture, or to copy a picture of a specific graph in a Scope window to the Clipboard to paste it into a report or other document.

Tip: If you are using a dial-up connection the Scope Sweep is slow. You may want to halt the Scope Sweep.

To pause or restart the Scope sweep

▼ Click the Sweep button in the toolbar.

Once you've stopped the Scope sweep, click the button again to restart the updating of information.

Capturing Initial Conditions in the Database

When the Power Recorder begins monitoring, it takes a snap-shot of the Scope's initial conditions and stores them as part of the power record for each location in the database. That way you can examine the Scope data off-site, as well as monitor it on a continuing basis at the facility.

One snap-shot of Scope data is stored for each location in the database. If you want to capture a different snapshot of the Scope settings, you can tell Power Recorder to capture the settings you want while you are linked.

To capture initial conditions in the database

▼ Choose **Capture** from the **Recorder** menu, or click the Capture button.

TIP	If you want to capture more than one snap-shot of Scope data for the same location, you can do so by creating multiple location names for the same location and capturing a snap-shot in each. (First, click the Unlink button and unlink from the Power Recorder.) You can identify such multiple locations with sequential names, such as *Subpanel 3A-1*, *Subpanel 3A-2*, *Subpanel 3A-3*, and so forth. When you unlink and then relink, the new location is automatically given the name of the last location with a number appended to the name.

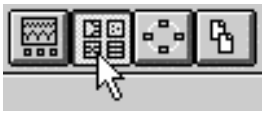
Using the Analysis Tools

When you want to analyze power quality and consumption over time or view disturbances, you start by installing the Power Recorder and leaving it at the facility to collect data. Once the data has been collected in the Power Recorder, you download it to the PC. You can then use the Analysis tools to check for disturbances, significant power events, power consumption, and more.

To analyze power data over time

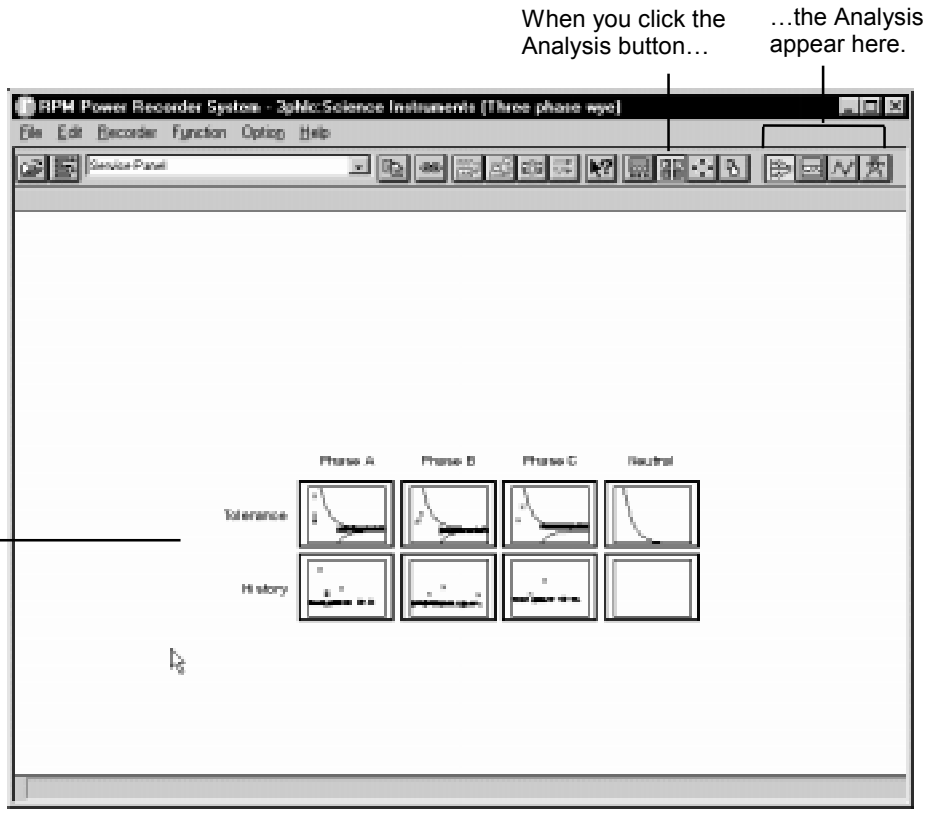
1. Install the Power Recorder at the facility and leave it to collect data over time.
2. When the data has been collected, connect the PC to the Power Recorder and establish a link through the Power Recorder System Software.
3. Use the Download tool and download the summaries, or the summaries and the events. (For details, see page 65.)

4. Click the Analysis button or choose **Analysis** from the **Function** menu.



The Analysis tool buttons appear at the right of the toolbar. The Disturbances tool automatically activates, and icons for the Disturbance History and Tolerance windows appear in the window.

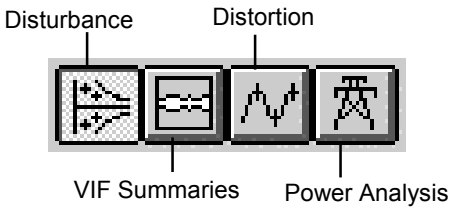
If you're linked to a Power Recorder, the software may open the Download dialog box so that you can download data to review with the Analysis tools.



Double-click an icon to open it to a window. For more about working with icons and windows, see page 12.

The Analysis Tools

The Power Recorder System Software includes four Analysis tools that display events and summary information.



Disturbance tools display graphs of events plotted by Tolerance and History for each phase.

VIF Summaries displays long-term summary graphs of voltage (VRMS), current (IRMS), and frequency for each phase.

Distortion displays long-term summary graphs of harmonic distortion of each of the phase voltages and currents, any imbalance for voltage or current, and flicker summaries for phase voltages.

Power Analysis displays graphs showing phase and total watts, demand, reactive power (VAR), Volts-Amps (VA), and power factor (PF).

For more information about the use of particular Analysis tools, activate that tool in the Power Recorder System Software and press **F1** to display the Power Recorder System Software Help. You'll also find some information about events and summary graphs in Appendix E, Event Tolerance Displays, and Appendix F, Summary Graphs.

Using Scope and Analysis Data in Reports

You can copy any of the Scope and Analysis graphs into other applications—such as Microsoft Word or Excel—to include them in reports. You can also copy the data from these graphs into a text file for further use in a word processing or spreadsheet document.

The Copy Graphics command on the Edit menu copies the contents of the active window to the Clipboard as a bitmap file. You can then paste the graph into another application. If you want to copy the information shown in the status bar as well, you can copy it separately.

The Copy to Text File command on the Edit menu lets you copy the data from the active window to a text file.

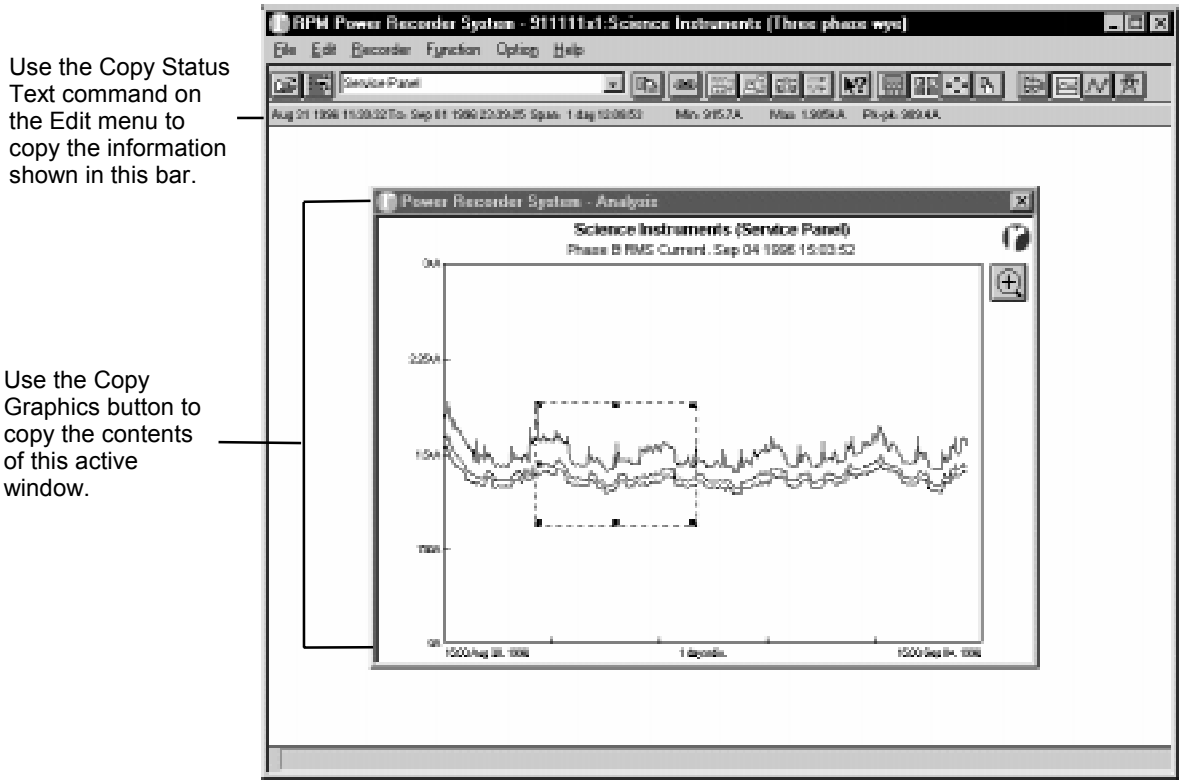
If you purchased the Report Writer for the Power Recorder System software, you have a tool that automatically creates reports. For details, see the *Report Writer Guide*.

To copy a black-and-white version of the graph to the Clipboard

If you want to print to a black-and-white printer, you'll get the best results if you first display the graphs in Monochrome.

1. Choose **Color** from the **Options** menu.
2. The Change Colors dialog box opens.
3. Click **Monochrome** at the bottom of the dialog box.
4. Click **Done**.
5. The current color settings change to monochrome.
6. Display the graph you want to copy.
7. Click the Copy Graphics button in the toolbar or choose **Copy Graphics** from the **Edit** menu.

The contents of the active window are copied to the Clipboard.



8. Open the application into which you want to paste the graphic and choose **Paste** from the **Edit** menu.

9. If you want to include the information in the status bar, choose **Copy Status Text** while the graph is open.

   The contents of the status bar are copied to the Clipboard.

10. Return to the document you pasted the graphic into in step 6, select the location where you want to paste the information, and choose **Paste** from the **Edit** menu.

To copy data into a text file

You can copy a text version of the information shown graphically in Power Recorder System Software windows. If one or more windows are open in a view, the data from the active window is copied. If no windows are open, and only the thumbnails appear in the view, the data from all the windows is copied. This can result in a file containing huge numbers of data entries. (One VIF summary can include up to 10,800 data entries.)

1. Open the window that contains the data you want to copy.
2. Choose **Copy to Text File** from the **Edit** menu.
3. In the dialog box that opens, type a name for the file to which the text will be copied.
4. Change the directory or drive if you want to save the file in a different location.
5. Click **OK**.

   The data is copied to the file.

   For more information about the data that's copied from Event Tolerance and History graphs, see "Saving Event Tolerance and History Data as Text" on page 115.

Changing the Colors in Graphs

You can change the colors used to display data in Power Recorder System Software windows. You can also change the display so that graphs are shown in Monochrome. This allows you to copy one or more graphs for printing on a black-and-white printer.

Note: You can hide the Min/Max or Average lines by changing them to the background color. (In Monochrome, the background color is white; in the default color scheme, it is black.)

To customize the color settings used in the Power Recorder System Software

Tip: You may want to open a Scope or Analysis window before changing colors. That way you can see the effect of changing colors immediately.

1. Choose **Colors** from the **Option** menu.
2. Select the screen element you want to change.

   The color now active for the selected element shows in the box on the right.

3. Click **Change Color** to open the Color dialog box.
4. Click the color you want, or use the arrow keys to select it.

   Or, if you want, click **Define Custom Color** and define the color you want.
5. Click **OK** to return to the Change Colors dialog box.

   If you have a graph open in the main window, you'll see the new color.
6. Repeat steps 2 through 5 for each screen element you want to change.
7. When you've finished, click **Done**.

   If you later want to use the original color settings, open the Color dialog box and click **Defaults**.

To display all graphs in monochrome

1. Choose **Colors** from the **Option** menu.
2. Click the **Monochrome** radio button at the bottom of the dialog box.

   You'll see the graphs change from colors to monochrome.

   Tip: If you want graphs to be surrounded by a gray border, double-click the **Exterior Fills** item in the list of screen elements. In the Color dialog box that opens, select the solid gray box. Then click **OK** to return to the Change Colors dialog box.
3. Click **Done**.

   All graphs will appear in black-and-white until you click the Colors setting.

   Note: If you previously customized color settings, the software remembers them when you switch to Monochrome. If you return to color settings, the settings you selected are returned. If you want to use the original color settings, click **Defaults**.

Setting Preferences

You can change some specialized default options by setting Preferences in the Power Recorder System Software.

To set preferences

1. Choose **Preferences** from the **Options** menu.

   The Preferences dialog box opens.

2. Specify the settings you want used as your preferences:

   Note: The preference settings grouped at the top of the dialog box as Location Defaults can all be changed for individual locations in the Location Information dialog box.

   Power Type Choose the type of power to be the default for new locations.

   Nominal Voltage Select a standard voltage from the list, or click in the box and type the voltage you want to designate as the 100% point for the CBEMA curve or the 0 point for the ANSI curve.

   Frequency Choose the frequency to be the default for new locations: 60Hz (U.S.) or 50 Hz (European).

   Tolerance Format Select the type of limit curve you want to use on the Disturbance graphs. The pop-up list includes ANSI, CBEMA, ITIC, and any tolerance formats you have defined and named using the Edit Tolerances command on the Function menu.

   Language Select the language you want to appear onscreen. This option only works if the necessary language files are installed.

Use Last Database Mark this option when you want the last database you used to open each time you start the Power Recorder System Software. If you don't mark this box, a new, empty database opens.

Display Event Links Mark this option when you want links to related events to display in Tolerance and History windows while you are inspecting specific events. (Related events appear in small detail insets.) Unmark this option if you do not want such links to display. (**Tip:** When you want to view the position of impulse wave shapes, turn **Display Event Links** off for a better picture.)

Monitoring Period Choose the monitor period that you want to be the default setting in the Monitor dialog box.

3. Click **OK**.

Changing Multipliers

When you are using a CT (current transformer) or a PT (potential transformer), you can have the Power Recorder System Software report the actual current and voltage read-outs by entering the appropriate turns ratio of these devices as multipliers. When you do so, you should enter the necessary multiplier for each phase, neutral, and ground.

To change multipliers

1. Choose **Multipliers** from the **Option** menu.

   The Multipliers dialog box opens.

2. Enter the multiplier you want to use for voltage and current on each of the phases and neutral.
3. Click **OK**.

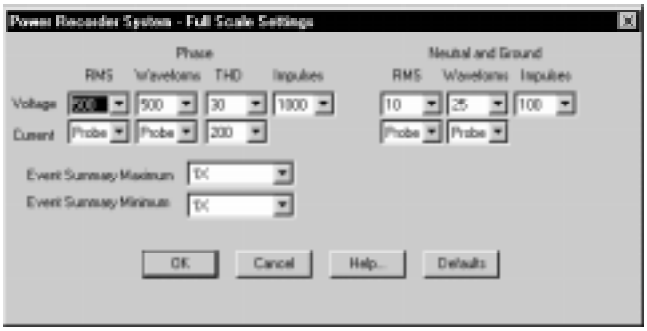
Changing Full Scale Settings

If the presentation on a graph is too large or too small, you can change the full scale values in this dialog box to rearrange how the data is presented in the windows. These settings can be set or changed at any time without altering captured data.

To change full scale settings

1. Choose **Full Scale Settings** from the **Options** menu.

   The Full Scale Settings dialog box opens.



2. For each of the Voltage and Current fields, enter the volts or amps to be used as the full scale in the windows.

   When you are connected to the Power Recorder, *Probe* appears as the full scale current value. This means that the value of the current clamp you have installed will be used. (You can enter a different value if you want—for instance, if you are using a 5 amp clamp with a CT.)

3. As the Event Summary Maximum, select the multiplier you want to use to expand the scale of the amplitude in the Event Summary windows.

   This is helpful when you are encountering large voltage impulses and want to see their relative value. They will not be jammed against the top of the graph.

4. As the Event Summary Minimum, select the multiplier you want to use to add negative voltage to the Event summary windows.

   When you have significant sags or outages, this allows you to see them more clearly. They will not be jammed against the bottom of the graph.

5. Click **OK**.

Setting the Demand Power Interval

You can set the interval over which watts are averaged on the Demand graph in the Power Analysis View. You can change this setting even if you've already downloaded data from a Power Recorder.

Typically, you should set the demand power interval to match that of your utility. You can then use the Demand graph to determine how best to manage loads.

To set the demand power

1. Choose **Demand Power** from the **Options** menu to open the Demand Power dialog box.
2. In the **Demand Interval** field, select the interval you want to use—from 5 to 60 minutes.
3. Mark the option **Use 5-minute sliding window** if appropriate.

   Utilities record demand based on a sliding or non-sliding window. Usually you will want to turn this setting on or off to match your utility's settings. If you're not sure what method your utility uses, your utility rate schedule will tell you.
4. Click **OK** to accept the changes in this dialog box.

   The interval you selected will now be used when you display Demand graphs.

Using the Phasors Tool to Verify Connections

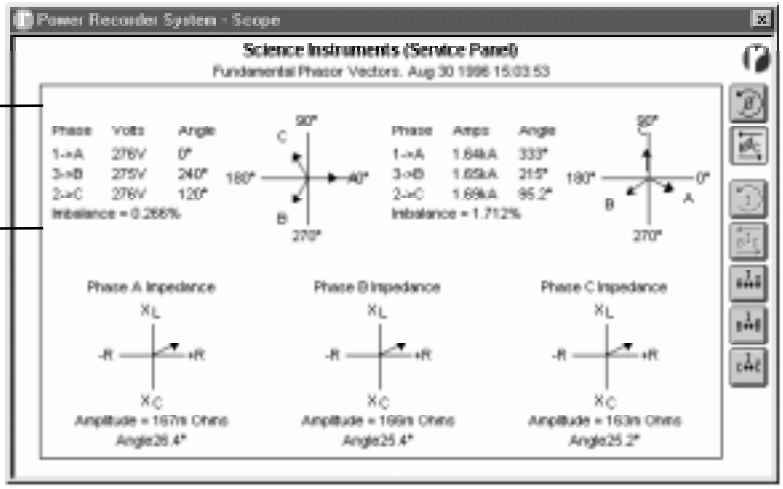
You can use the Phasors tool to determine if the current clamps and voltage probes are correctly installed.

If the polarity of the current clamps is incorrect, or if you have attached voltage probes or current clamps to the wrong phases, you can make corrections with the tools in the Phasors window so that the data being collected can be correctly displayed. This lets you avoid re-entering the panel to make physical changes to the position of the clamps and probes.

NOTE	It's a good idea to link to the Power Recorder and use the Phasors tool to check and correct any miswiring before you start to monitor data. Some connection mistakes must be corrected before the power is monitored to ensure accurate data. Voltage and current must be paired correctly.

Checking Phase Rotation

The graphs at the top of the Phasors window indicate whether the probes and clamps are attached to the correct wires. When they are attached correctly, the phase angles are A-0°, B-240°, and C-120°, and the vectors representing the phases rotate counter-clockwise, as shown in the screenshot on the next page.



If the graphs in the Phasors window show different phase angles, or show the phases in a different rotation, one or more of the probes and clamps are connected to the wrong wire.

Changing Phase Rotation

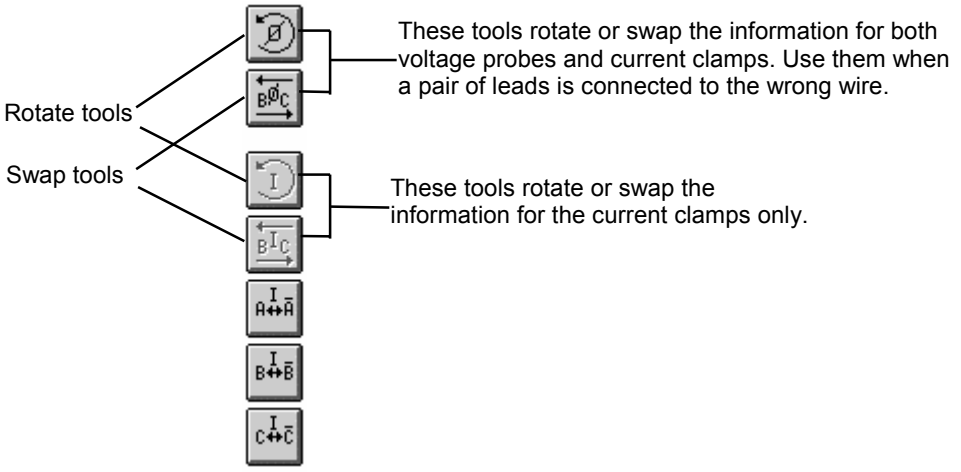
If the probes and clamps are hooked up incorrectly, you can specify which connections are incorrect and need to be adjusted through the software.

Two kinds of changes can be made—rotating the position of all three leads, or swapping the position of two leads.

Rotating. If all three leads are connected to the wrong wires, you can have the Power Recorder System Software rotate the positions counter-clockwise, so that the lead for channel 1 shifts to phase C, the lead for channel 2 shifts to phase A, and the lead for channel 3 shifts to phase B. Rotating a second time would shift channel 1 to phase B, channel 2 to phase C, and channel 3 to phase A.

Swapping. If you've connected the leads for channel 2 (the red leads) to the phase C wire instead of the phase B wire, and the leads for channel 3 (the blue leads) to the phase B wire, you can have the software swap the two channels. The information coming in on channel 2 will then be interpreted as belonging to phase B, and the information coming in on channel 3 as belonging to phase C.

The Phasors window includes two sets of tools for correcting phase rotation errors:



Most of the time, you'll probably use the Phase Rotate and Phase Swap tools and make a change that affects a pair of leads. But if you didn't correctly pair a voltage probe and current clamp when connecting to the wiring, you must use the Current Rotate and Current Swap tools in combination with the phase tools to indicate how the leads are actually connected.

CAUTION	If you incorrectly paired voltage probes and current clamps, you should correct this problem **before** monitoring power to collect data. The Power Recorder System calculates information about power using both voltage and current information for each phase. Individual voltage and current pairs cannot be separated after data has been collected in the Power Recorder through monitoring.

To rotate the phases

1. Click the Phase Rotate tool.

   Channel 1 moves to phase C, channel 2 moves to phase A, and channel 3 moves to phase B. You'll see the change take place in both voltage and current phasor graphs.

2. If necessary, click the Phase Rotate tool again to rotate the phases another turn.

To swap phases

1. Click the Phase Swap tool.

   Channels B and C are interchanged for voltage and current.

   If you need to swap channels other than B and C, use the Phase Swap tool and the Phase Rotate tool until the settings are correct. You can tell when the necessary changes have been made because the phase angles will be approximately A-0°, B-120°, and C-240°.

2. If necessary, use the Phase Rotate tool now to rotate the phases.

To rotate the current

1. Click the Current Rotate tool.

   Channel 1 moves to phase C, channel 2 moves to phase B, and channel 3 moves to phase A. You'll see the change take place in the current phasor graph.

   Note: If you've already monitored data, the Current Rotate tool is not available.

2. If necessary, click the Current Rotate tool again to rotate the current phases another turn.

To swap current

1. Click the Current Swap tool.

   Channels B and C are interchanged for current.

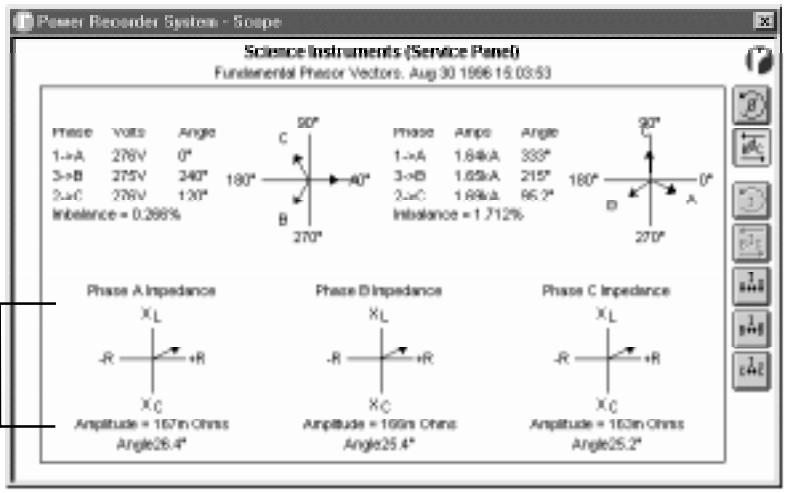
   If you've already monitored data, the Current Swap tool is not available.

   If you need to swap channels other than B and C, use the Current Swap tool and the Current Rotate tool until the settings are correct.

2. If necessary, use the Current Rotate tool now to rotate the phases.

Checking the Polarity of the Current Clamps

The graphs at the bottom of the Phasors window show the impedance for each of the phases. The values below each graph show the vector's amplitude and angle.



Impedance Graphs

If the impedance is negative (the vector is in either quadrant on the left side of the graph), the polarity of the current clamps is probably reversed.

Another indication of reversed polarity is if the current phasor is pointing in the wrong direction by 180°.

NOTE	Before you change the polarity, check to see if there is a generator in the system. Negative impedances are also indicated if there is an additional generator in the system. If there is an additional generator, don't change the polarity.

If you would like more information about phasors, see the references in Appendix B, Background Materials.

Reversing the Polarity

The Phasors window includes tools that correct for reversed polarity. An Invert tool appears for each of the phases in the power you're measuring.

To reverse the polarity

1. Click the Invert button for the phase for which you want to reverse the polarity.

   The Power Recorder System Software reverses the polarity for that phase, just as though you physically inverted the clamp.

2. If necessary, click additional Invert buttons to change the polarity of other current clamps.

Appendices

Appendix A. Glossary

Configuration

The configuration for the Power Recorder specifies information about the location where power is being monitored, such as power type and feed phase (for single phase). It can also contain information about the facility where power is being monitored, names of contacts at the site, and a description of the problem. Site and location names can also be included. When you link the a PC to a Power Recorder, the configuration now in the Power Recorder appears in the Link dialog box.

Database

The Power Recorder System Software organizes information in a database. Each database can contain information about the power at many different locations. A Power Recorder System Software database is actually a collection of files, with one primary file that uses the database's name. The files associated with each database are stored together in a subdirectory.

Location

This is the particular panel or branch load where you physically connect the Power Recorder to measure power. In the Power Recorder System Software database, locations are organized under *Sites*.

Power Recorder

The Power Recorder is the power monitoring unit that you connect to the power to measure, collect, and store data.

Power Recorder System

The complete power analysis system available from Reliable Power Meters, including both a PC running the Power Recorder System Software and a Power Recorder.

Site

A building or other facility, or portion of one, represented by a name in the database and in the Power Recorder configuration. Sites provide a way to group information about related locations in your database. You can enter information about a site, such as an account number and contact name, and include information about the power problems being experienced at the site. You can measure power at multiple locations within the same site. (See also Location.)

Appendix B. Background Materials

Following is a list of publications and other materials you may find useful if you want additional background information about the Power Recorder System.

Practical Guide to Quality Power for Sensitive Electronic Equipment, EC&M Intertec Electrical Group, 1992. (Available from Reliable Power Meters.)

Guideline on Electrical Power For ADP Installations, a Federal Information Processing Standards Publication, U.S. Department of Commerce, National Bureau of Standards, 1983.

Interaction Between Computer Systems and Their Power Source, A Tutorial Seminar presented at The Power Sources User's Conference, by John Frederick Kalbach.

Practical Guide to Power Distribution Systems for Computers, EC&M Intertec Electrical Group.

Practical Guide to Energy Efficiency & Reduced Costs, EC&M Intertec Electrical Group.

Practical Guide to Motors & Motor Controllers, EC&M Intertec Electrical Group.

Power Quality Reference Guide, Maura C. Ryan, Ontario Hydro, 1988.

IEEE Std. 519—1992, IEEE
Guide for Harmonic Control and Reactive Compensation of Static Power Converters.

IEEE Std. 1100—1992, IEEE
Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

IEEE Std. C62.41—1991, IEEE
Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

IEEE Std. 141—1993, IEEE
Recommended Practice for Electric Power Distribution for Industrial Plants (ANSI) (Red Book)

IEEE Std. 100-1992, IEEE
Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (ANSI) (Emerald Book).

IEEE Std. 242-1986
Recommended Practice for Energy Conservation and Cost-Effective Planning in Industrial Facilities (ANSI) (Bronze Book).

IEEE Std. 399-1990
Recommended Practice for Industrial and Commercial Power Systems Analysis (ANSI) (Brown Book).

IEEE Std. 493-1990
Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems (ANSI) (Gold Book).

IEEE Std. 241-1990
Recommended Practice for Electric Power Systems in Commercial Buildings (ANSI) (Gray Book).

IEEE Std. 446-1987
Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (ANSI) (Orange Book).

IEEE Std. 602-1986
Electric Systems in Health Care Facilities (ANSI) (White Book).

Guide to Quality of Electrical Supply for Industrial Installations, Advance VIE Edition, Subject to Revision, Prepared by Groupe de travail GT2 "Perturbations sur reseaux", "Disturbances" Working group GT 2, Union Internationale d'Electrotehermie, Paris, France.

Handbook for Electricity Metering, Edison Electric Institute, 1986.

Computer Electrical Power Requirements, Mark Waller, Howard W. Sams & Company, 1987.

The Dranetz Field Handbook for Power Quality Analysis, Dranetz Technologies Incorporated, 1991.

Handbook of Power Signatures, Alexander McEachern, Basic Measuring Instruments, 1988.

Appendix C. Updating the Power Recorder System Software

When you update the Power Recorder System Software with a more recent version, you must change the software in both the PC and the Power Recorder. **After you update the software in the PC, it will not communicate with the Power Recorder until you have updated the software in the Power Recorder.**

If you are adding the Polling/Annunciation Software or the Report Writer Software but are not updating to a newer version of the basic Power Recorder System Software, you do not have to update the Power Recorder.

CAUTION: UPDATING WILL REPLACE EXISTING DATA	■ Updating the Power Recorder System Software will replace the old sample database (SAMPLE.OMG) with a new sample database. If you want to keep the old sample database and get the new one, use the **Save As** command on the File menu to save the old sample database under a different name. ■ Updating the software in the Power Recorder will remove all data from the recorder. **Be sure to download and save all data from the Power Recorder before updating the software**. If you have more than one Power Recorder, you must download data from each recorder while the current version of the software is on your PC. If you cannot download data from all recorders before installing the new version, be sure to keep your previous version of the Power Recorder System Software.

Requirements

If you are adding the Report Writer Software, you must have **Microsoft Word Version 8.0** or higher installed on the computer that will be used to generate Power Recorder System reports.

To update the software in the PC

1. Start Microsoft Windows on your PC.
2. Insert the first installation disk in drive A or B.
3. In the dialog box that appears, type:
   - **`A:\SETUP`** or **`B:\SETUP`**
   - **Be sure to use the correct designator for the floppy drive in which you inserted the installation disk.**
   - **Click** OK**.**
   - **Follow the instructions that appear on the screen, and swap diskettes when requested.**

   The Power Recorder System Software is installed on the hard drive of your computer and a program group named "RPM" is created.

Note: If you have questions or problems regarding this software update, please contact Technical Support at Reliable Power Meters (408) 358-5100.

To update the software in the Power Recorder

Be sure to update the software in each of your Power Recorders.

1. If necessary, connect a PC running the Power Recorder System Software to the Power Recorder.
2. Plug the Power Recorder into a power source.

   The recorder must be powered up for at least two minutes before you install the new software.
3. Turn on your PC and start the Power Recorder System Software.

   You do not need to link to the Power Recorder.
4. Press Ctrl-Shift-F7.

   This means to hold down the **Ctrl** and **Shift** keys and press **F7**. Then release the keys.

   If you're connected to a Parallel Power Recorder, the software in the Power Recorder is updated.

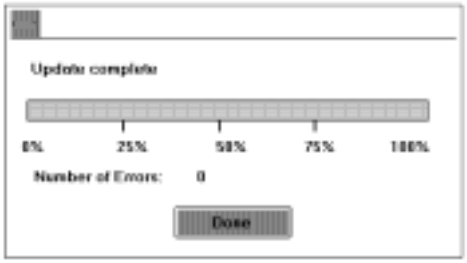
   If you're connected to an Ethernet Power Recorder, the List Recorders dialog box appears and lists all available recorders.
5. Select one or more Power Recorders for which you want to update the software and click **OK**.

You can use the Shift-Click and Ctrl-Click to select multiple recorders in the list.

The software in the Power Recorder(s) is updated.

6. If you're prompted to disconnect the meter power for 5 minutes, unplug the power cable to the Power Recorder and wait 5 minutes.
7. Reconnect the power to the Power Recorder.

   The following screen appears:



8. Click **Done**.
9. To confirm that the update was performed successfully, link to the Power Recorder.
10. From the **Help** menu, choose **About Power Recorder System**.

    Make sure the correct versions of the software are shown as installed in the About box.

Appendix D. Upgrading a Power Recorder with Additional Measurement Options

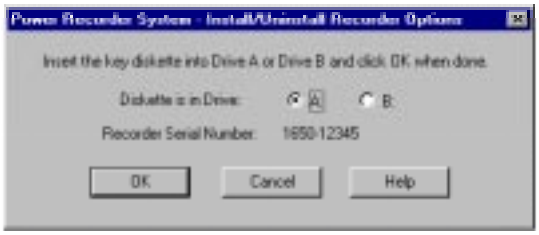
You can add measurement options to a Power Recorder by updating the software in it. Before you begin, you need the key diskette that contains the software. This diskette is provided by Reliable Power Meters when you purchase the measurement options.

If you're not sure what options are currently in a Power Recorder, link to it and click the **About** button in the Link dialog box. You can also choose **About** from the Help menu while you are linked to the recorder.

To upgrade a Power Recorder with additional measurement options

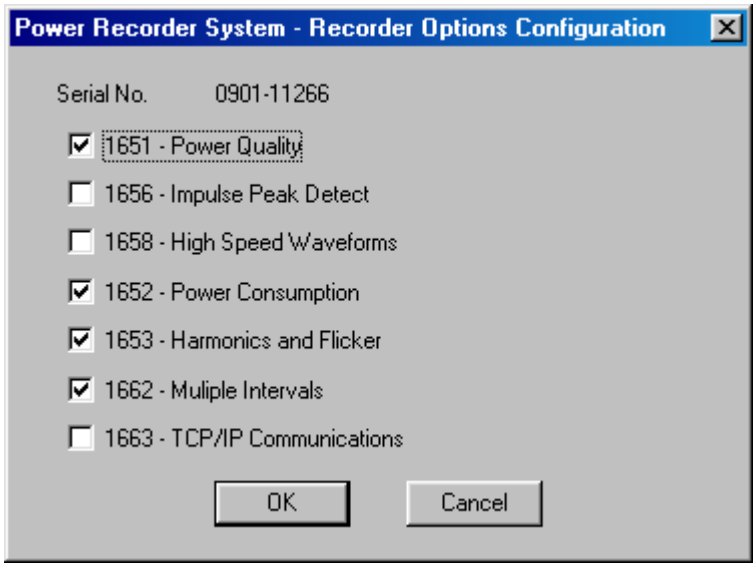
1. From a PC running the Power Recorder System Software, link to the Power Recorder you want to upgrade.
2. Choose **Configure Recorder Option** from the **Recorder** menu.

   The Install/Uninstall Recorder Options dialog box appears.



3. Insert the key diskette containing the software in Drive A or B.
4. Make sure the dialog box reflects the drive in which you inserted the diskette and click **OK**.

   The Recorder Options dialog box appears.



5. To add an option, make sure the box next to it is checked.

   (You can also remove an option by unmarking the box next to it.)

   If an option is gray, it is not on the key diskette and cannot be installed or removed.

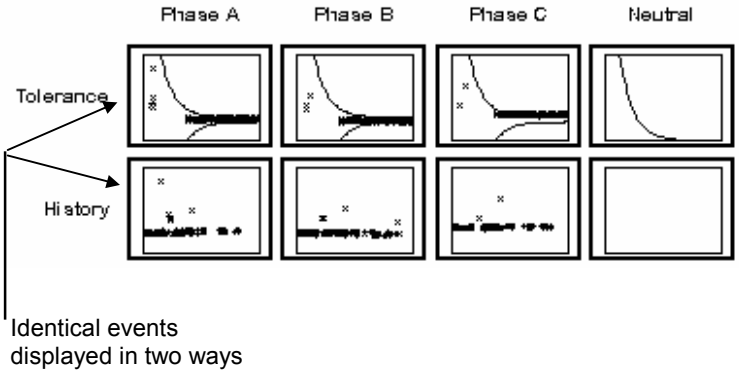
6. Click **OK**.

   The software in the Power Recorder is upgraded with the measurement options you specified.

Appendix E. Event Tolerance Displays

Events consist of Impulses, Waveshape faults, and surges and sags. These events are created by changes in monitored voltage.

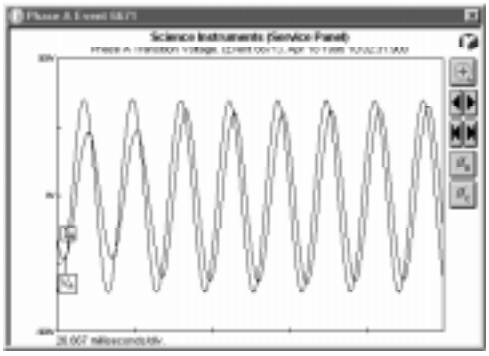
Events are graphed on both Tolerance and History Summary displays. The **Tolerance** graph displays events by **amplitude versus duration**. The **History** graph displays these same events by **amplitude versus date/time of occurrence**.



Types of Graphic Presentation of Events

In general events are shown in three types of graphic presentations: Transitional, Event, and Impulse.

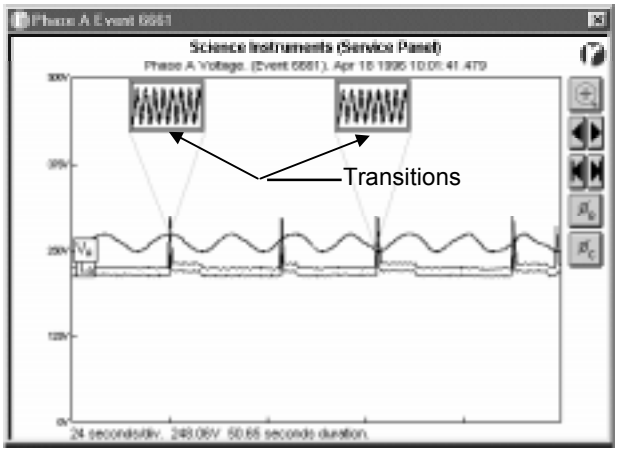
1. Transitional - where the voltage has not stabilized and the Δ Rms is greater than the adaptive threshold value.



Transition Graphic

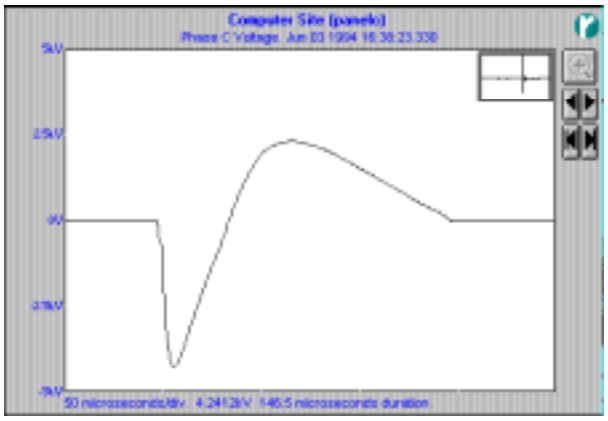
2. Event Graphic - the period between two transitional events. Each Event graphic is bounded by two Transitional Events.

   Events are plotted as dots on the tolerance curves.



Event Graphic

3. Impulse - high frequency surge typically caused by lightning or switching.

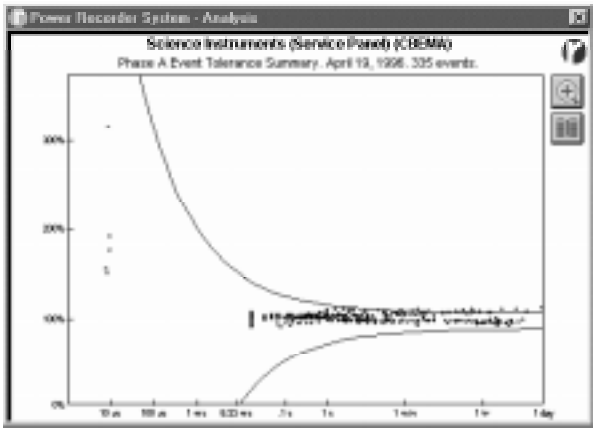


Impulse Graphic

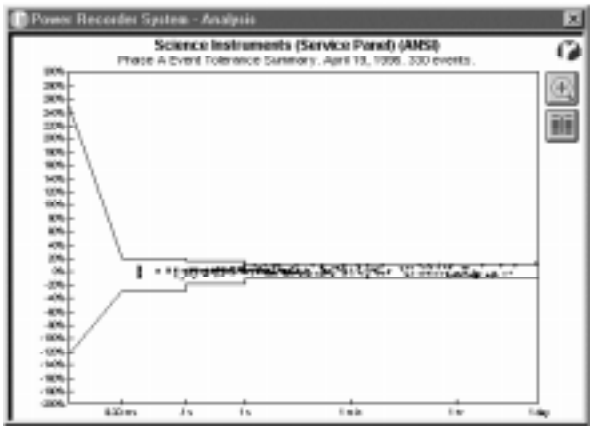
Tolerance Curves

All events are mapped on a tolerance curve. These events are marked on the tolerance curve when summaries are downloaded.

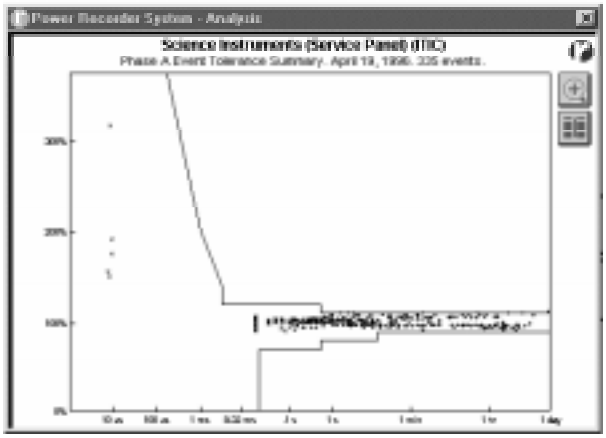
The tolerance curves consist of the CBEMA curve (Computer Business Equipment Manufacturers' Association), the ANSI curve (American National Standards Institute), the ITIC curve (Information Technology Industry Council). You can create other curves by using the CBEMA, ANSI, or ITIC curve as an editing model. (Use the Edit Tolerances command from the Function menu.)



CBEMA Curve



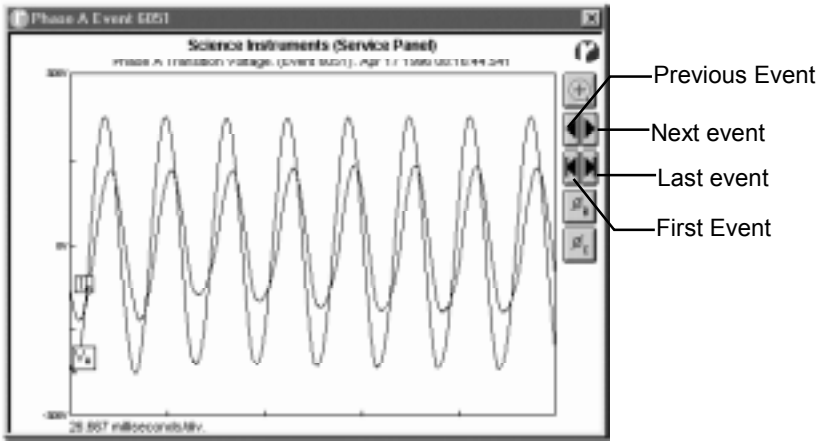
ANSI Curve



ITIC Curve

Downloading Individual Events and Moving Between Events

When you view a History or Tolerance graph, some points that indicate events may appear as X's. This occurs when only summary data (the amplitude and location) has been downloaded. If you double click on one of the X's while connected to the Power Recorder, the graphic presentation is downloaded from the Power Recorder and presented on the screen, like this:



Detailed Graphic of an Event

After you download such an event, the "x" on the graph becomes a dot.

Buttons on the graph allow you to "walk" through next and previous events. Each graphic is downloaded to your PC as you select it.

If you unlink from the Power Recorder prior to downloading a graphic (either by placing a selection box around a group of events, double clicking on a single event, viewing an event, or downloading all events) double clicking on an "X" will produce an empty graph, like this:

Event Not Downloaded From Monitor

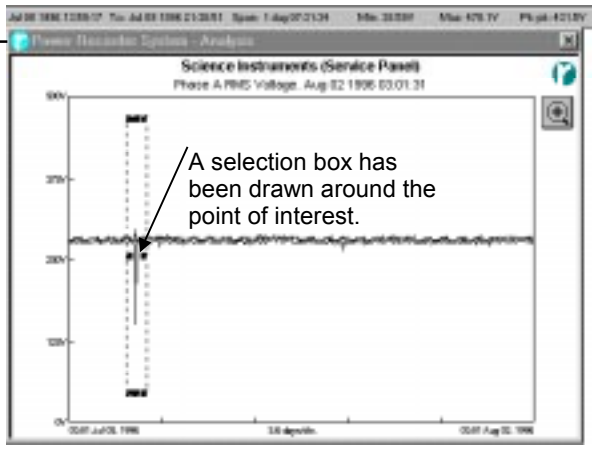
Using the History Graph to Check for Events at Specific Dates and Times

While the **Tolerance** graph displays events by **amplitude versus duration**, the **History** graph displays these same events by **amplitude versus date/time of occurrence**.

The History graph can be particularly useful when locating specific dates and times during the monitoring period to determine if any events occurred. Anomalies seen in summaries at specific times can therefore be associated with certain events happening at simultaneous times.

To take advantage of this feature, first view the VIF summary graphs to identify a period of interest. For example, the next graph shows how a selection box drawn around a period of interest in an RMS Voltage graph to identify the exact date and time.

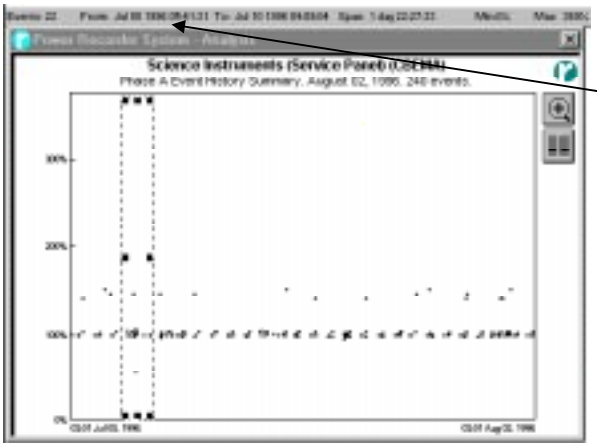
The date, time, and span of time that correspond with the selection box appear in the status bar at the top of the screen.



Summary Graph

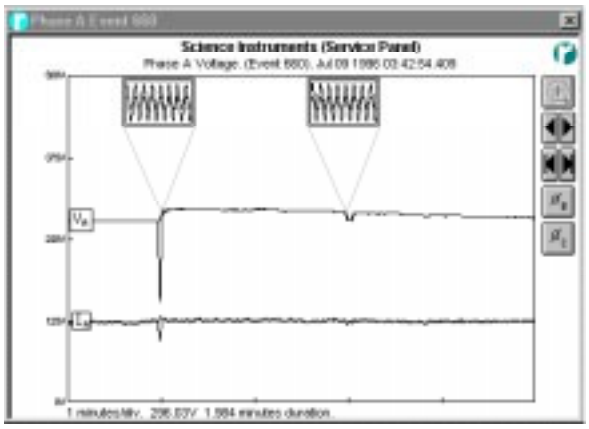
Write down the date and time of interest.

Next, open the History Graph, draw a selection box of about the same size, and move it across the graph until the same date and time appear in the status bar, as shown in this next graph:



Event History Graph

Notice whether an event appears in the selection box on the History graph. If one does, double-click on it see the detailed event, like this one:



RMS Voltage Min/Max Graph

Saving Event Tolerance and History Data as Text

Event Tolerance and Event History graphs can be saved as text reports. They are formatted as follows:

Phase A Event Tolerance Summary. June 08, 1994. 22 events.

< Site> (<Location>)

16:27 Jun 08, 1994 17:27 Jun 08, 1994

Number	Type	Amplitude	Duration	Date and Time
30	4	203.176	0.000	Jun 08 1994 16:28:00.534
20	4	203.176	0.000	Jun 08 1994 16:28:00.584
40	17	1.953	0.133	Jun 08 1994 16:28:00.525

Graph Number — Event Type — Voltage Amplitude — Seconds Duration — Date & Time

Note: The last digit of the Graph Number indicates the phase—0 indicates phase A, 1 indicates phase B, and 2 indicates phase C. The sample above shows data about Phase A events.

Events can be out of numerical sequence. This happens when an event is in process during a period in which another event occurs.

Here's what the event types mean:

0 RMS Voltage event, single line graph

1 RMS Voltage event, min/max graph

2 Voltage waveform event, single line graph

4 Voltage impulse event, single line graph

15 RMS Voltage transition event, single line graph

16 RMS Voltage transition event, min/max graph

17 Voltage waveform transition event, single line graph

19 Voltage impulse transition event, single line graph

24 RMS Voltage/Current event, single line graph

25 RMS Voltage/Current event, min/max graph

26 Voltage/Current waveform event, single line graph

28 RMS Voltage/Current transition event, single line graph.

29 RMS Voltage/Current transition event, min/max graph.

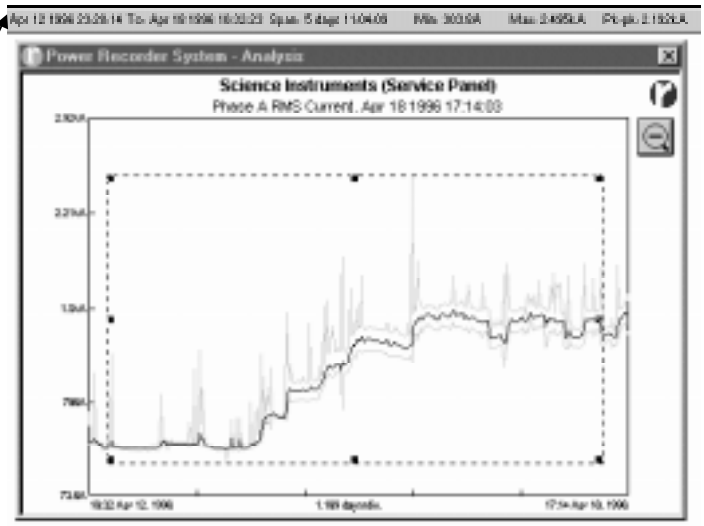
30 Voltage/Current transition waveform event, single line graph.

Appendix F. Summary Graphs

The Power Recorder System Software summary graphs are powerful tools in both the Power Quality and Power Flow environments. These graphs not only help you to understand the parameters being monitored, they help you explain your conclusions to others. This appendix gives some suggestions you may find helpful when dealing with this data.

The three line summary graph depicts the maximum, average, and minimum values monitored during the monitoring session, and also the peak-to-peak value.

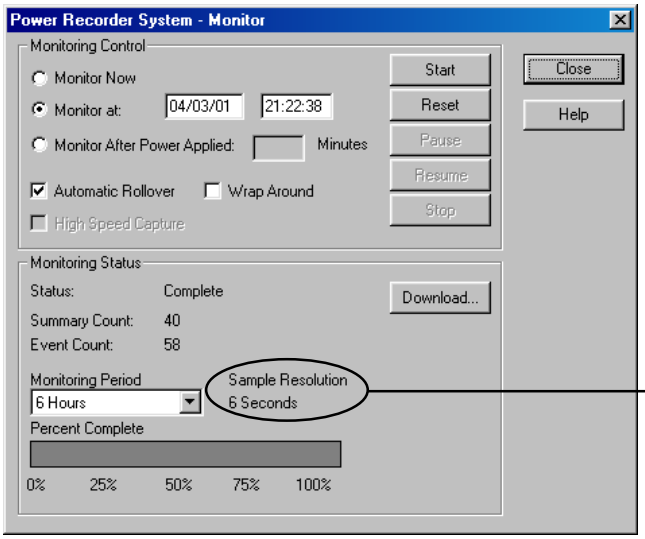
Data in the selection box appears in the status bar.



A selection box has been drawn, causing the values on the box to appear in the status bar. The dark center line is the average of the sampled data.

Minimum, Maximum, and Average

The average values are calculated over a time base which is set by choosing the selected monitoring period in the Monitor dialog box (shown below). This averaging period is indicated by the Sample Resolution which changes for each monitoring period selected.

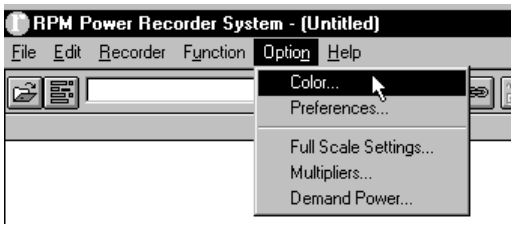


In the above example, the average value presented for summaries is the Cycle-by-Cycle RMS values averaged over a 6 second window. The maximum (displayed as the upper gray line on the graph) in this same period is the maximum single cycle RMS value measured every 6-seconds used to calculate the average. The minimum value (presented as the lower gray line on the graph) is the minimum individual cycle RMS value measured for all cycles constituting this same average. Therefore, the user is provided with the maximum RMS cycle value, minimum RMS cycle value, and average of all cycles for every 6-second interval during the monitoring period of 6-hours.

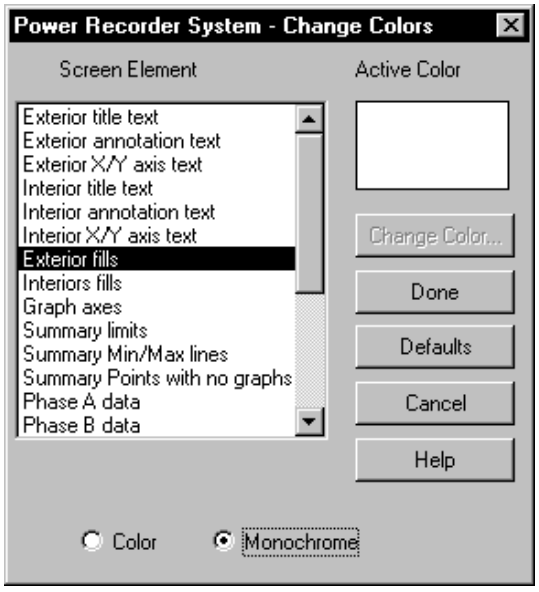
Using These Graphs in Other Documents

The summary graphs presented in this document were copied from the Power Analysis System Software. So that they would print correctly, the following settings were used.

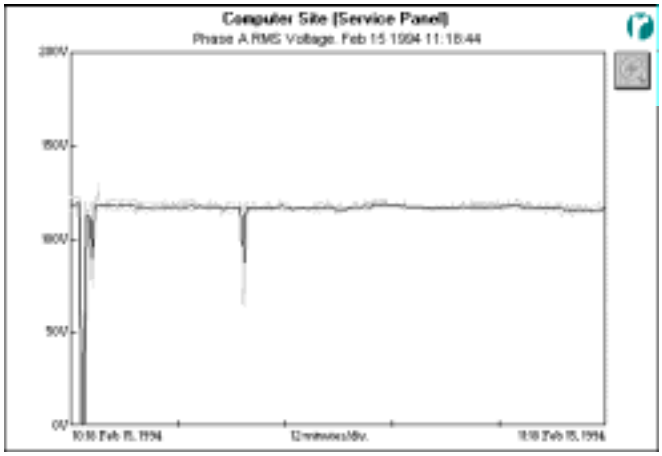
- From the Option Menu, the Color command was chosen…



- … and Monochrome was selected.



While Monochrome was selected, the Summary Min/Max lines were changed to the color yellow. When printed using an HP LaserJet, the yellow lines appear grayed and distinct from the average line as follows.



Appendix G. Dial-Up Networking Settings

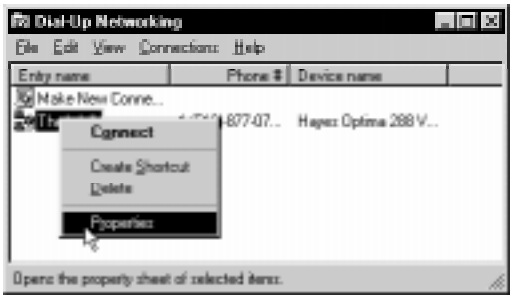
If you want to use Dial-Up Networking to connect to a Power Recorder on a remote network under Windows, you should make sure that the settings in Dial-Up Networking match the ones in your Network Control panel.

To compare Dial-Up Networking Settings against Network Control Panel settings

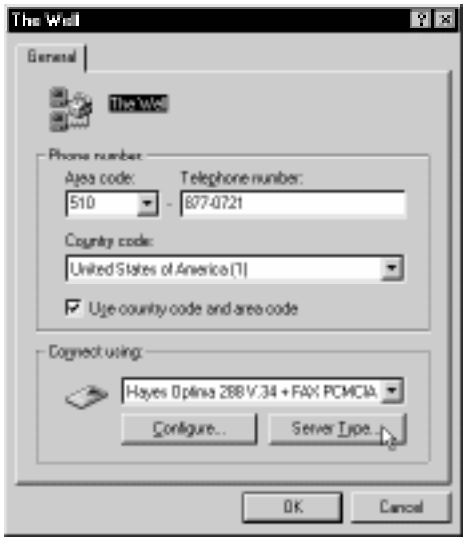
1. Open the Dial-Up Networking Folder (Dial-Up Networking must already be installed.)

   In Windows, double-click the My Computer icon to see the folder for Dial-Up Networking. Then double-click the Dial-Up Networking folder to open it.

2. the list of connections, highlight the connection you want to check, click the right mouse button to display the menu, and choose **Properties**.



3. In the dialog box that appears, click the **Server Type** button.



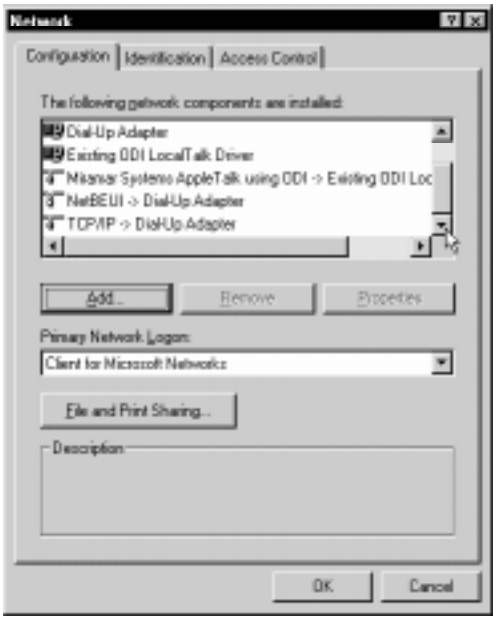
4. In the Server Type dialog box, review the settings under "Allowed Network Protocols".

The Allowed Network Protocols are the protocols that must match settings in the Network Control panel.

5. Open the Network Control Panel.

   From the **Start** menu, choose **Settings**, **Control Panel**, and then **Network**.

6. In the Control Panel, scroll through the list of installed components until you see the ones for the Dial-Up Adapter.



You should see installed components that match the protocols in the Dial-Up Networking connection. For example, if NetBEUI is marked in the Dial-Up Networking Server Type dialog box, then you should have an installed component named "NetBEUI."

If the installed components don't match the settings in Dial-Up Network, you probably need to install additional components from the Windows system disk. For more information, see the topic "Dial-Up Networking" in the Windows online help.

Appendix H. International Color Codes

Color codes associated with phases, neutral and ground are different throughout the world. The following table shows color coding for the United States, Europe, and Great Britain.

Phase	U. S. Color Code	European Color Code	U. K. Color Code
A	Black	Black	Red
B	Red	Red	Yellow
C	Blue	White	Blue
Neutral	White	Blue	Black
Ground	Green	Yellow and Green Stripe	Yellow and Green Stripe

Appendix I. Power Recorder (PR) Specifications

Measurement Parameters

Voltage

Five (5) Channels:

Channels 1 - 3 (generally used for phase conductor measurements)

Input: 100 millivolts to 1000 Volts peak (707 volts RMS max.)
Accuracy: ± 1% of full scale. (typically 0.5%)
Impulses: 100 volts peak to 6400 Volts peak ± 2% of full scale.
Impedance: 2 megohms to ground
Capacitance: < 30 pf
Frequency: 60/50 Hz ± 0.1 Hz

Channel 4 (for neutral conductor measurements)

Input: 10 millivolts to 100 Volts peak (70 volts RMS max.)
Accuracy: ± 1% of full scale.
Impulses: 10 volts peak to 640 Volts peak ± 2% of full scale.
Impedance: 200 kohms to ground
Capacitance: < 30 pf

Current

Five (5) Channels

Channels 6 - 10 (for current measurements with current clamp)

Input:	Current Clamp Dependent	
	Standard Configurations:	0.10 - 5.0 Amps RMS
		0.10 - 40 Amps RMS
		1.00 - 1000 Amps RMS
		10.0 - 3000 Amps RMS
CT Accuracy:		**5 Amp Clamp - 10mA to 5A: 2% ± 1 mA**
	40 Amp Clamp -	10 mA to 40 A:1.5% ± 2mA
	1000 Amp Clamp -	1 A: 10% of Reading
		50 A: 0.7% of Reading
		200 A: 0.6% of Reading
		1000 A: 0.5% of Reading
	3000 Amp Clamp	150A: 1.5% of Reading
		600A: 0.75% of Reading
		3000A: 0.5% of Reading

Accuracy: ± 0.1% of full scale (plus CT accuracy)

Sampling

Voltage and current wave-forms are sampled with a 14 bit analog to digital converter at a rate providing 128 sampled points per cycle at 50 and 60 Hz. Impulses are sampled using a 10 bit analog to digital converter at a software selected rate of 2 million times per second.

Power Requirements

85 - 264 Vrms, 47 - 440 Hz
10 - 15 VDC with optional DC power cable
47 VA Max.

Dimensions

Size: 8.5" x 11" x 3.5"
Weight: 13.5 pounds

Environmental Requirements

Operating: 0° C to 50° C
Humidity: Weatherproof
Storage: -20° C to 60° C

Measurement Characteristics

1. The monitor has a minimum of nine simultaneous measurement channels, with a minimum of five channels to measure current.
2. Voltage measurements are covered in a single range.
3. Voltage and current wave-forms are sampled with a 14 bit analog to digital converter at a rate providing 128 sampled points per cycle at 50 and 60 Hz. Impulses are sampled using a 10 bit analog to digital converter at a software selected rate of 2 million times per second.
4. Harmonic measurements on all channels are to the 63rd harmonic to include amplitude and phase angle for each harmonic, % of fundamental, and individual harmonic RMS volts and currents.
5. RMS and harmonic measurements are made continuously on each cycle. The minimum RMS measurement time is one cycle.
6. The following power measurements are made every cycle: Watts, VA, VAR, true power factor, and displacement power factor.
7. The Power Recorder SYSTEM provides vector addition and subtraction tools add or subtract voltage or current wave-forms on an IBM compatible PC.

Calibration

The Power Recorder is a microprocessor based instrument utilizing advanced solid state IC's and A/D converters that are inherently stable with respect to repeatability and time. If your company has a recommended calibration schedule, the Power Recorder can be checked for accuracy. Should the instrument not meet the accuracy specifications (+/- 1% FS for voltage and +/- 0.1% FS plus CT accuracies for current), the Power Recorder may need to be returned to Reliable Power Meters for testing and/or repair. Contact RPM Technical Support.

Batteries

The Power Recorder utilizes two batteries on board. The clock oscillator uses a lithium battery with a life span of ten years. The second battery is a nicad battery which is used to power the instrument in the event of a power failure. This battery will power the instrument for five minutes before the instrument will perform an orderly shutdown and is charged when power is applied to the Power Recorder. If the battery fails to charge, return the instrument to RPM for repair.

Resolution Vs Recording Time

The PR has a user selectable recording period. Based on the period selected, the PR will provide a predetermined resolution of RMS, power, and harmonic data as follows:

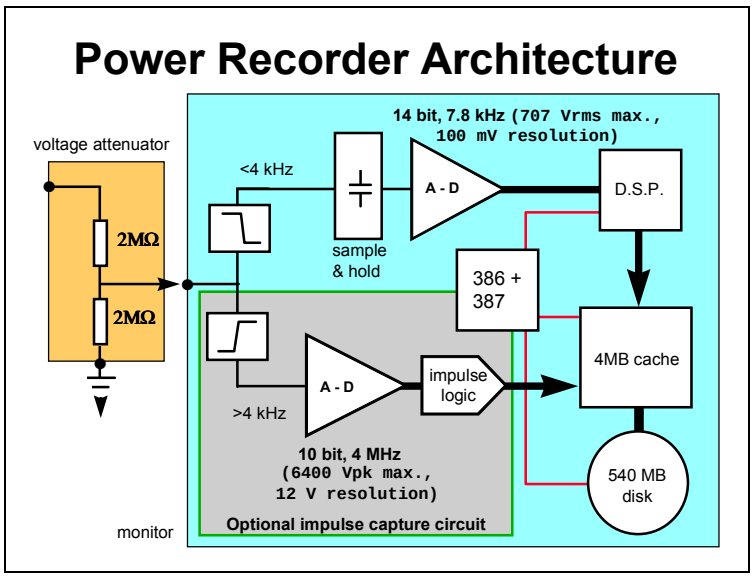
Recording Period	Resolution
15 Minutes	15 cycles
30 Minutes	0.5 second
1 hour	1 second
3 hours	3 seconds
6 hours	6 seconds
12 hours	15 seconds
24 hours	30 seconds
48 hours	1 minute
5 days	3 minutes
1 week	5 minutes
2 weeks	10 minutes
1 month	15 minutes
90 days	1 hour
1 year	4 hours

All recordings are performed via the digital signal-processing chip and are done on a cycle-by-cycle basis. Regardless of the recording period or the resolution, the minimum and maximum values have a one-cycle response.

If you should have any further questions, please call the factory at (408) 358-5100 for assistance.

Appendix J. Theory of Operation

Calculations Utilized by the Power Recorder



Architecture

1000:1 attenuation allows direct connection to 707 Vrms. Voltage and current wave-forms are sampled with a 14 bit analog-to-digital converter at an approximate rate of 8 kHz, phase locked, providing 128 sampled points per cycle at 50 and 60 Hz. Sampled data is passed to the digital signal processor (DSP) that performs a Fast Fourier Transform to the 63rd harmonic (FFT) in less than 10 µsec on each cycle of voltage and current. Impulses are sampled using a 10 bit analog-to-digital converter at a software selected rate of 4 or 2 million times per second. Internal control is via 386/387 and 4 MB cache memory.

Computations

1. True RMS measurements

The Power Recorder computes the RMS voltage and current over each cycle (128 data points) as follows:

$$V_{rms} = \sqrt{\frac{\sum_{n=1}^{128} V_n^2}{128}} \qquad I_{rms} = \sqrt{\frac{\sum_{n=1}^{128} I_n^2}{128}}$$

where V_{rms} and I_{rms} are sampled voltage and current values

2. Imbalance

Imbalance of voltage and current are calculated in accordance with the IEEE definition of the maximum deviation from the avg of the voltages or currents, divided by the avg of the voltages or currents, expressed in percent.

$$V_{\mathrm{Im}balance} = \frac{V_{Maxdev}}{V_{Avg}} \times 100\%, \text{ where } V_{Maxdev} = V_{Avg} - V_{Dev}$$

3. Total Harmonic Distortion (THD)

Total Harmonic Distortion (THD) is calculated on a cycle-by-cycle basis for both voltage and current as follows (where V_n and A_n are the respective harmonic voltage and current):

$$V_{THD} = \frac{\sqrt{\sum_{n=2}^{63} V_n^2}}{V_1} \times 100\% \qquad I_{THD} = \frac{\sqrt{\sum_{n=2}^{63} I_n^2}}{I_1} \times 100\%$$

4. Apparent Power (VA)

AC power in Volt-Amps is calculated as follows where V_{rms} I_{rms} are True RMS values and V_F and I_F are the Fundamental RMS value:

$$\text{True VA} = VA_{True} = V_{rms} \times I_{rms}$$

$$\text{Fundamental VA} = VA_F = V_F \times I_F$$

5. Watts

Watts are calculated from each sampled voltage point times its corresponding sampled current point, on a cycle-by-cycle basis. This results in true power calculations including any harmonic distortion:

$$W_{True} = \frac{\sum_{1}^{128} V_n \text{ X } I_n}{128}$$

Fundamental Watts are calculated as shown:

$$W_F = V_F \text{ X } I_F \text{ Cos } (\theta)$$

6. Power Factor

True Power Factor is the ratio of true power to apparent power and is calculated as follows:

$$PF_{True} = \frac{W_{True}}{VA_{True}}$$

Fundamental Power Factor is the angle between fundamental Voltage and fundamental Current (Displacement Power Factor)

$$PF_F = \text{Cos } (\theta)$$

where θ is the angle between fundamental Voltage and fundamental Current (Displacement Power Factor).

7. Reactive Power (VAR)

Fundamental VAR is calculated as the product of the fundamental voltage times the fundamental frequency times the Sine of the displacement power factor.

$$VAR_F = VA_F Sin\theta$$

True VAR is calculated as follows:

$$VAR_{True} = \sqrt{VA_{True}^{\ 2} - W_{True}^{\ 2}}$$

8. Distortion Power D (Watts)

Distortion Power is the non-fundamental power and is calculated as follows:

$$\mathbf{D = WATTS_{True} - WATTS_F}$$

Index

A

analysis data
  copying, 84
  in reports, 84
  viewing, 82
Analysis tools
  displaying, 82
  overview, 83
  using, 82
analyzing power quality and consumption, 82
ANSI. *See* Tolerance Curves
apparent power (VA) , how it is calculated, 132
arming the Power Recorder, 41, 52, 64
Average lines, hiding, 86

B

batteries in Power Recorder, 129
battery-type voltage probe, 50

C

calculations and measurements, 131
Capture button, 81
CBEMA. *See* Tolerance Curves
checking
  connections, 54
  connections with the Phasors tool, 95
  polarity of current clamps, 95
  status of monitoring, 65
  voltage interface cable LEDs, 55
clamps and probes, installing, 53
closing a window, 13
color coded leads, 53
color codes
  color coded leads, 48
  International, 125
  on the Power Recorder panel, 48, 50, 53
color settings
  changing, 86
  customizing, 86
  returning to original, 87
communication controller
  setting up a Dial-Up Server, 29
compressing a database, 19
configuration
  Power Recorder
    changing, 40, 41
    definition, 99
    editing, 40, 41
    in the Link dialog box, 39
  system, 4
configuring the Power Recorder, 26–43
connecting a Power Recorder to wiring, 53
Connecting to a Power Recorder, 27
  using a dial-up connection, 29
  using a direct connection from a PC, 28
  using a network connection, 27
connections
  checking, 54, 55
  double-checking, 58
  verifying with the Phasors tool, 91–96
conventions in this manual, ix
Copy Graphics command, 84
Copy Status Text command, 85
Copy to Text File command, 84, 86
copying
  black and white version of a graph, 84
  data into a text file, 86
  status text, 85
creating
  database, 18
  new location, 24
  new site, 22
crocodile-type voltage probe, 49
current
  rotating, 94
  swapping, 95
current clamps
  attaching to the current interface cable, 48
  attaching to the Power Recorder, 48
  checking the polarity of, 95

selecting and attaching, 46
table of clamps, 46
current clamps and voltage probes
pairing, 53, 54, 58
current interface cable
attaching to current clamps, 48
LEDs, flashing on and off, 52
Current Rotate tools, 93, 94
Current Swap tools, 93, 95
Customer Support, iv

D

data, saving or discarding, 72
database
compressing a copy, 19
creating, 18
definition, 99
deleting, 21
expanding a compressed copy, 20
opening, 17
opening a new one (preferences), 18, 89
opening the last used (preferences), 89
repairing, 20
saving a copy, 18
database, Power Recorder System Software, 17–21
deleting a database, 21
demand power interval, setting, 91
Dial-Up Connection to a Power Recorder, 29
Dial-Up Networking settings, 121
Dial-Up Server
dialing in to access a Power Recorder, 31
setting up a Dial-Up Server to be a communication controller, 29
directory of sites, 22
disconnecting
PC and parallel Power Recorder, 74
Power Recorder from the Wiring, 75
disk space in Power Recorder, 2
disk space required
for a database file, 66
for the software, 9
distortion power (Watts), how it is calculated, 133
Distortion tool, 83
distortion, viewing, 82
Disturbance tool, 83
disturbances, viewing, 82
Download dialog box, 68
downloading data, 65–70
events, 67, 70
individual events, 70
selected events, 68
several approaches, 66
some or all data, 67
summaries, 67
while checking the status of monitoring, 68

E

edit configuration settings, 40, 41
Ethernet Settings in the Network Control Panel, 27
Event History graph, 83, 109
event links, whether to display (preference), 89
Event Tolerance graph, 83, 109
event types, 116
events
downloading, 67, 70
graphs of, plotted by tolerance and history, 83, 109
locating ones at specific dates & times, 113
moving from one event to another, 112
not downloaded, 113
sample Impulse graphic, 110
sample of steady state event, 110
sample transition event, 109
saving data from graphs as text, 86, 115
that appear as Xs on a graph, 112
types of graphs, 109
viewing, 82
expanding a compressed database, 20

F

feed phase, set for a single-phase location, 24
frequency
set as a preference, 88
full scale settings, changing, 90
fundamental VAR, how it is calculated, 133

G

getting help, 15
graphs
changing colors of, 86
gray border, displaying around graphs, 87

H

Harmonics tool, 80
harmonics, viewing, 78
help
  about a view or window, 15
  getting, 15
  using, 15
History graph, 109. *See* Event History graph
  using to check for events at specific dates and times, 113

I

icons
  defined, 12
  opening, 12, 13
icons and windows, using, 12
imbalance for voltage or current, on Distortion graphs, 83
imbalance, how it is calculated, 132
impedance
  negative, 95
  viewing, 78
Impedance tool, 80
Impulse Graphic, sample, 110
in-line fuse holder, 50
installing
  clamps and probes, 53
  Power Recorder System Software, 7
  the Power Recorder, 43–59
International color codes, 125
Invert tool, 96
ITIC. *See* Tolerance Curves

L

language used onscreen, set as a preference, 88
leads, color coded, 48, 53
LEDs
  checking on voltage interface cable, 55
  current interface cable, 54
  flashing on and off, 52
  Power Recorder connection panel, 54, 55
  voltage interface cable, 58
Link Info command, 40
linking the Power Recorder and the PC, 36
location information, 22
locations
  capturing scope settings for, 81
  creating, 24
  definition, 99
  multiple for one site, 24, 72
locking Power Recorder in place, 59
long-term summary data
  inspecting, 2
long-term summary graphs of voltage, current, and frequency, 83

M

magnify
  tool, 14
  waveform data, 14
measurement characteristics of Power Recorder, 129
measurement options, adding to a Power Recorder, 107
Min/Max lines
  changing color of, 119
Min/Max lines, hiding, 86
minimum, maximum, and average on summary graphs, 117
minimum, maximum, and average, how they're calculated, 118
Monitor dialog box, 42, 62
Monitor Period, set as a preference, 89
monitoring
  arming the Power Recorder, 64
  changing the settings, 64
  checking the status, 65
  control options
    Monitor After Power Applied, 42, 64
    Monitor at, 42, 64
    Monitor Now, 42, 62
  for how long, 42
  period, 63, 64
  period, set as a preference, 89
  resuming after pausing, 63
  setting when it will take place, 41
  starting now, 62
  stopping or pausing, 63
monitoring data, 59–65
monochrome, displaying graphs in, 84, 86, 87
multiple locations for one site, 24
multipliers, changing, 89

N

negative impedance, 95
NetBEUI, 27, 123
network connection
  Power Recorder and PC, 27
Network Control Panel settings
  for Dial-Up Networking, 121
  for Ethernet, 27
nominal voltage, set as a preference, 88

O

opening
  an icon, 12, 13
  another window, 14
  database, 17
  sample database, 11
  windows, 13
oscilloscope tools, 1

P

pairing current clamps and voltage probes, 53, 54, 58
panel, color coded, 48
pausing monitoring, 63
  and resuming, 63
PC System Requirements, 5
PF, VAR, VA, and watts, 84
phase connectors
  connecting voltage probes to, 54
Phase Rotate tools, 93, 94
phase rotation, 94
  changing, 93
  checking, 92
Phase Swap tools, 93, 94
phase swapping, 94
Phasors tool, 79
  using to check connections, 91–96
phasors, viewing, 78
plunger type voltage probe, 50
polarity
  checking, 95
  reversed, 95
  reversing, 96
polarity of current clamps, 95
  incorrect, 92
Power Analysis tool, 84
power analysis, viewing, 82
power factor, how it is calculated, 133
Power Recorder
  architecture, 131
  arming, 41, 52
  batteries, 129
  calculations and measurements, 131
  configuring, 26–43
  connecting directly to a PC, 28
  connecting to power source, 51
  connecting to wiring, 53
  definition, 99
  disconnecting from PC (parallel or Ethernet), 74
  disconnecting from the wiring, 75
  installing, 43–59
  measurement characteristics of, 129
  putting in place, 51
  resetting, 62
  specifications, 127
  theory of operation, 131
  unlinking from PC, 72
  updating the Power Recorder System Software in, 104
  upgrading with additional measurement options, 107
Power Recorder configuration
  changing, 41
  definition, 99
  editing, 40, 41
  in the Link dialog box, 39
Power Recorder System
  definition, 99
  what's included, 4
Power Recorder System Help, ix, 15
Power Recorder System overview, 10–3
Power Recorder System Software
  basics, 9
  database, 17–21
  overview of tools, 75–96
  shutting down, 74
power type for a location, 24
power type, set as a preference, 88
Power Vectors tool, 80
preferences, 87–89
  database to open, 18
  display event links, 89
  frequency, 88
  language, 88
  monitoring period, 89
  nominal voltage, 88

power type, 88
tolerance format, 88
Use Last Database, 89
probes and clamps
connecting to wiring, 53

R

range lights
checking, 54
reactive power (VAR) , how it is calculated, 133
real-time conditions, inspecting, 1, 78
reference materials, 101
repairing a database, 20
reports
using scope and analysis data in, 84–86
resetting the Power Recorder, 40, 62
resuming monitoring after pausing, 63
reversing polarity, 95, 96
rotating phases, 94
rotating the current, 94

S

safety features, 3
safety tips
pairing probes and clamps, 54
tagging, labeling, posting signs, 59
when grounding, 45
when making connections, iii, 53
Sample Database
keeping or overwriting when updating software, 103
opening, 11
saving a copy of a database, 18
saving or discarding data, 72
scope data
capturing scope settings, 81
copying, 84
in reports, 84
viewing, 78
scope sweep, 80
pausing and restarting, 80
scope tools, 78
displaying, 78
overview, 79
using, 78
selecting
current clamps to use, 46
events, and downloading them, 68
voltage probes to use, 49
setting up a new site, 22
shutting down the Power Recorder System Software, 74
side-clamp voltage probe, 49
site directory, 22, 41
location, definition, 99
setting up sites and locations, 22
site, definition, 99
sites and locations, 22
snapshot of waveforms, 1
Specifications, 127
starting the Power Recorder System Software, 9
status of monitoring, checking, 65
steady state event, sample of, 110
stopping monitoring, 63
summary graphs, 117
minimum, maximum, and average, 117
swapping current, 95
swapping phases, 94
syringe stud-type voltage probe, 49
system configuration, 4
System Requirements, 5

T

TCP/IP
assigning a TCP/IP address to a Power Recorder, 33
associating TCP/IP address with Power Recorder serial number, 34
setting up a TCP/IP connection, 33
Trouble-Shooting Tip, 35
technical support, iv
text file, copying data into, 86
threaded stud-type voltage probe, 49
Tolerance curves, 111
set as a preference, 88
set for a location, 24
Tolerance graph, 109. *See* Event Tolerance graph
tools
in a window, 13
magnify tool, 14
overview, 75–96
total harmonic distortion (THD) , how it is calculated, 132
transition event, sample, 109
True RMS measurements, 131

U

unlinking the Power Recorder and the PC, 72
updating the Power Recorder System Software, 103
    in the PC, 104
    in the Power Recorder, 104

V

VAR, VA, PF, and watts, 84
VIF summaries tool, 83
VIF summaries, viewing, 82
voltage interface cable
    attaching to voltage probes, 50
    LEDs, flashing on and off, 52
voltage interface cable LEDs, 58
voltage probes
    attaching to leads on the voltage interface cable, 50
    attaching to the Power Recorder, 50
    battery-type, 50
    connecting to phase connectors, 54
    crocodile-type, 49
    in-line fuse holder, 50
    plunger type, 50
    selecting and attaching, 49
    side-clamp, 49
    syringe stud-type, 49
    threaded stud-type, 49
voltage probes and current clamps, pairing correctly, 53, 54, 58

W

watts, how calculated, 132
Watts, VAR, VA, and PF, 84
waveforms, 79
    capturing snapshot of, 81
    snapshot of, 1
    viewing, 78
Waveforms tool, 79
window tools, 13
windows
    closing, 13
    opening, 13
    opening more than one, 14
    seeing more detail, 14
wiring
    connecting a Power Recorder to, 53
wiring, disconnecting the Power Recorder from, 75

Z

zoom
    see magnify, 14