

PowerTronics

PQR Series Model 2020

*Three Phase Voltage
Disturbance Analyzer*



User's Manual

**PowerTronics
143 Raymond Road - Box 735
Candia, N.H. 03034
(603) 483-5876**

<http://www.powertronics.com>

PQR 2020

All information and specifications written or implied in this manual are current at the time of release. However, due to the ongoing process of adding improvements to the product, PowerTronics / Eastern Time Designs, Inc. reserves the right to make changes at any time without notice.

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SAFETY NOTICE

The power cable attached to the device is supplied with a safety and reference ground. Do not use the PQR 2020 when powered from an ungrounded outlet.

High voltage exists at many points inside the cabinet. Qualified personnel ONLY! should open the covers. Opening the covers may affect the warranty.

PQR 2020

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PQR 2020

18 MONTH WARRANTY

Eastern Time Designs, Inc. (PowerTronics) warrants to the original retail purchaser that each PQR Series 2020 Power Line Monitor sold by PowerTronics or any authorized representative is free from defects in material and workmanship for 18 MONTHS from the date of purchase.

In the event of malfunction or other indication of failure attributable directly to faulty workmanship and/or materials, Eastern Time Designs, Inc. (PowerTronics) will at its option, repair or replace the defective product, to whatever extent it shall deem necessary to restore the product to proper operating condition, provided the purchaser includes proof of the date of purchase of the product along with the defective product.

Please note that Eastern Time Designs, Inc. may replace the defective product with a new or re-manufactured functionally equivalent product of equal value.

When returning a product for repair, be sure to include the customer's mailing address, email address and telephone number . Products should be returned to:

PowerTronics
Attention: CUSTOMER SERVICE DEPARTMENT
143 Raymond Rd.
Candia, NH 03034

During the first 18 months after the date of purchase all labor and materials will be provided without charge. There will be no warranty for either parts or labor after the expiration of 18 months from the date of purchase.

The customer shall be solely responsible for the failure of any Eastern Time Designs product or component thereof resulting from accident, abuse or misapplication of the product, and Eastern Time Designs assumes no liability as a consequence of such events under the terms of this warranty. Some states do not allow the exclusion of implied warranties, so the above exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

PQR 2020

INTRODUCTION

This reference guide is designed to aid users of the PQR 2020 in the interpretation of AC power line problems.

The PQR 2020 Power Line Monitor is made in the U.S.A. by PowerTronics. This unit incorporates the latest technology in surface mount assembled circuit boards to provide the user with detailed information describing the power line. It will detect a wide range of disturbances including dropouts, power failures, sags, surges, impulses, high frequency noise, and common mode noise on the three phases of AC voltage and the Neutral line. The PQR 2020 monitors these disturbances and records them, along with a data log of channel readings at user selected intervals, in non-volatile FLASH RAM for future access.

Electronic equipment is damaged more often by power disturbances than by fire, theft, and vandalism combined. Intermittent power problems are the most expensive, hidden cost to the owners of microprocessor-based equipment. It is therefore essential that power supplies be properly tested to insure that no such damage occurs.

The PQR 2020 is easy to use and provides immediate and long-term information for the technician and customer to understand power line disturbances. It is an important tool for installers of electronic equipment, service technicians, medical facilities' technicians, or anyone that needs to identify the power quality of a particular site.

The PQR 2020 is one of a series of practical power line monitors, designed and priced to be outfitted to everyone who services or installs three-phase electrical and electronic equipment. We believe that the PQR 2020 Power Line Monitor is one of the most cost effective and practical power line monitors on the market. Look for more advanced diagnostic products from PowerTronics (Eastern Time Designs, Inc.) in the near future.

To monitor the three phases of AC line voltage with the PQR 2020, connect the test leads between the circuits to be tested and the three phase and Neutral inputs located on the back of the unit. Then plug the power cord provided with the unit into a standard 110 volt or 220 volt outlet. After running an internal self test, the unit will start testing the three phases and the Neutral lines. It is recommended that the unit test the three phase power source for at least a 24 to 72 hour period.

After testing is completed simply attach the PQR 2020 to a computer to access the data via USB or RS232 serial communications. The summary, detail, and data log reports can then be examined and used in the rendering of graphics using the PowerTronics PQR Host Communications Software or a similar terminal emulation software.



PQR 2020

CALIBRATION

The PowerTronics Power Quality Recorders are designed to test the Power Line with a high degree of accuracy. In this unit all measurements are referenced to a state of the art, temperature compensated voltage source. It is recommended that each unit be calibrated annually by the factory as certain components may require periodic calibration. The procedure typically takes seven days and will be provided upon request for a nominal fee.

Mention CALIBRATION PROCEDURE when calling for an RMA number.

PQR 2020

OVERVIEW

The PQR 2020 Power Line Monitor is a state of the art, fully integrated instrument which measures, records, and reports power disturbances, aiding in the analysis of power quality for Three Phase AC power in medical, commercial, and industrial applications.

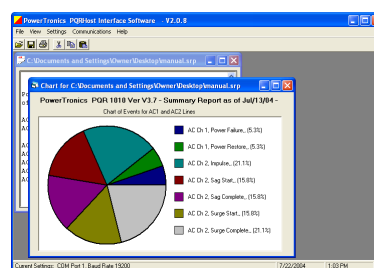


Power disturbances detected on multiple channels are recorded by their time, date, and magnitude in non-volatile FLASH RAM memory. This data is then retrieved from the PQR through its serial communications port.

The PQR 2020 continuously data logs the voltages on the three AC Phases and Neutral line. This data is then stored in memory, independent of the disturbances. The unit's Data Logger will log these readings at the interval length selected by the user.

Connections to the PQR 2020 are made between the safety connectors on the back of the unit and the circuit being tested. The power to operate the unit comes from any 110/220 volt, 15/20 amp AC power supply. Once plugged in, the PQR 2020 immediately begins testing the signals on the testing inputs. The unit comes equipped with a power cord for plugging into a standard 110 volt, 15/20 amp AC outlet. Adapter cables (or Patch Cords) are available from PowerTronics in order to allow the unit to be powered off of other style, voltage, and/or amperage outlets. The unit may also be powered by DC voltages of 9 to 24 volts

Graphics Software Included!



The
**PQR Host
Communications
Software**
is provided with the
PQR 2020

Software Features:

- ◆ Download data from the PowerTronics PQR Series monitors
- ◆ Generate Summary Report **PIE CHARTS** of disturbances
- ◆ Create Detail Report **HISTOGRAMS** of all events detected
- ◆ Plot Data Log **LINE CHARTS** of the Channel Readings

MONITOR 3 PHASE AC POWER

(Three Phase + Neutral AC Line Voltage)

FEATURES

- ◆ User-Friendly
- ◆ Minimal Setup Time
- ◆ Made in the USA
- ◆ Eighteen Month Warranty
- ◆ Non-Volatile Memory
(Flash RAM - 20 year Data Retention
Guaranteed at 125° C without power)
- ◆ Multi Phase Monitoring
- ◆ Continuous Data Logging of AC Voltages
(3 Phases + Neutral)
- ◆ Continuous Disturbance Detection on all four AC
Voltage inputs
- ◆ Programmable Sampling Rates and Disturbance
Thresholds
- ◆ Fast Impulse Detection
- ◆ Serial Communications port for easy connection
to a Computer or Terminal
- ◆ Easy to Understand Reports
- ◆ Comes complete with Communications and
Graphics Software designed for the unit

Stores events in non-volatile Flash RAM:

- Over 32,000 Total Events recorded!
- Stores over 32,000 Data Log Entries!
(or one data log reading every minute for over
22 days)

Simple to operate:

- Connect the test leads to a service
panel and the unit
- Plug the power cord into a
grounded outlet
- Periodically connect to the unit to
a computer for reports



Measure all types of Power Disturbances:

- ◆ Dropouts
- ◆ Power Failures
- ◆ Sags
- ◆ Surges
- ◆ Impulses
- ◆ High Frequency Noise
- ◆ Common Mode Noise
- ◆ Frequency/Phase Deviations

SIGNAL TESTING

Power Up Procedure

Applying AC Power

The main power to operate the unit comes from any standard 110/220 volt, 15/20 amp AC voltage supply provided through the AC connector located at the back of the unit. The unit comes equipped with a power cord for powering off of a 120 volt, 15 or 20 amp outlet.

When the PQR 2020 is first connected to AC power (110 V AC or 220 V AC), it will go through a series of power on diagnostics. The status of these tests can be seen in the Unit Status LED. As soon as the diagnostics have completed, the PQR 2020 is on-line and monitoring the input channels. Simply leave the PQR 2020 plugged in with the voltages to be tested attached to the three AC input channels and the Neutral channel as will be described in the following pages.

After testing connect the PQR 2020 to a PC using a null modem cable attached to the USB or RS232 serial communications port. The PowerTronics PQR Host Communications Software (or a similar program) can then be used to download all the necessary data from the unit and render the text-based reports into graphical presentation formats

Applying DC Power (optional)

The PQR 2020 has a DC Power Input connector for running off a DC power supply. The most common use of this power option is for allowing the unit to continue functioning off battery power even after a massive power failure has hit the test site. The connection is made using a standard Female DC Connector with outer/inner diameters of 5.5/2.1 mm. The outer shell must have the positive voltage. Note that when using the DC power supply option it is essential that the AC power cord still be attached as it supplies the safety and reference ground. The source can be 9 to 24 V DC.

Unit Status LED

The Unit Status LED is located on the front panel of the PQR 2020. It indicates system diagnostics status and Channel operational status.

While the initial tests are being executed (approximately 15 seconds) the LED will blink. After the tests are completed, it will turn off briefly, and then turn on steady. The LED will also blink for fifteen seconds whenever a disturbance is detected on any input or the serial port has been accessed.

The recommended testing time is 24 to 72 hours in order to determine the suitability of an outlet for powering electronic equipment.

Testing AC Voltages - Connecting

The PQR 2020 Three Phase Voltage Power Line Monitor is designed to obtain the maximum amount of useful data from the circuits under test, while requiring the minimum amount of setup time. It is capable of analyzing the power on Three Phases and a Neutral channel of AC voltage.

All signals to be tested are applied to the four test input banana jacks located on the back of the PQR 2020. There is one jack for each phase and one for the Neutral. The phases are applied to the Red Jacks while the Black Jack is reserved for Neutral. Data from the four input connector starts being collected as soon as power is applied to the AC power connector (or alternate DC power connector) located on the back of the unit. Data will continue to be gathered until the unit is unplugged. Note that all signals are referenced to the safety ground of the unit. The unit **MUST** have this safety ground. (Plugging the PQR 2020 into a grounded outlet using the supplied AC Power Cord will take care of this.)

To test one or more of the AC phase lines simply connect the supplied PowerTronics Test Leads between the PQR 2020 input jacks and the Service Panel using the following procedure:

- Connect the Safety Banana Plug of the **Black Test Lead** to the **Black Neutral** input jack on the back of the PQR 2020
- Connect the Alligator Clip of the **Black Test Lead** to the **NEUTRAL BAR** on the Service Panel
- Connect the Safety Banana Plug of a **Black Test Lead** to the **Black Phase 1** input jack on the back of the PQR 2020
- Connect the Alligator Clip of the **Black Test Lead** to the first phase to be tested on the Service Panel. **USE CARE!!!**
- Follow the same procedure for Phases 2 and 3 if so desired. **USE CARE!!!**

DANGER! HIGH VOLTAGE!

The Voltages you are testing can **KILL!**
Only a **Certified Electrician**
can connect the test leads to a distribution panel.

Please use Care!

Testing AC Voltages - Monitoring

Long term voltage recording is known as Data Logging. The PQR 2020 samples the voltage on each of the 4 AC inputs continuously and stores the average readings once each minute (or at the sampling interval the Data Logger is set to). There is enough data storage capacity in the unit to collect over 32,000 of these readings. When the Data Logger is set to one minute intervals this is equivalent to over 22 days of voltage readings on all four channels.

The PQR 2020 will continuously test the three phase voltage inputs and Neutral line for Dropouts, Power Failures, Sags, Surges, Impulses, High Frequency Noise, and changes in Line Frequency and Phase. Any power quality problems that exceed the preset thresholds will be recorded in the Flash RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect over 32,000 disturbance events total between all 4 channels.

Additional information with regards to the data storage and event detection capabilities for the four AC Voltage testing channels of the PQR 2020 is supplied in the Specifications Section of this manual.

SERIAL COMMUNICATIONS

Connecting to the PQR 2020

DIRECT:

The serial port connector on the front panel of the PQR 2020 is a 9 pin DB style RS232. The pinout is as follows:

| | |
|--------------|----------------------|
| Pin 2 | Receive Data |
| Pin 3 | Transmit Data |
| Pin 5 | Ground |

A Null modem cable must be used to establish a connection between this port and a PC. This type of cable connects the Transmit Data pin on the PC to the Receive Data pin on the PQR, and the Transmit Data pin on the PQR to the Receive Data pin on the PC. It also connects the Ground pins together.

The PQR 2020 is configured to operate at 19,200 baud (factory default), with 8 data bits, 1 stop bit, and no parity checking. Select Xon/Xoff Communications protocol.

MODEM:

Use a straight cable (not a null modem) when connecting to a modem.

Power the PQR 2020 and the Modem up at the same time after connecting the cable. The PQR 2020 will auto configure the Hayes compatible Modem for auto answer mode, at 19,200 baud (or present baud rate setting). If the modem is not Hayes compatible, configure it to answer the phone on 2 rings, with a Baud rate of 19,200 (or current setting), 8 data bits, 1 stop bit, and no parity checking.

COMMUNICATIONS SOFTWARE:

The PQR Series 2020 can communicate with a PC using programs such as the PowerTronics PQR Host Communications Software and HyperTerminal. Note that such programs will provide a means of directly downloading the data in a text file format. This data can then be employed by the user in the generation of graphical plots and charts as needed. The PQR Host Communications Software is specially designed to facilitate the easy creation of these graphical representations of the data gathered by the PQR 2020. The following pages will deal with its installation and use. Discussion will also be made about more general commands useable through basic communications programs such as HyperTerminal.

PQR Host Communications Software

Introduction:

This section of the manual is designed to aid PQR users in the use of the PowerTronics PQR Host Communications Software available with their unit in order to maximize the ease of the interpretation of AC and DC power line disturbances as well as environmental problems.

The PQR Host Communications Software is designed to work with the PQR Series of Power Line Monitors, which are portable diagnostic instruments designed to monitor AC and DC Power Lines, analyze and capture disturbances, and record these disturbances for later retrieval. The PQR Host Communications Software is also capable of working with other PowerTronics product lines such as the PDL Series Data Loggers and units in the DETECTIVE SERIES line that have been designed and/or modified for Windows compatibility. See the PowerTronics Product Support page for the most recent list of PowerTronics units that are supported by the PQR Host Communications Software.

Made in the U.S.A. by PowerTronics, the PQR Series Monitors incorporate the latest technology in their surface mount assembled circuit boards to provide the user with detailed information describing all types of power line and environmental disturbances. Once detected, the PQR Series monitors will record the most important information about these events, such as the event type, the event magnitude, the time and date of the occurrence, and the channel it occurred on. This information is stored in FLASH RAM, where it is formatted into an easily read format that may be downloaded to your computer for display or printing. This format is also designed to be used directly with the PowerTronics PQR Host Communications Software.

When testing a power site, it is recommended that you test the power source for a period of at least 72 hours. After testing, attach the PQR Series monitor to your computer through the serial communications port on the unit, start the PQR Host Communications Software program, and scroll through the list of functions to choose the report or display you need.

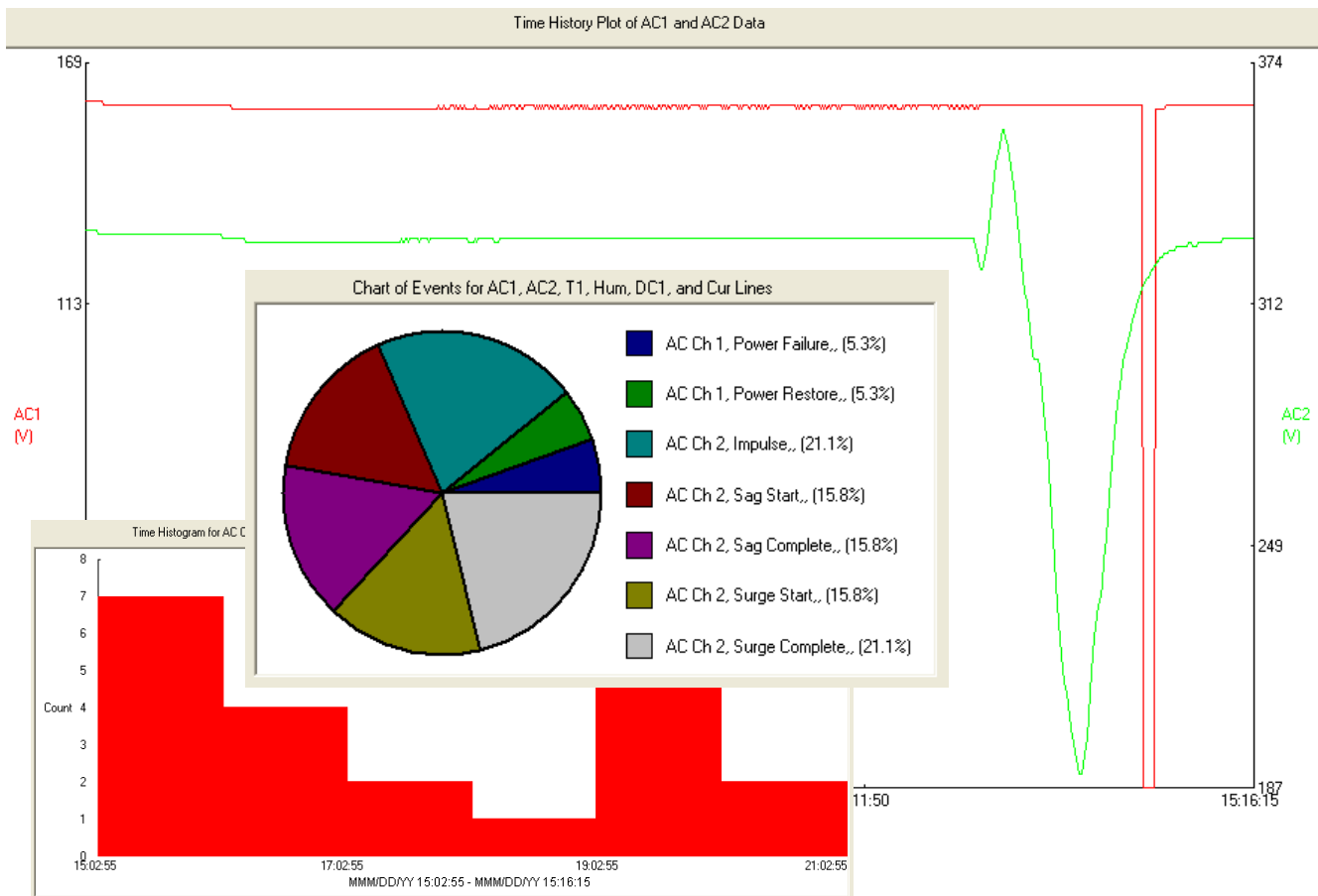
The PQR Host software program will provide you with a listing of disturbances and channel readings in summary, detail, or data log form. The disturbances are recorded as individual events which are analyzed according to their magnitude, time, date, and channel. The Data Log of each channel can also be displayed on your computer monitor or printed to a local printer. In addition, the Data Log data can be zoomed in on using the PQR Host Software to highlight any areas of concern.

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Software Overview:

The PowerTronics PQR Host Communications Software is provided with the PQR 2020. When the PQR 2020 is connected to a computer via a null modem cable, the PQR Host Software provides several functions to the user:

- ◆ Automatically connects to the PQR 2020
- ◆ Allows the user to configure the Settings of the PQR 2020
- ◆ Downloads data from the PQR 2020 and saves it directly to the computer
- ◆ Generates Reports, Charts, and Graphs from the downloaded data



(Note that not all functions of the PQR Host Software are available to every unit.)

Installation Procedure:

Go to www.PowerTronics.com, click on the support link, and download the latest version of the software or place the Software Installation CD provided with your unit into the CD drive on your computer.

Select or Double click on the **SETUP** file. A series of installation setup files will then be copied to your computer's memory. The installation program will then initiate the installation and display a window with the following:

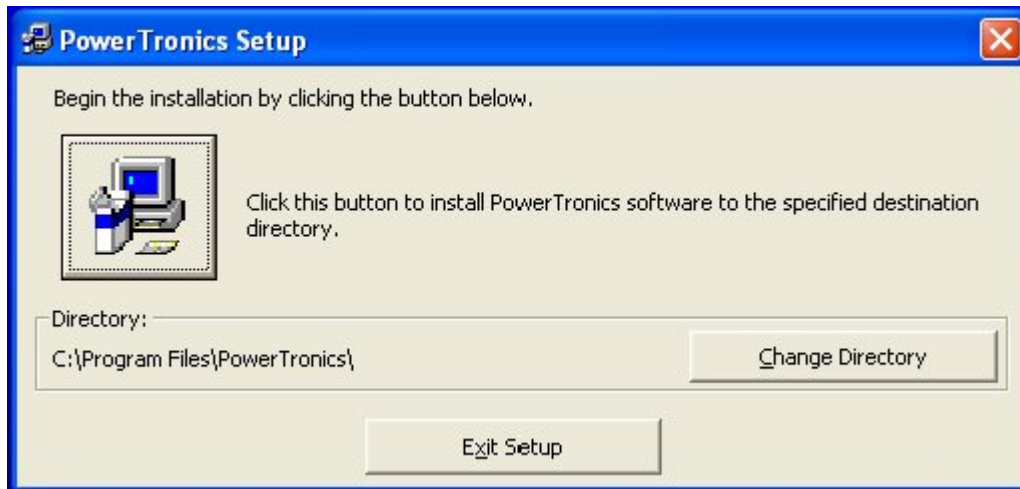


To prevent any software conflicts, you should close any other applications or programs running before continuing with the PQR Host Communications Software installation. Then click the **OK** button depicted in the window above.

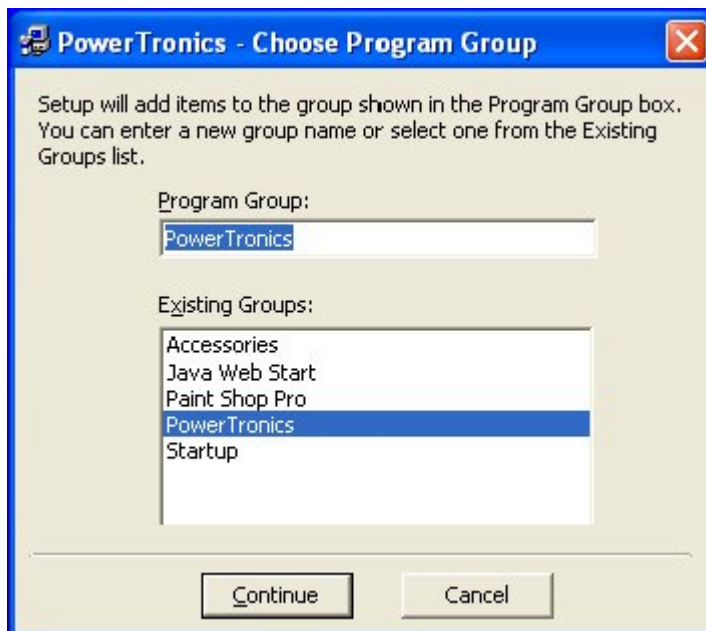
Note that the installation processes can be terminated at any time simply by pressing the **Exit Setup** button. The installation software will then confirm that the user wishes to abort the installation procedure and will then proceed to delete the installation setup files previously placed on the system. The user will be notified upon completion of these tasks.

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Once the user has selected the **OK** button the installation software will proceed to the destination directory window depicted below.



To proceed directly to the installation and use the default directory for the destination of the software, simply click on the **Computer Icon** button shown in the above window image. Alternatively, selecting the **Change Directory** will allow the user to choose the desired location on the computer system for the software installation. Once an alternate location has been specified simply press the **Computer Icon** to proceed. Note that the location that will be used for installation is shown to the left of the **Change Directory** button.



The installation program will then proceed to the window shown on the left.

This stage allows the user to select the Program Group under which the software will be placed. By default, the installation software uses the PowerTronics Group. Click on another to change to that group.

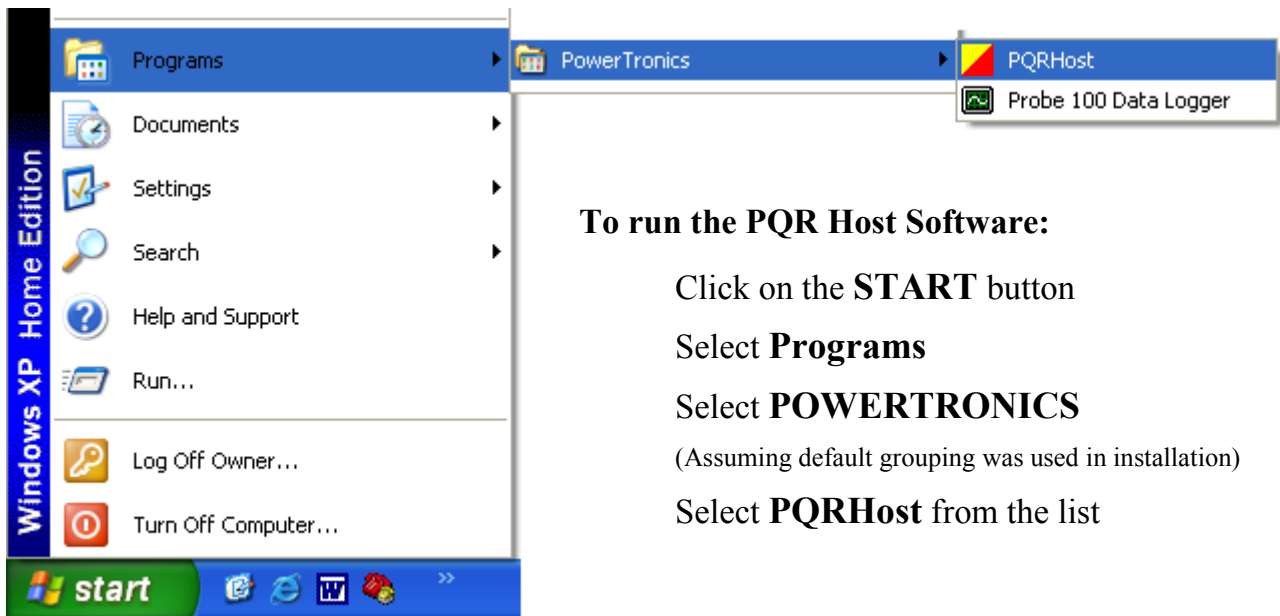
When complete click **Continue**. This will allow the Software to be installed. The installation program will notify the user once the installation procedure has been successfully completed.

The PQR Software can be uninstalled using the *Add or Remove Programs* utility.

PQR 2020

Accessing the Software:

Now that the PowerTronics PQR Host Communications Software has been successfully installed, the program can be used to communicate with the PQR Series units and to provide graphical analysis of the gathered data.



To run the PQR Host Software:

Click on the **START** button

Select **Programs**

Select **POWERTRONICS**

(Assuming default grouping was used in installation)

Select **PQRHost** from the list

Note that to facilitate speedy access of the PQR Host Software a shortcut can be created on the desktop. This is accomplished by right clicking on the PQRHost from the above listing. Select the COPY command and then PASTE to the desktop. This icon can now be used to start the PQR Host Software in addition to the method described above.

The following pages will outline the use of the software to communicate with the unit and analyze the data transmitted.

PQR 2020

Operating the PQR Host Software:

The PowerTronics PQR Host Communications Software is a graphical interface, Windows-based program. The main tasks in the operation of the software are performed through the use of pull-down menus located at the top of the main window. The following provides a summary of these menus which are described in more detail on the following pages.

File

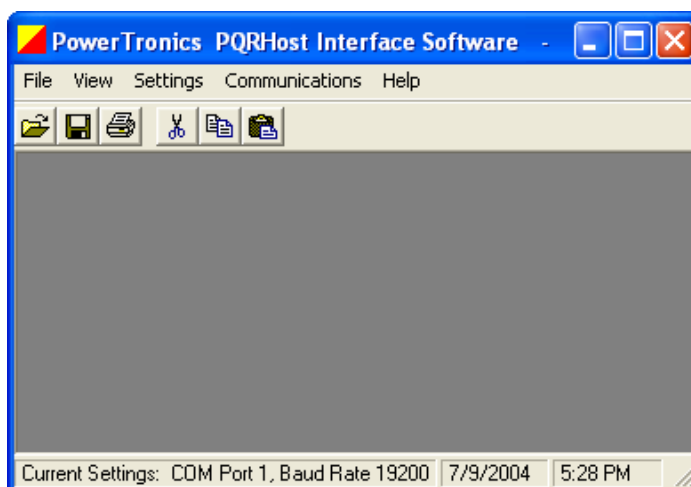
The File menu contains options for using data files that are stored on the computer hard drive or a disk.

Edit

In the Edit menu are some of the standard text editing options. Only available when a text report is open.

View

The View menu provides items used to control what tools are visible and available to the user in the main program window. These items can aid the user in the operation of the PQR Host Software.



*The screen shown here is the starting point for working with the units in the PQR Series. Note that not all menus described above are shown as they become available at certain times - such as **Graph** menu appears only when a text report is open.*

Settings

The Settings menu contains items that allow the user to specify certain settings for communication between the software and the PQR device. The menu also provides an interface for setting the internal PQR device parameters.

Communications

The Communications menu contains items that allow the user to retrieve data from the device. It also allows for the clearing of the unit and checking for proper channel operation. Along with the Graph menu, the Communications menu composes the core of the PQR Host Software.

Graph

The Graph menu lists the graphical representation options available to the user for the creation of plots and charts based on the data contained in the active data file. Only the graphing options that are valid for the active data window will be displayed.

Help

The Help menu provides an in-program help for the user concerning the operation of the software. In addition, the Help menu provides important information with regards to the software version.

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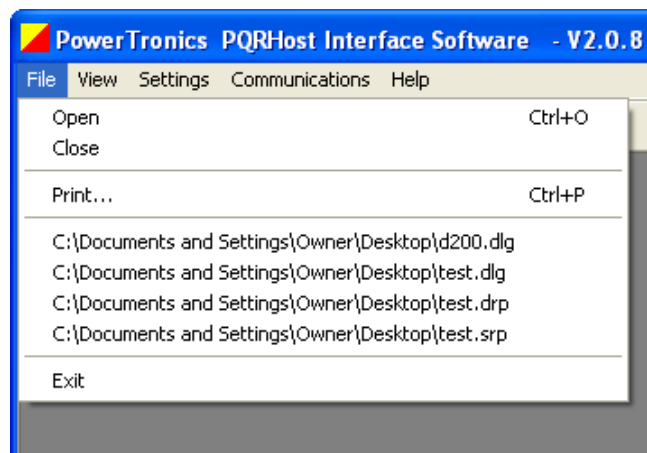
File Menu:

The **File** menu contains options for using data files stored on the computer's hard drive or a disk.

Open

Select the **Open** menu item to open a data log, detail report, or summary report that is stored on the computer's hard drive or a disk from a previous download. After specifying the desired file, the program will open a window that contains the data from the file. Note that the file type must also be selected.

This function can also be performed at any time by using the **Open File** command on the Quick Launch Toolbar.



Close

Select the **Close** menu item to close the active device data or graphical display window.

Save

Select the **Save** menu item to save the active data file to its current file name and location. This function also can be performed by using the **Save File** command on the Quick Launch Toolbar.

Save As...

Select the **Save As** menu item to save the active data file to a new file name and location specified by the user.

Print

Select the **Print** option to send the present active window to a printer. The selection of this menu item will cause a Print Dialog to be displayed for the user to select which printer to use and to specify the desired settings. This function also has an icon in the Quick Launch Toolbar.

Memory Files

This program will keep track of the last four files that have been used, and keep their names and locations in memory. To reopen any of these files, simply select the menu item with the desired file's name. The program will display the contents of the file in a new window.

Exit

Select the **Exit** menu item to close all windows and exit the program.

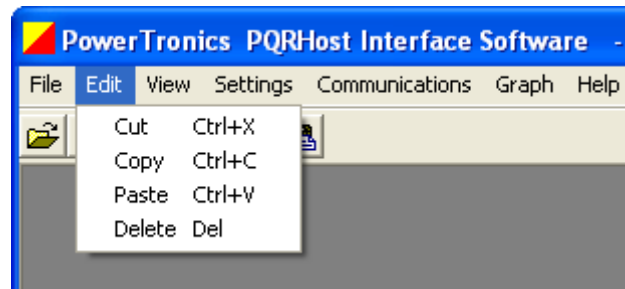
PQR 2020

Edit Menu:

The **Edit** menu contains various, standard text editing options. This menu is only available when a text report is open.

Cut

Selecting the **Cut** menu item will remove the text that is selected in the PQR device text file of the presently active window. The text will be stored in the clipboard of the computer for future pasting if so desired.



Copy

Selecting the **Copy** menu item will make a duplicate copy of the text that is selected in the PQR device text file of the presently active window. The duplicate copy is stored on the clipboard of the computer for future pasting.

Paste

The **Paste** menu item takes the contents of the clipboard and inserts it at the present location of the cursor within the PQR device text document that is presently in the active window.

The previous three function can also be performed at any time by using the **Cut**, **Copy**, and **Paste** commands, respectively, on the Quick Launch Toolbar. The standard **Control-** text editing commands are also available.

Delete

The **Delete** option removes the text that has been selected in the PQR device text file currently in the active window. The text is completely removed from the document and is NOT stored in the clipboard. This function can also be performed by using the Delete Key at any time.

To **UNDO** or **REDO** changes made to a document use the **Control-Z** and **Control-Y** text editing commands respectively.

Note that in order for any file modifications to be effective in future graphical renderings the file must be resaved after these operations.

PQR 2020

View Menu:

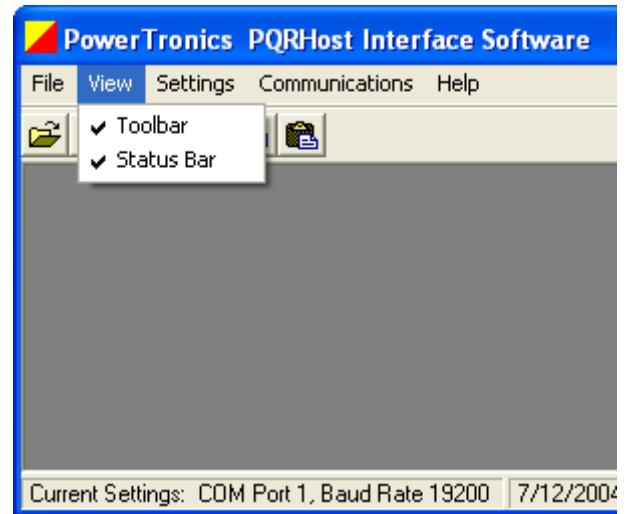
The **View** menu provides items used to control what tools are visible and available to the user in the main program window. These items aid the user in the operation of the PQR Host Software.

Toolbar

Select the **Toolbar** menu item to toggle the existence of the Quick Launch Toolbar. The toolbar, located just below the pull-down menus, contains buttons for easily opening, printing, editing, and saving files.

Status Bar

Select the **Status Bar** menu item to toggle the existence of the status bar located at the bottom of the main program window. The status bar displays the program's current COM port and baud rate settings. It also lists the computer's current system time and date.



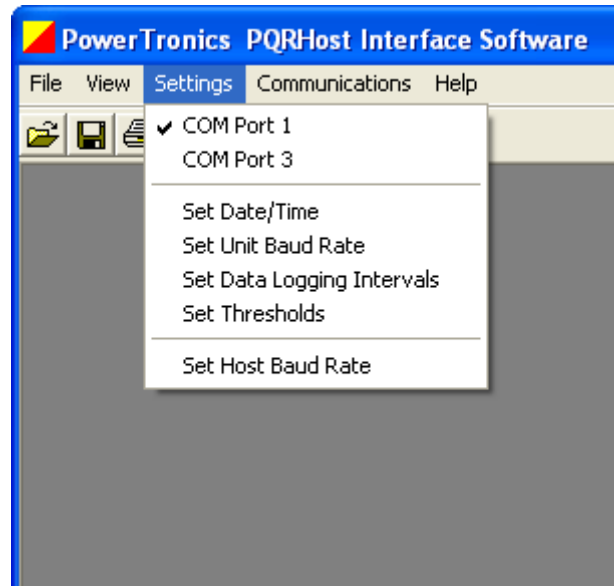
PQR 2020

Settings Menu:

The **Settings** menu contains items that allow the user to specify certain settings for communications between the software and the PQR device. The menu also provides an interface for setting the PQR device parameters.

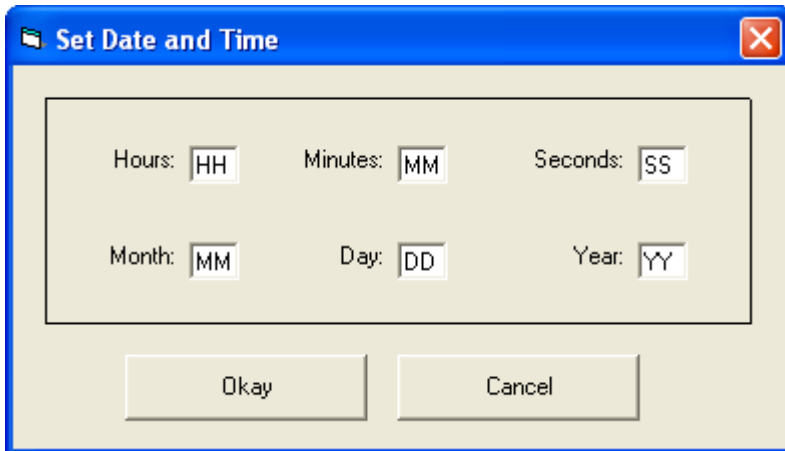
COM Ports 1 - 20

The **COM Port** menu item is used to specify which computer COM port the PQR device is connected to. The PQR Host Software scans the system and determines all available ports from 1 to 20. Note that it is essential that other programs such as HyperTerminal not have control over the desired port as this will lock the PQR Software from that port until such time as control is relinquished. Selecting one of the port options will change the program settings to that particular port. The current settings are indicated by a check mark next to the port in use. The current COM port setting is also displayed in the status bar at the bottom of the main program window.



Set Date/Time

Select the **Set Date/Time** menu item to set the device date and time used for data logging and event time stamping. A dialog box will be displayed as shown here that provides the user an interface with which to specify the date and time.



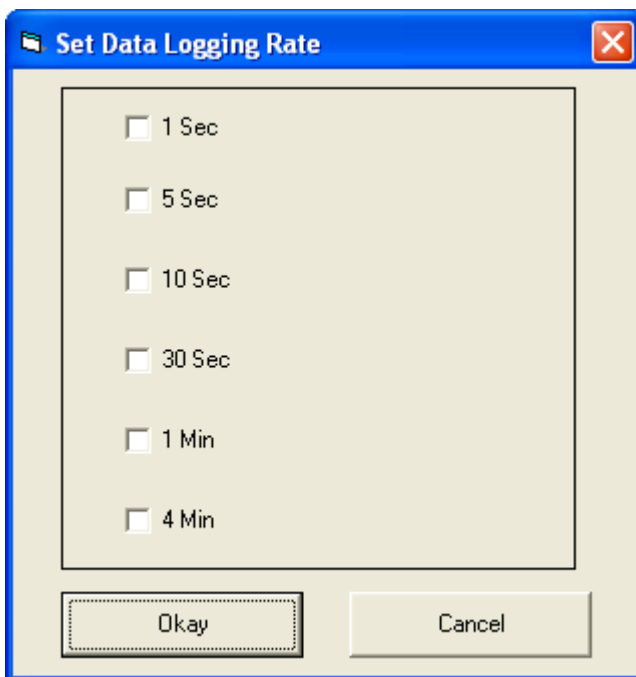
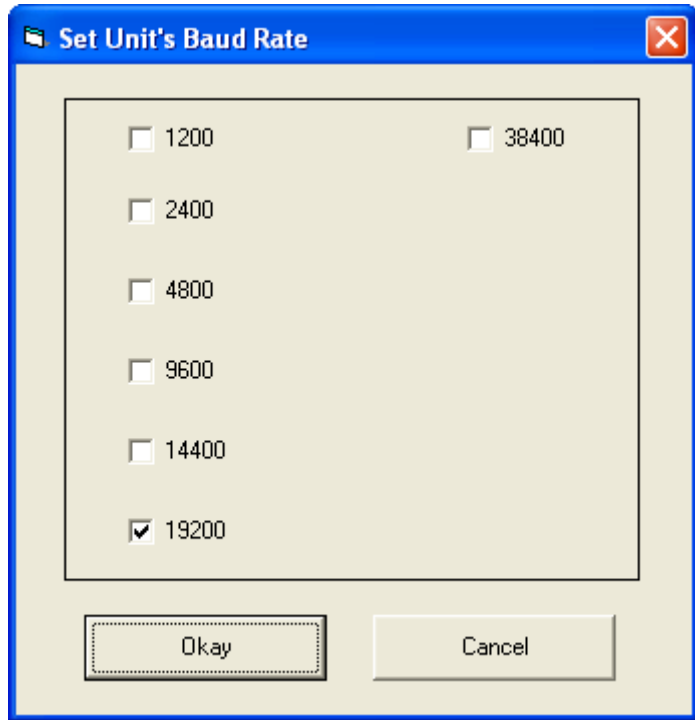
The settings will be defaulted to the current date and time, or to the date and time specified previously in the same program session. When manually setting the Date and Time follow the input character format as specified in the section of the manual dealing with HyperTerminal Communications.

After inputting the desired date and time, pressing the **Okay** button will instruct the program to set the device to the specified settings. This process may take a few seconds.

Set Unit's Baud Rate

The **Set Unit's Baud Rate** menu option allows the user to specify the data rate to be used when communicating with the device. The program will display a dialog box with the seven valid baud rates to select from. (Note only valid rates for the unit may be specified.) The seven rates are: 1200, 2400, 4800, 9600, 14400, 19200, and 38400. After selecting the desired baud rate, pressing the **Okay** button will instruct the program to set the device baud rate. This process may take a few seconds. The program baud rate setting will also be set to the selected settings.

When the rate is changed, the new setting is saved in FLASH RAM, and is used as the power up default until the next time the setting is changed.



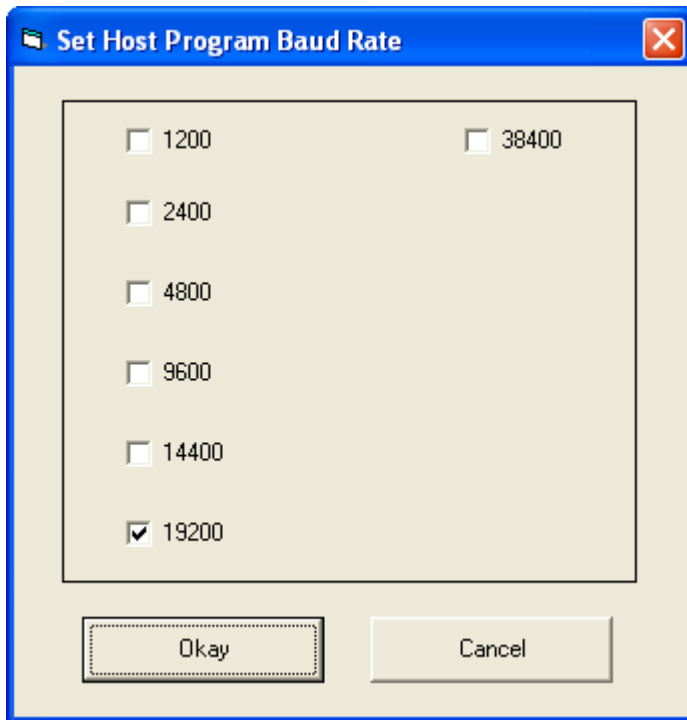
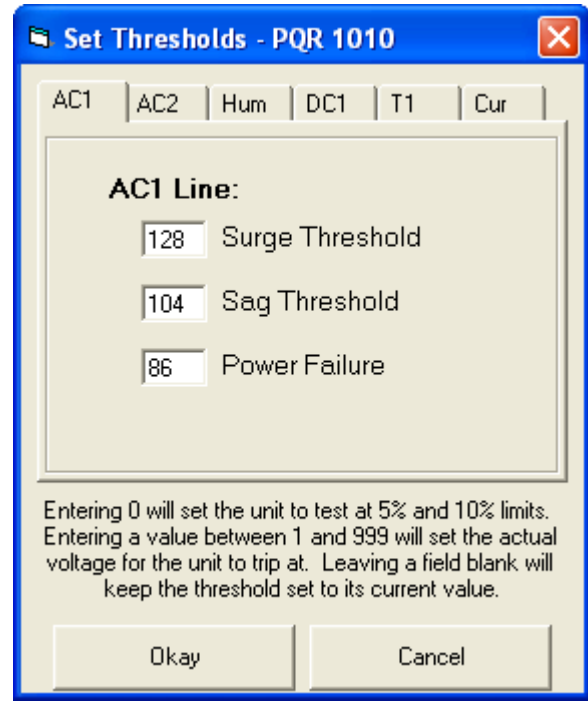
Set Data Logger

The **Set Data Logger** menu item allows the user to specify the device data logging rate, or the time interval between data log samples. The user will be provided six choices: 1 second, 5 seconds, 10 seconds, 30 seconds, 1 minute, and 4 minutes. After selecting the desired logging interval, pressing the **Okay** button will instruct the program to change the device setting. This process may take a few seconds.

When the rate is changed, the new setting is saved in non-volatile RAM, and is used as the power up default until the next time the setting is changed.

Set Thresholds

The **Set Thresholds** menu item allows the user to specify the thresholds at which the device will trigger events. The user will be provided with a dialog box with input fields to specify the surge, sag, and power failure thresholds for all available lines. Entering zero will set the unit to test at 5% and 10% limits. Entering a value between 1 and 999 will set the actual voltage for the unit to trip at. Leaving a field blank will keep the threshold set to its current value. To change the settings on a particular channel, simply click the Tab labeled with the channel name. After specifying the desired settings, pressing the Okay button will instruct the program to have the unit change its threshold settings. This process may take a few seconds.



Set Host Baud Rate

When a command is issued through the PQR Host Software the program will automatically cyclically attempt to locate the unit on all available COM ports at each available Baud Rate. This process begins at the previous settings used. The Set Host Baud Rate option allows the user to manually set the System's communications baud rate to speed up this process.

The **Set Host Baud Rate** option does not effect the baud rate setting of the device connected to the computer. Adjustments to that baud rate must be made using the previously discussed **Set Unit's Baud Rate**.

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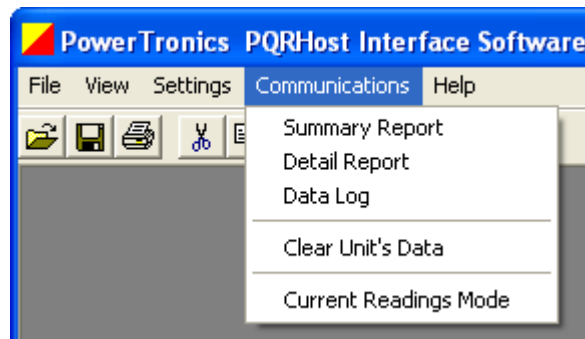
Communications and Graph Menus:

The **Communications** menu contains items that allow the user to retrieve data from the PQR device. It also allows for clearing the unit and checking for proper channel operation. The **Graph** menu lists the graphical representation options available to the user for the creation of plots and charts based on the data contained in a PQR device data file. Only the graphing options that are valid for the active data window will be displayed. Accordingly the **Graph** menu is only visible when a PQR device report is open.

Together the Graph menu and Communications menus compose the core of the PQR Host Communications Software. They provide the user with a means to access the data as well as the ability to view it in an understandable and useful format.

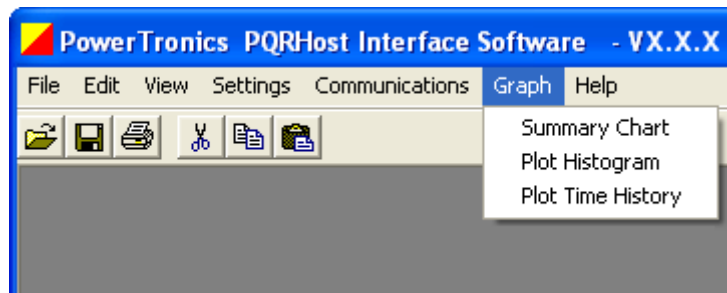
The Communications menu, shown on the right, consists of the following communications options:

- Summary Report**
- Detail Report**
- Data Log**
- Clear Unit's Data**
- Current Readings Mode**



The available graphs, corresponding to the three data files listed above, include the following which can be created using the PQR Host Software Graph menu items:

- Event Summary Chart**
- Event Histogram Plot**
- Time History Plot**



Additional information on each Communications Report/Graph pairing is available in the following pages.

PQR 2020

Summary Report

Selecting the **Summary Report** menu item will download a listing of counts for all the disturbances detected since the unit was put on-line and the RAM was last cleared. Before starting the transmission, the user will be asked to specify the name and location of a file to save the data to. This can include such details as the site name, customer, etc. (Note the file will have a .srp extension.) After the transfer is complete, the program will automatically open a text data window containing the downloaded data. Each event is described by the channel, event type, and quantity of that disturbance for the channel.

A sample summary report is shown below. Note that the contents of the report will depend on the type of unit which is connected to the computer and PQR Software.

```
C:\Program Files\VPQRHost\site003 data.srp

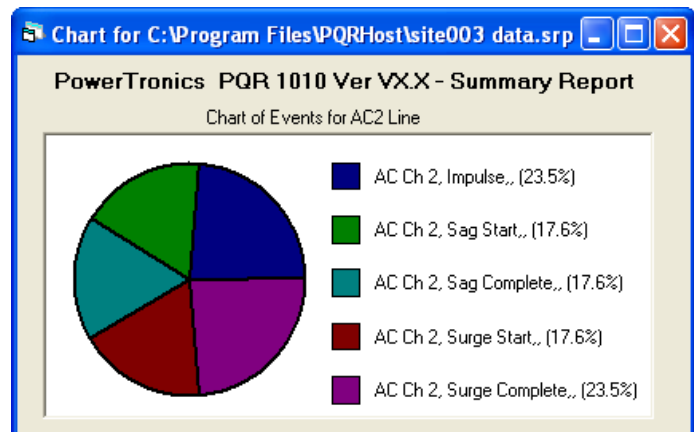
PowerTronics PQR 1010 Ver VX.X - Summary Report as of MMM/DD/YY - ID: XXXXXX

AC Ch 1, Power Failure, , ,1
AC Ch 1, Power Restore, , ,1

AC Ch 2, Impulse, , ,4
AC Ch 2, Sag Start, , ,3
AC Ch 2, Sag Complete, , ,3
AC Ch 2, Surge Start, , ,3
AC Ch 2, Surge Complete, , ,4
```

Summary Chart

Selecting the **Summary Chart** menu item from the now available **Graph** menu will cause a window to appear. This window allows the user to select which channels to include in the Summary Report chart. Once a channel (or channels) with disturbance events detected on it is selected and the **Okay** button pressed, the PQR Host Software will generate a pie chart, from the summary report file open, showing the distribution of the detected events. If no events are available the user will be notified and no plot will be created. A sample pie chart display is shown here.

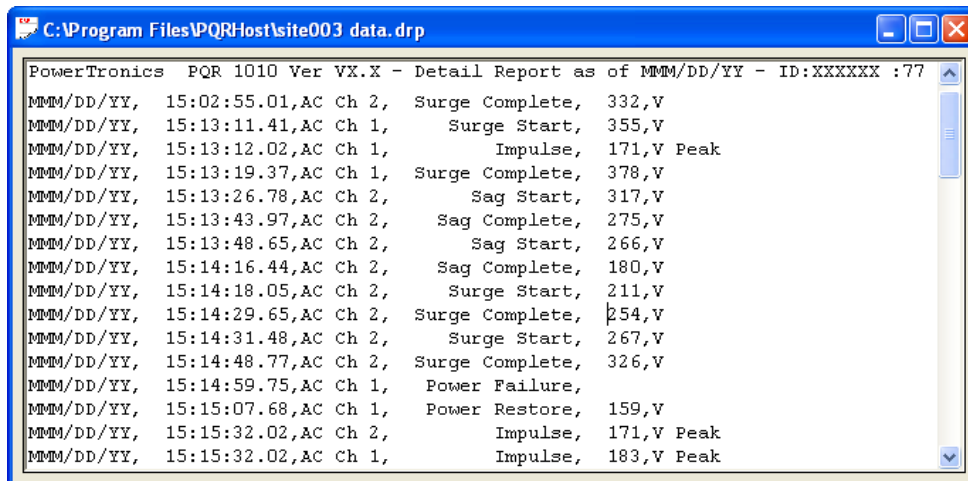


Note the Summary Chart option is only available when a Summary Report file (.srp) is open and in the active window.

Detail Report

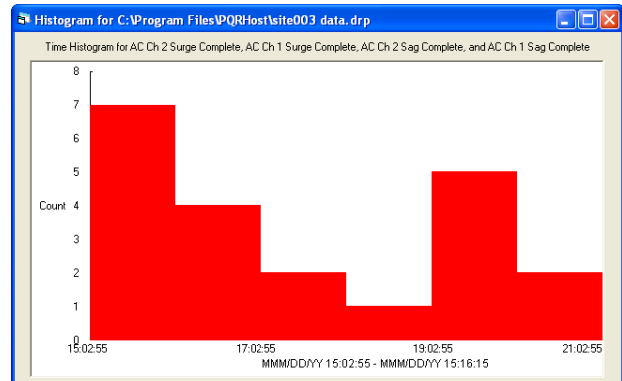
Selecting the **Detail Report** menu item will download a listing of all the disturbances saved since the unit was put on-line and the RAM was last cleared. Before starting the transmission, the user will be asked to specify the name and location of a file to save the data to. This can include such details as the site name, customer, etc. (Note the file will have a .drp extension.) After the transfer is complete, the program will automatically open a text data window containing the downloaded data. Each event is described by the date and time, channel, event type, and magnitude.

A portion of a sample detail report is shown below. Note that the contents of the report will depend on the type of unit which is connected to the computer and PQR Software.



Histogram Plot

Selecting the **Plot Histogram** menu item from the now available **Graph** menu will cause a window to appear. This window allows the user to select the events to be included in the Time Histogram from those available in the current Detail Report. Once events have been selected and the **Okay** button pressed, the software will generate a histogram showing the total number of the selected events that occurred within each one hour interval of the report. A sample histogram plot is shown here. Note multiple hour increments must be available that contain the selected event types.

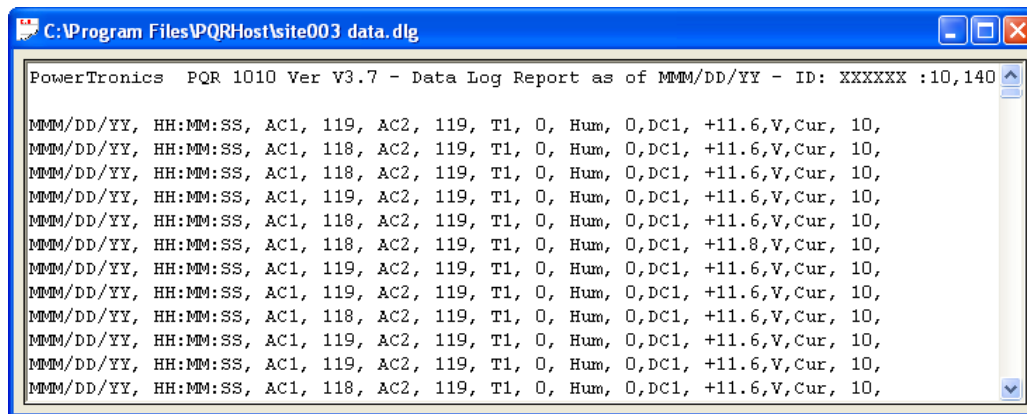


Note the Histogram can be zoomed in on to target certain areas of interest (see Active Plot Zooming following the Data Log section). Also the Histogram Plot option is only available when a Detail Report file (.drp) is open and in the active window.

Data Log

Selecting the **Data Log** menu item will download a listing of the readings measured on all the input channels since the unit was put on-line and the RAM was last cleared. Before starting the transmission, the user will be asked to specify the name and location of a file to save the data to. This can include such details as the site name, customer, etc. After the transfer is complete, the program will automatically open a text data window containing the downloaded data. The contents of each entry in the data log report will include the date and time the reading was taken followed by each input channel and its readings.

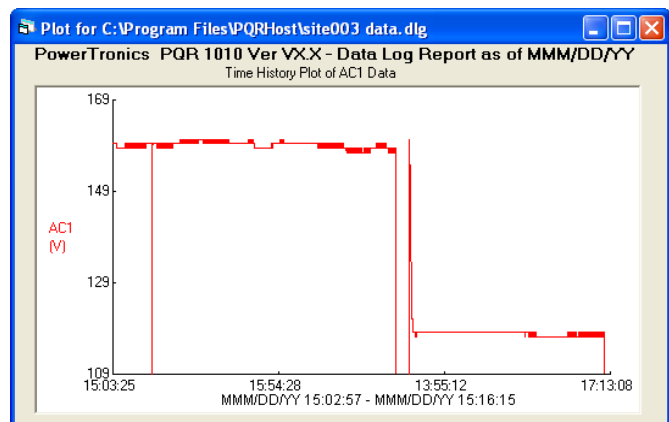
A portion of a sample data log file is shown below. Note the channels vary between units. Also, the spacing between samples will be the data logging interval set in the unit's memory.



```
PowerTronics PQR 1010 Ver V3.7 - Data Log Report as of MMM/DD/YY - ID: XXXXXX :10,140
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 118, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 118, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 118, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 118, AC2, 119, T1, 0, Hum, 0, DC1, +11.8, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 118, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 119, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
MMM/DD/YY, HH:MM:SS, AC1, 118, AC2, 119, T1, 0, Hum, 0, DC1, +11.6, V, Cur, 10,
```

Time History Plot

Selecting the **Plot Time History** menu item from the now available **Graph** menu will cause a window to appear. The window will list all available channels from the open Data Log report. The user may select one or two of the channels for plotting on the single Time History Plot. After the user has made a selection and pressed the **Okay** button, the PQR Host Software will read in the data log file and create a plot of the readings for the selected channels. A sample time history plot is shown here.



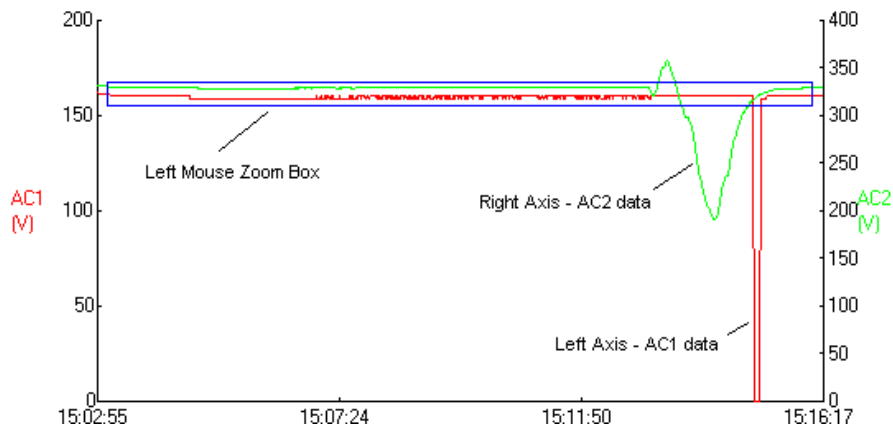
Note the Time History Plot can also be zoomed in upon to target certain areas of interest (see Active Plot Zooming). Also the Time History Plot option is only available when a Data Log file (.dlg) is open and in the active window.

Note that data in the file should have a constant time-stamp spacing of one data point per data logging interval (device setting). See the following page for additional information on data gaps.

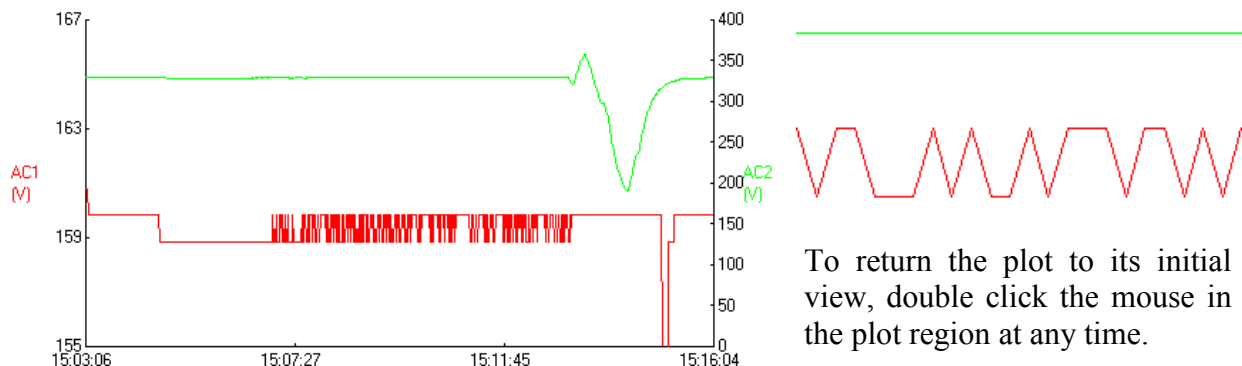
Active Plot Zooming

The Detail Report Histogram Plot and the Data Log Report Time History Plot both support a zoom function for increased viewing capabilities. To zoom in on a region in an active plot, simply use the mouse to click and drag over the desired region. Upon release of the mouse button, the plot will redraw itself, expanding the selected region to fill the active window.

For Data Log Time History Plots, in occasions where two channels are being plotted, there actually are two concurrent yet exclusive plots. One is labeled on the left vertical axis the other is labeled on the right vertical axis. The two plots can, however, be zoomed in on independent of each other. Using the left mouse button to define a region using the click-and-drag procedure will zoom in on the data using the left axis. Likewise, using the right mouse button will zoom in on the right axis data. In either case, the time axis will be zoomed in on for **both** data sets. For instance, if a user selects a region on a double plot using the right mouse button, in the resulting plot the left axis will remain unchanged but only the data points in the selected time range will be plotted.



A sample two channel plot is shown here. Note that AC1 is marked by the left vertical axis while AC2 is marked by the right vertical axis. A zoom box is being placed over the AC1 data as there is little change over much of the log file. Note the zoomed in image below observing how the AC2 data remains at the same vertical scale. A portion of the plot, after further zooming, is shown next to it.



To return the plot to its initial view, double click the mouse in the plot region at any time.

Additional Notes on Graphing Data

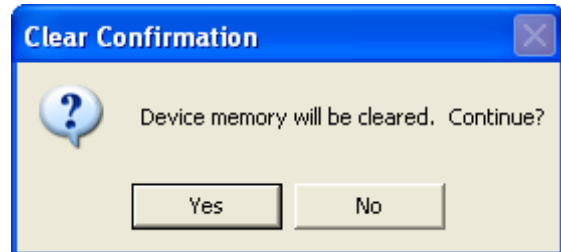
Note, in all of the above cases, if the program encounters incomplete or invalid data in the active data file, the user will be given the option of aborting the graphing procedure or viewing a graph of the data up to the erroneous data line. These faults can be solved by deleting the non-conforming data points until the consistent entries are reached. **The data must then be resaved** (possibly as a new file) and then replotted.

Also, in the course of unplugging a unit to bring it to a new location, the unit will often record power failures and other events that are not valid for the test site. These are rather caused by arcing at the power connector as the unit is plugged in. To solve this problem, the user can again simply delete these entries from the device text document and then save it - prior to the plotting. Note that the time stamps will be helpful in the task of determining which events occurred in the initial and final moments of the test.

It is also important to remember that anytime the unit is powered-up it restarts the data log record. The implication of this is that when the unit is first moved to the site it will often have a single data log entry left from just after the last clear command. This also will cause a gap in the time steps when the unit is unpowered and then powered again for the downloading of the data. If gaps in the data are found, the PQR Host Software will assume it is due to a unit power down and the gap will simply be ignored in the plotting. Note that these gaps can be eliminated using the same technique described above.

Clear Unit's Data

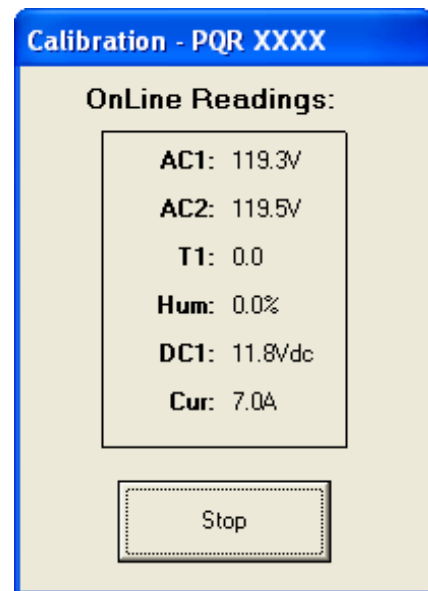
Selecting the **Clear Data** menu item from the **Communications** menu will clear all of the events and data log information stored in the internal FLASH RAM of the device. The summary report quantities will be reset to zero and the data logging will restart the tracking of channel readings. The program will ask the user for confirmation prior to transmitting the **Clear** command to the device. Note that once this operation is performed the data previously stored in the unit is **completely erased** and is **no longer recoverable!**



Current Readings Mode

Selecting the **Current Readings Mode** item from the **Communications** menu will command the device to begin transmitting the current channel readings to the computer. The channel readings are then displayed in a special window for the user to view. The readings displayed will be updated approximately once per second (depending on the unit with which the software is in communication). No other command can be performed while the program is in **Current Readings Mode**. To end the transmission, the user must press the **Stop** button; otherwise, the transmission will self-terminate after about four minutes.

Note that this function is very useful when insuring that the signals under test are properly connected.



PQR 2020

Help Menu:

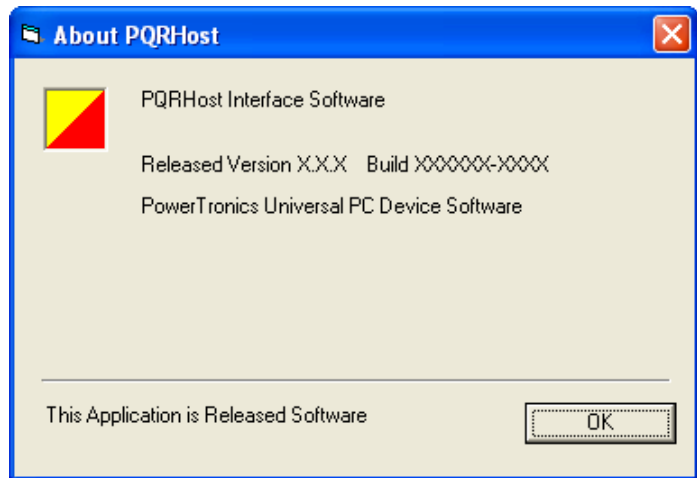
The Help menu provides in-program assistance to the user concerning the operation of the PQR Host Communications Software. In addition, the Help menu also provides important information with regards to the Software Version, Release Type, etc.

Help Topics

Select the **Help Topics** menu item to initiate the in-program Help File provided for the PowerTronics PQR Series Host Communications Software. This helpful subprogram is designed to supply a limited degree of assistance to users, as quickly as possible, as they work with the PQR Host Software.

About PQRHost...

Select the **About PQRHOST...** menu option to view the program information available for the PQR Host Software version being used on your system. This notice will inform the user of the in-system name for the software as well as its technical release name. It also contains the Software Version and Build numbers, both of which assist the user in maintaining the most up-to-date edition available. Such data may also prove helpful when speaking with the PowerTronics Technical Staff.



Note that the latest software version is available on the PowerTronics website at www.PowerTronics.com. Use the product support link and go to the Software Updates section.

Communication Notices:

In communicating with a device via the PQR Host Software, various notices will often be returned to the user. Some of the more common are discussed here.

Check Baud Rate Error

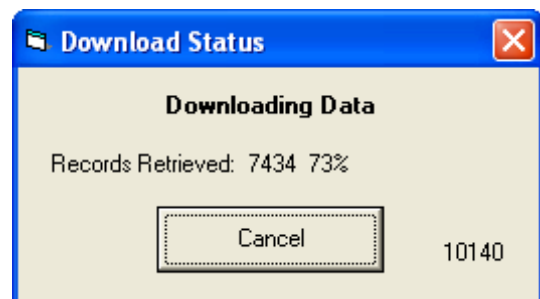
If for any reason the PQR Host Software is unable to contact the unit at the previously used COM port and baud rate settings it will begin to cycle through all available COM ports at each baud rate for the computer system searching for the device. If it is able to locate the unit, the software will store these new settings as the new default for communicating with PQR devices on your system. If, however, after searching through the available communications settings the software is still unable to locate the unit, it will return an error message like the one shown here.



Note that if this occurs the most likely error is that the unit is either not connected properly or is not a unit capable of communication with the PQR Host Software. Make sure that the unit is connected via a NULL modem cable (for direct connection, a Straight cable should be used when employing a modem) and that the unit is properly powered up, which can be confirmed by checking the status LED. Also, make sure that no other programs such as HyperTerminal have captured the port the device is on. Note that for the PQR Host Software to use a relinquished port, the port must be available when the software is first begun. It may therefore be necessary to restart the program.

Download Status

Note that a large amount of downloading time may be necessary in certain cases where the data is transmitted from the device to the computer. The exact duration is dependent upon the baud rate settings and the amount of data being download. In these cases a status window, like the one shown here, will be displayed allowing the user to monitor the progress of the data transmission. The status window shows a running count of the blocks written to the file during the current transmission. The block count provides the number of lines of data that have been transferred. Thus, by way of example, for a data log report the total number of blocks will be the number of data log entries that were recorded by the unit. Depending on the unit, the status window may also show the percent of the total download, of that report, that has been received up to that point. The user can cut the transmission short by simply pressing the **Cancel** button in the status window.



HyperTerminal

Communication with the PQR 2020 is also possible, without the use of the PowerTronics PQR Host Communications Software, using most other terminal emulation software including HyperTerminal. This communication is performed on a command basis.

Commands:

The PQR 2020 will respond to commands received through the serial port. All commands are started with a C. Entering C, followed by the command number will initiate the function corresponding to that command number.

The commands for the PQR 2020 are as follows:

- C0 Transmit the Command Menu**
- C1 Transmit the Unit Version Number**
- C2 Transmit a Summary Report**
- C3 Transmit a Detail Report**
- C4 Transmit a Data Log of Recorded Readings**
- C5 Clear all Events and Data Log**
- C6 Configure the PQR Hardware**
- C90 Continuous Transmission of Readings**
- CX Hang up the Phone**

After the PQR 2020 has completed the task initiated by the operator command, it returns on-line to its monitoring duties. Each of the commands for the PQR 2020 are detailed in the following pages.

PQR 2020

Initial Transmission:

When power is restored and the unit is connected to HyperTerminal, the user will receive a set of specific character lines. These lines notify the user that the unit is going through its initialization routines and initialize the any modem which it may be connected to. Commands may be entered once these lines have been output.

Power up the unit.

The PQR 2020 will respond with:

```
+++AT&F
AT S0=2 V0 E0 Q1 &G1 &K0 &D0 &S0 &Y0 &W0

PQR 2020 Ver VX.X   MMM/DD/YY  HH:MM:SS.ss
```

Commands can now be entered into HyperTerminal and the unit will respond appropriately.

PQR 2020

C0 - Transmit the Command Menu:

This command will transmit the Command Menu back to the operator through the serial port. This is usually the first command to be issued when the operator is connected to the PQR 2020.

Transmit or Type: **C0**, or **CONNECT**

The PQR 2020 will respond with:

```
PowerTronics  PQR 2020 Ver VX.X  MMM/DD/YY  HH:MM:SS.ss - ID: XXXXXX
These are your Command Options:
C 0 - Display this Command List
C 1 - Display Unit Version Number
C 2 - Summary of all Detected Events
C 3 - Detail Report of Stored Events
C 4 - Data Log Report of all Channels
ESC - Will STOP data transfer
SPACE Will Pause data transfers
C 5 - Clear All Events
C 6 - Configure the PQR Hardware
C X - Hang up
```

This Menu can be called up any time the operator is connected to the unit, and the Menu is transmitted automatically upon receipt of the word CONNECT from a modem.

PQR 2020

C1 - Transmit the Unit Version Number:

This command will transmit the Model Name and Version Number back to the operator through the serial port.

Transmit or Type: **C1**

The PQR 2020 will respond with:

```
PowerTronics PQR 2020 Ver VX.X ** PQR SERIES ** MMM/DD/YY - ID: XXXXXX
```

The Version Number refers to the Firmware Program stored in the PROM located inside the unit. This number is needed whenever the operator contacts PowerTronics technical support specialists.

PQR 2020

C2 - Transmit a Summary Report:

Transmit or Type: C2

The PQR 2020 will respond by transmitting a summary report. The report is a count of all the disturbances detected since the unit was put on-line, and the RAM was cleared, categorized by channel and event type. A sample summary report is shown below:

```
PowerTronics PQR 2020 Ver VX.X - Summary Report as of MMM/DD/YY - ID: XXXXXX

Phase 1      Impulse, , ,2
Phase 1      Power Failure, , ,4
Phase 1      Power Restore, , ,5
Phase 1      Surge Start, , ,2
Phase 1      Surge Complete, , ,2

Phase 2      Impulse, , ,3
Phase 2      Power Restore, , ,1
Phase 2      Surge Start, , ,2
Phase 2      Surge Complete, , ,2

Phase 3      Impulse, , ,3
Phase 3      Power Restore, , ,1
Phase 3      Surge Start, , ,2
Phase 3      Surge Complete, , ,2

Neutral      Impulse, , ,6
```

Each entry is described by the channel on which it was detected, the event type, and the quantity of that event that occurred on that channel.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report. Typing, or Transmitting the Space character will pause the report. The report will resume transmission after a brief wait or the user can request an immediate continue by re-transmitting the Space character.

PQR 2020

C3 - Transmit a Detail Report:

Transmit or Type: C3

The PQR 2020 will respond by transmitting the Detail Report of all the disturbances saved since the unit was put on-line and the RAM cleared. A portion of a sample detail report is shown below:

```
PowerTronics PQR 2020 Ver VX.X - Detail Report as of MMM/DD/YY - ID: XXXXXX:24
MMM/DD/YY, HH:MM:SS.ss, Neutral Impulse, 128,V Peak
MMM/DD/YY, HH:MM:SS.ss, Neutral Impulse, 88,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 3 Power Restore, 120,V
MMM/DD/YY, HH:MM:SS.ss, Phase 2 Power Restore, 116,V
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Power Restore, 121,V
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Power Failure,
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Impulse, 149,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Power Restore, 108,V
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Impulse, 381,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 2 Impulse, 195,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 3 Impulse, 194,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Surge Start, 140,V
MMM/DD/YY, HH:MM:SS.ss, Phase 2 Surge Start, 142,V
MMM/DD/YY, HH:MM:SS.ss, Phase 3 Surge Start, 139,V
MMM/DD/YY, HH:MM:SS.ss, Phase 2 Impulse, 93,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 3 Impulse, 209,V Peak
MMM/DD/YY, HH:MM:SS.ss, Neutral Impulse, 141,V Peak
MMM/DD/YY, HH:MM:SS.ss, Phase 1 Surge Complete, 121,V
MMM/DD/YY, HH:MM:SS.ss, Phase 2 Surge Complete, 121,V
MMM/DD/YY, HH:MM:SS.ss, Phase 3 Surge Complete, 120,V
```

Each event is described by the date and time of occurrence, the channel on which it was detected, the event type, and the magnitude of the event (if applicable).

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report. Typing, or Transmitting the Space character will pause the report. The report will resume transmission after a brief wait or the user can request an immediate continue by re-transmitting the Space character.

PQR 2020

C4 - Transmit a Data Log of Recorded Readings:

Transmit or Type: **C4**

The PQR 2020 will respond by transmitting the listing of the voltages measured on all four AC Voltage inputs each data logger sampling interval since the unit was put on-line and the RAM cleared. A portion of a sample data log report is shown below:

```
PowerTronics PQR 2020 Ver VX.X - Data Log Report as of MMM/DD/YY - ID:
XXXXXXXX:1387

MMM/DD/YY, HH:MM:SS.ss, AC1, 121, AC2, 121, AC3, 117, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 121, AC2, 120, AC3, 119, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 121, AC2, 120, AC3, 120, Neu, 1,
MMM/DD/YY, HH:MM:SS.ss, AC1, 121, AC2, 120, AC3, 120, Neu, 1,
MMM/DD/YY, HH:MM:SS.ss, AC1, 121, AC2, 120, AC3, 120, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 121, AC3, 120, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 122, AC3, 119, Neu, 0,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 122, AC3, 119, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 122, AC3, 119, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 121, AC3, 119, Neu, 1,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 120, AC3, 119, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 119, AC3, 119, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 120, AC3, 119, Neu, 2,
MMM/DD/YY, HH:MM:SS.ss, AC1, 120, AC2, 120, AC3, 120, Neu, 2,
```

The first line of transmission has a header listing the date of the unit at the time the Data Log was requested. Also, following the serial number, the unit lists the total number of samples taken. The following lines of the file are the values stored from the average readings tested during each interval. The data is listed in the following format: The date and time of each data log reading (at the sampling interval selected by the user with a default of one sample per minute) followed by the line voltages for Phases 1, 2, and 3 and the Neutral channel during that interval.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report. Typing, or Transmitting the Space character will pause the report. The report will resume transmission after a brief wait or the user can request an immediate continue by re-transmitting the Space character.

PQR 2020

C5 - Clear All Events, and Data Log:

This Command will clear all of the events and all of the data log information stored in the internal Flash RAM. The Summary Report quantities will be reset to zero and the Data Logging will start over again with the tracking of channel voltage readings.

Transmit or Type: **C5**

The PQR 2020 will respond by transmitting the following message:

```
Are You Sure you want to CLEAR ALL DATA on this board ? _
```

To proceed with the clearing of all data stored in the unit's memory enter a **CAPITAL Y**. The PQR 2020 will acknowledge receipt of the confirmation of the clear command and show erase completion by displaying the message shown below, followed by the initialization output.

```
Are You Sure you want to CLEAR ALL DATA on this board ? Y OK  
Ram has been cleared !
```

Note that once the FLASH RAM has been cleared **all Power Line data will be completely erased and will be lost!** There is no means of recovering the data from the unit once this operation has been completed.

Entering any other character at the original prompt will cause the clear operation to abort. The PQR 2020 will acknowledge the abort command by displaying the following:

```
Are You Sure you want to CLEAR ALL DATA on this board ? N  
Ram has NOT been cleared !
```

PQR 2020

C6 - Configure the PQR Hardware:

This Command will cause the unit to transmit the Setup Command Menu back to the operator through the serial port. Selection may then be made of the desired setup option.

Transmit or Type: **C6**

The PQR 2020 will respond by transmitting the following setup options list:

```
These are your Setup Options:                               Current Settings:

 1 - Set the Date and Time                                  MMM/DD/YY  HH:MM:SS.ss
 2 - Set the Baud Rate                                     19,200 Baud
 3 - Select a Data Logging Sample rate                    1 Minute
 4 - Set the Sag, Surge, and Power fail thresholds

ESC - Exit this Menu

Select an Option : _
```

This Menu can be called up anytime the operator is connected to the unit. Note that the Current Settings show how the PQR 2020 is configured at the present time.

At the prompt enter the number of the setup option you wish to enter. This will allow you to set various options available for the PQR 2020. Typing or transmitting the escape character at any time will cause the unit to exit the Setup Option menus.

- Type 1** **to Set the Date and Time**
- Type 2** **to Set the Baud Rate**
- Type 3** **to Select a Sampling Rate for the Data Logger**
- Type 4** **to Set the Disturbance Thresholds**

The unit will then display the listings for the selected setup option. Additional discussion of each option is made in the following pages.

PQR 2020

C6 - (Option 1) Set the Date and Time:

This Command allows the operator to change the Time and Date setting inside the PQR 2020.

Select Option 1: **1**

The PQR 2020 will respond by transmitting the following message:

```
Input the Date and Time in the format MM/DD/YY,HH:MM:SS
: _
```

| | |
|-------------|---|
| MM = Month | Jan = 01, ... Dec = 12 |
| DD = Day | 1 st = 01, ... 31 st = 31 |
| YY = Year | 1995 = 95, 2001 = 01 |
| HH = Hour | 1:00 AM = 01, 1:00 PM = 13 |
| MM = Minute | 0 = 00, 59 = 59 |
| SS = Second | 0 = 00, 59 = 59 |

The data must be entered in the format shown, including commas, slashes, and colons. After entering the Time and Date, enter a Carriage Return. The unit will echo each character as it is entered. If the format is correct the PQR 2020 will respond with:

```
Command OK
```

Cancellation (by typing or transmitting the escape character) or an incorrect format will result in the unit responding with:

```
Command terminated
```

PQR 2020

C6 - (Option 2) Set the Baud Rate:

This Command allows the operator to change the Communications Baud Rate setting inside the PQR 2020.

Select Option 2: **2**

The PQR 2020 will respond by transmitting the following message:

```
Select a Baud Rate           - Currently set to 19,200 Baud

                                  1) 1200       2) 2400       3) 4800
                                  4) 9600       5) 14400      6) 19200

WARNING - You will need to change the rate on your terminal to match the PQR

New Rate : _
```

Typing the number indicated next to the desired rate will change the rate of the PQR 2020 immediately to the new rate. The factory setting for the Baud Rate is 19,200 Baud.

Note: Changing the baud rate breaks down the connection between the PQR 2020 and the communications device. The baud rate of the communications device must also be changed in order to match the new rate of the PQR 2020. To cancel the setting of the baud rate, type or transmit the escape character.

When the rate is changed, the new setting is saved in non-volatile Flash RAM, and is used as the power up default until the next time the setting is changed.

PQR 2020

C6 - (Option 3) Select a Data Logger Sample Rate:

This Command allows the operator to change the sampling interval for data logger readings stored inside the PQR 2020.

Select Option 3: **3**

The PQR 2020 will respond by transmitting the following message:

```
Enter the number of seconds between Data log samples
  1) 1 Sec   2) 5 Sec   3) 10 Sec
  4) 30 Sec  5) 1 Min   6) 4 Min

Any other choice sets rate to 1 Minute (default).

New Rate : _
```

Typing the number indicated next to the desired sampling rate will change the sampling rate of the PQR 2020 immediately to that new rate.

Note: When the rate is changed, the new setting is saved in non-volatile Flash Ram and used as the power up default until the next time the setting is changed.

Upon entry of a number the PQR will respond (depending on the entry) with:

```
Enter the number of seconds between Data log samples
  1) 1 Sec   2) 5 Sec   3) 10 Sec
  4) 30 Sec  5) 1 Min   6) 4 Min

Any other choice sets rate to 1 Minute (default).

New Rate : 5
Data Logger will now save 1 sample every 1 Minute
```

Note that once the sampling interval is changed all data log entries stored in the unit will be **cleared** and **permanently lost!** To prevent changing the data logger sampling interval, and erasing the data, type or transmit the escape character.

PQR 2020

C6 - (Option 4) Set the Disturbance Thresholds:

This Command allows the operator to change the threshold points for the PQR 2020 disturbance events.

Select Option 4: **4**

The PQR 2020 will respond by transmitting the following message:

```
Phase 1 - Surge Threshold ..... : (5%,10%) .. : 0 (5%,10%)
Phase 1 - Sag Threshold ..... : (5%,10%) .. : 0 (5%,10%)
Phase 1 - Power Failure ..... : (5%,10%) .. : 0 (5%,10%)
Phase 2 - Surge Threshold ..... : (5%,10%) .. : 0 (5%,10%)
Phase 2 - Sag Threshold ..... : (5%,10%) .. : 0 (5%,10%)
Phase 2 - Power Failure ..... : (5%,10%) .. : 0 (5%,10%)
Phase 3 - Surge Threshold ..... : (5%,10%) .. : 0 (5%,10%)
Phase 3 - Sag Threshold ..... : (5%,10%) .. : 0 (5%,10%)
Phase 3 - Power Failure ..... : (5%,10%) .. : 0 (5%,10%)
```

To Set to a Fixed Threshold:

Type the desired setting number. For example, to set the Phase 1 Surge Threshold to 130 volts simply type 130 at **AC 1 - Surge Threshold : (5%,10%) .. :** followed by a carriage return. The PQR 2020 will respond with the entered value indicating the level at which it will now trip.

To Set to Relative Thresholds (5% and 10%):

Type the number zero. For example, to set the Phase 1 Surge Threshold to trip at 5% and 10%, type 0 at **AC 1 - Surge Threshold : (5%,10%) .. :** followed by a carriage return. The PQR 2020 will respond with (5%, 10%) indicating it will now trip when the Phase 1 voltage is 5% and 10% above the average RMS Phase 1 voltage.

Note: The above transmission is performed line by line upon each entry by the user. The break down is as follows: the PQR prompts for a given event type and gives the present threshold value. The user then enters the desired value and enters a return carriage. The PQR 2020 will then echo that 'new' value and prompts for the next event type. Upon completion, the unit returns the following:

```
Setup Completed
```

Typing or transmitting the escape character will terminate the setting of thresholds, saving those entries made up to that point. Entering a Carriage Return without entering a threshold will cause the unit to retain the previously used threshold for that line entry. The new threshold settings are saved in non-volatile Flash RAM and used as the power-up default.

PQR 2020

C90 - Continuous Transmission of Channel Data:

This command allows the operator to view the voltage readings present on each of the three Phases and Neutral of the PQR 2020.

Transmit or Type: **C90**

The PQR 2020 will respond by transmitting data similar to the following:

```
Unit Off-Line, - entering Calibration mode
Ph1: 116V   Ph2: 115V   Ph3: 115V   Neutral: 2V
Ph1: 116V   Ph2: 115V   Ph3: 115V   Neutral: 2V
Ph1: 117V   Ph2: 115V   Ph3: 115V   Neutral: 2V
Ph1: 117V   Ph2: 115V   Ph3: 115V   Neutral: 1V
Ph1: 117V   Ph2: 114V   Ph3: 116V   Neutral: 1V
Ph1: 117V   Ph2: 114V   Ph3: 115V   Neutral: 1V
Ph1: 117V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 117V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 117V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 117V   Ph2: 114V   Ph3: 115V   Neutral: 0V
Ph1: 117V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 117V   Ph2: 114V   Ph3: 116V   Neutral: 2V
Ph1: 117V   Ph2: 114V   Ph3: 116V   Neutral: 2V
Ph1: 118V   Ph2: 115V   Ph3: 116V   Neutral: 1V
Ph1: 116V   Ph2: 115V   Ph3: 117V   Neutral: 2V
Ph1: 117V   Ph2: 115V   Ph3: 117V   Neutral: 1V
Ph1: 117V   Ph2: 115V   Ph3: 117V   Neutral: 1V
Ph1: 116V   Ph2: 115V   Ph3: 117V   Neutral: 1V
Ph1: 116V   Ph2: 114V   Ph3: 116V   Neutral: 1V
Ph1: 116V   Ph2: 114V   Ph3: 116V   Neutral: 2V
Ph1: 116V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 116V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 116V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 116V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Ph1: 116V   Ph2: 114V   Ph3: 115V   Neutral: 2V
Unit returning to On-Line mode
```

The unit will send this reading continuously, resulting in the screen being updated about three times a second.

This command is helpful in confirming the unit is properly connected to the signals under test.

To quit the test, send any character to the unit, or wait for 4 minutes when the unit will return to the on-line testing mode on it's own.

PQR 2020

CX - Hang Up the Phone:

This command allows the operator to disconnect the signal from a phone line on a modem attached to the PQR 2020.

Transmit or Type: **CX**

The PQR 2020 will respond by transmitting the following:

```
Thank you, and good bye.  
+++ATH0
```

Having sent this message, the unit then sends the hang-up command to the modem. If there is a modem connected, and it had the phone off-hook, it would put the phone on-hook.

AC Voltage Channels Specifications

DATA LOGGING

RMS Voltage Phase 1, 2, 3, and Neutral

- ◆ Range: 80 to 480 V AC RMS
- ◆ Resolution: 1 V RMS
- ◆ Accuracy: +/- 1.5%
- ◆ Sample Rate: Programmable - range of one reading per second to one reading per four minutes

THRESHOLD REPORTING

Dropouts

- ◆ Threshold: Programmable: User set values
- ◆ Duration Limits: Longer than 8 ms, shorter than 80 ms

Power Failure

- ◆ Threshold: Programmable: User set values
- ◆ Duration Limits: Longer than 80 ms

Sags

- ◆ Threshold: Programmable: User set values or 5% and 10% of average RMS
- ◆ Duration Limits: 1 cycle or 20 ms
- ◆ Accuracy: +/- 1.5%

Surges

- ◆ Threshold: Programmable: User set values or 5% and 10% of average RMS
- ◆ Duration Limits: 1 cycle or 20 ms
- ◆ Accuracy: +/- 1.5%

Impulses

- ◆ Range: 20 V to > 2500 V peak
- ◆ Resolution: 5 V RMS (Impulse Magnitude Recorded)
- ◆ Accuracy: +/- 10%
- ◆ Pulse Detection: 500 ns above threshold

PQR 2020

High Frequency Noise

- ◆ Amplitude: 2 volts peak
- ◆ Frequency: 10 KHz - 10 MHz
- ◆ Accuracy: +/- 10%
- ◆ Response Time: 1 ms

Line Frequency

- ◆ Range: 40 - 400 Hz
- ◆ Accuracy: +/- 1%
- ◆ Response Time: 1 AC cycle
- ◆ Threshold: +/- 2%

Mechanical Specifications

- ◆ Weight: 2 pounds
- ◆ Size: 6.25" wide x 7" deep, x 1.75" high
- ◆ Power Cord: 6 feet
- ◆ AC Test Leads: Safety Banana/Alligator clip, 6 feet
- ◆ Serial Comm. Cable: DB9F Null Modem, 6 feet

Operating Specifications

- ◆ Temperature: 30 - 120 degrees F
- ◆ Humidity: 10% to 80% (non-condensing)
- ◆ AC Voltage: 80 - 260 Volts AC
- ◆ AC Current: 0.1 amps
- ◆ Line Frequency: DC - 400 Hz
- ◆ DC Voltage: 9 - 24 Volts DC

Interface Specifications

Serial Connector

- ◆ Connector: DB9M - RS 232C (cable included)
- ◆ Baud Rate: Programmable: 1200, 2400, 4800, 9600, 14400, 19200, or 38400 (Default to 19,200)
- ◆ Protocol: 8 Data, 1 Stop, No Parity bits

Data Storage Specifications

- ◆ Summary Event Count: 32,750 total events
- ◆ Detail Storage: 32,750 total events
- ◆ Data Log Storage: 32,750 voltage readings (per channel)
- ◆ Data Retention: FLASH RAM Data Storage, Guaranteed 20⁺ years without power at 125° C

Service Specifications

- ◆ MTBF (Mean Time Between Failure) 26,000 hours
- ◆ MTTR (Mean Time To Repair) 30 minutes

Types of Power Problems and what they look like.

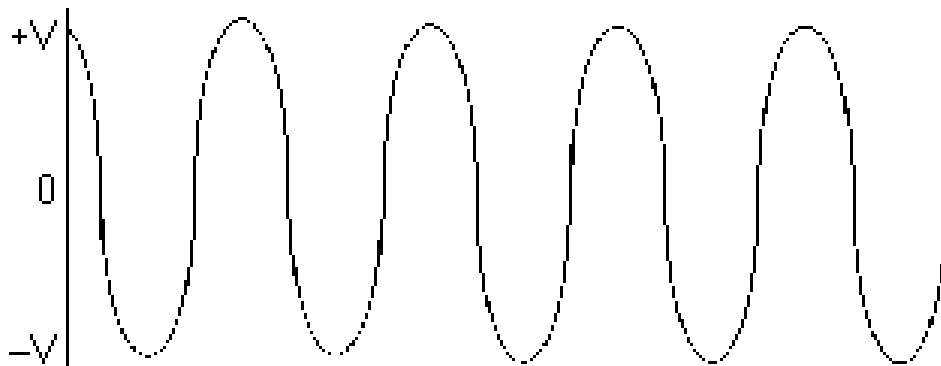
Over the recent decades, electronic components have been drastically reduced in size to produce increased speed and storage capacity. As a result of this decrease in size, these components have become many times more susceptible to AC power disturbances than similar devices of the past. PowerTronics knows this and has been working to increase awareness in the electronics industry by creating numerous power line monitors which will detect a wide range of power disturbances.

There are many types of power problems that can affect the quality of the AC power being delivered to a piece of equipment. Different types of problems will have different effects on the operation, or even life expectancy of this equipment. Knowing what these problems are, and what some of the consequences are of having these problems, can help in the process of identifying what can be done to help protect this equipment. This section is designed to inform the user of some various power line disturbances.

The following pages describe several of the more common types of power disturbances and list what some of the causes are.

- ◆ Dropout/Power Failure
- ◆ Sag
- ◆ Surge
- ◆ Impulse
- ◆ High Frequency Noise
- ◆ Common Mode Noise

Typical AC Waveform

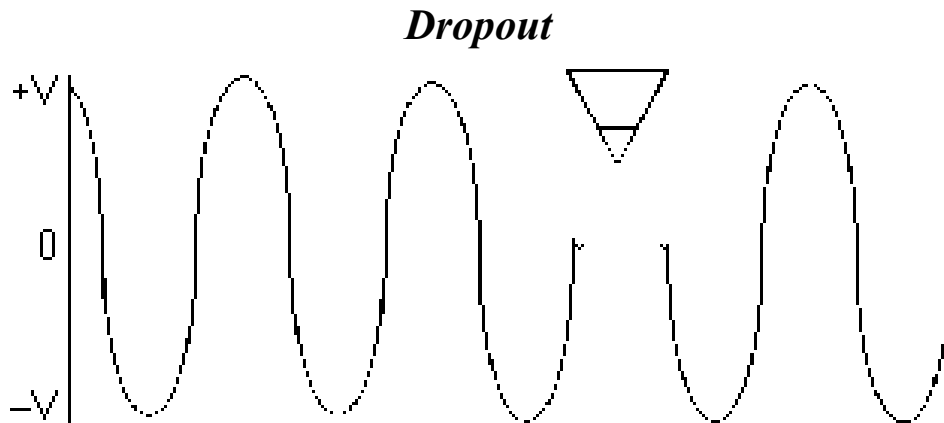


DROPOUT (NOTCH)

A condition where a portion of the sine wave has a lower than expected value or is missing entirely, usually for a portion of a cycle. These types of problems can be caused when large motors are started, Lightning arresters are employed (during a lightning hit), or when electrical equipment fails. Dropouts can lead to failures in computers and electronic equipment , reduced life of motors and flickering lights.

POWER FAILURE (BLACKOUT)

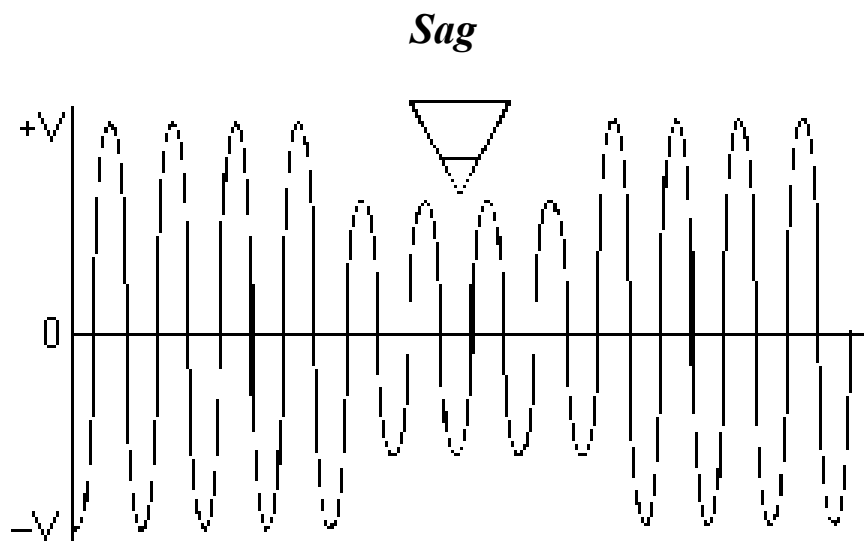
When the duration of a dropout exceeds 1 cycle it is usually referred to as a Power Failure, or Blackout. A blackout is a reduction in RMS (Root Mean Square) line voltage below 80 volts for several cycles or longer, often recognized as a complete power failure for varying lengths of time. System hang-ups, data erasures, and erroneous data transfers often result from this problem. This problem is also the easiest to observe.



SAG (UNDER-VOLTAGE, DIP, BROWNOUT)

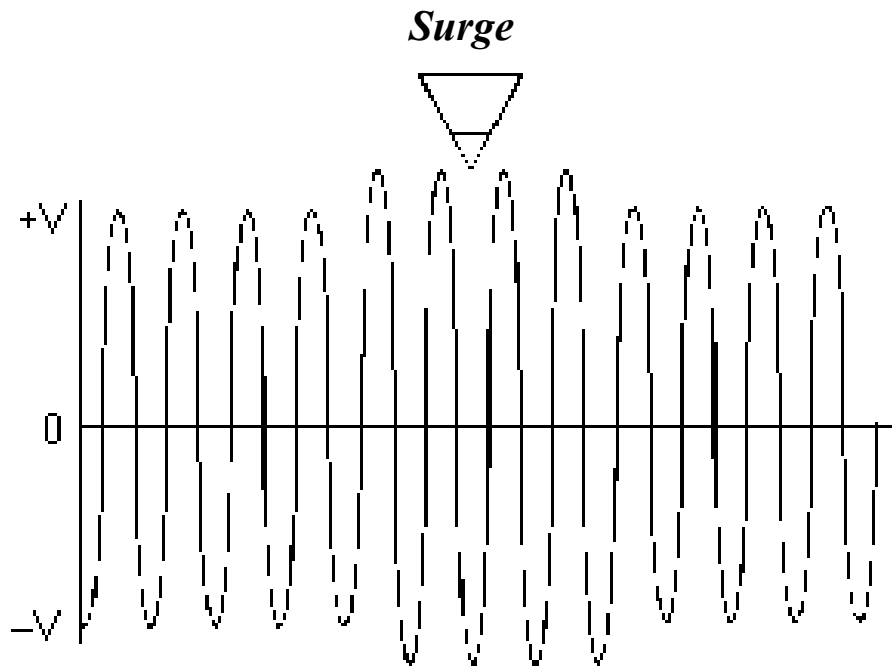
A power sag (or low line voltage) is a decrease in line voltage of at least 10% of the average line voltage for half a cycle or longer. The power sag is often caused by large inductive equipment (e.g. photocopy, postage equipment) being applied on the same AC line as is being tested. Sags can be caused by external factors as well, such as large power draining equipment used in other buildings. Sags can be particularly detrimental to electronic equipment because of the malfunctions caused by the sudden decrease of available voltage to the power supply. Complete failure rarely occurs, and often the equipment user continues to operate the device, unaware of the potential logic circuit problems that may have occurred.

A **Brownout** is a common example of a sag. Due to ever increasing demands for energy, brownouts are often intentionally caused by electric utilities as a method of conserving energy. Brownouts decrease the margin of voltage available to protect equipment from the effects of power sags.



SURGE (SWELL, OVER-VOLTAGE)

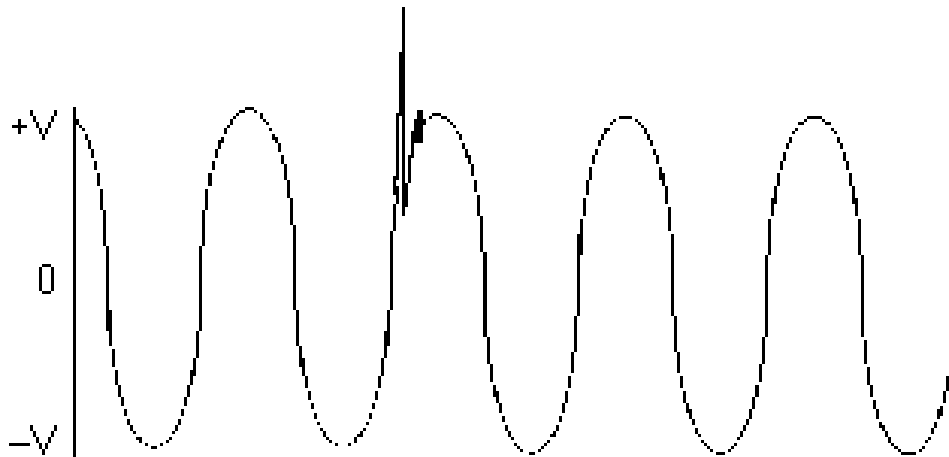
A power surge is the opposite of a sag and is often referred to as "High Line Voltage". A surge is defined as an increase in line voltage above 128 volts (on a 115V Line) for a half cycle or longer. Like the sag, the power surge is often caused by large inductive loads being applied on the same line. Power surges cause some of the most dangerous occurrences, and their results are the most difficult to correct.



IMPULSE (SPIKE, SURGE)

The impulse is a surge of energy superimposed on the AC line, usually with a relatively short duration. Impulses can potentially have the most serious effects on electronic equipment due to their high energy content, and the Integrated Circuits inability to absorb the energy. Many events can cause impulses, such as lightning strikes, utility grid switching, switching inductive loads on and off, and SCR (Silicon Control Rectifier) dimmers. Although properly designed equipment has some built-in impulse protection, repeated hits by high energy impulses can eventually render these components useless.

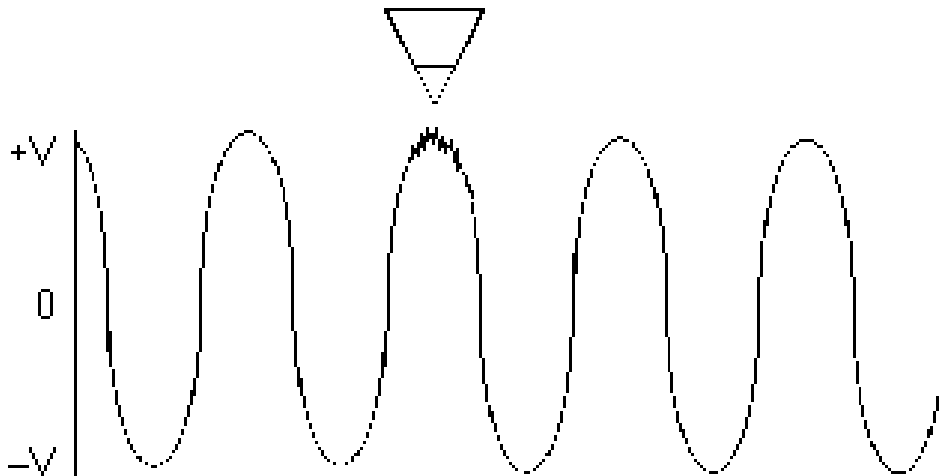
Impulse



HIGH FREQUENCY NOISE

High frequency noise can be caused by electronic equipment feeding internal noise back onto the power line, or logic induced noise from switching power supplies. This noise is transferred to the AC line causing disturbances greater than 2V peak-to-peak superimposed on the AC sine wave (normal mode noise). This noise can cause internal component degradation and eventual system failure. During this degradation period; system lockups, resets, and data transfer errors may increase.

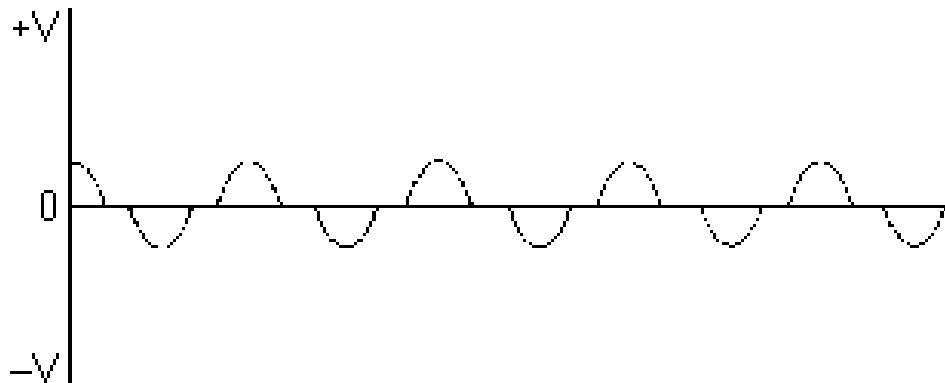
High Frequency Noise



COMMON MODE NOISE

In single phase power systems, as found in many countries such as the USA, the load (computer or equipment) is connected between the Hot and Neutral lines. Usually the Neutral line is connected to Earth Ground at the service entrance, so that in effect the neutral line should have 0 volts at the load. However, at a typical site, voltage is induced onto the neutral line by other equipment. This voltage can appear in the form of impulses, or a continuous pseudo sine wave.

Common Mode Noise



Power Conditioning And Power Protection Equipment

PowerTronics has created numerous products designed to provide accurate, informative analysis of your AC power. As a result of such analysis you might discover that some sort of power conditioning and/or protective device may be necessary to extend the life of your electronic equipment and to save a lot of wasted time and money due to faulty power causing damage. This section is designed to introduce several power protection devices. In all cases, the user should contact a local power protection dealer before the purchase of any device.

The following is a brief overview of several different types of power protection devices.

- ◆ Switching Power Supplies
- ◆ Spike and Surge Protectors
- ◆ Power Line Filters
- ◆ Computer Grade Transformers
- ◆ Line Voltage Regulators
- ◆ Power Line Conditioners
- ◆ Uninterruptible Power Supplies (UPS)
- ◆ Standby Power Supplies (SPS)

SWITCHING POWER SUPPLIES

The most basic defense against power disturbances is located right in the power supplies of most electronic equipment. These power supplies act as filters, “cleaning” the incoming AC and sending it to the components as DC power. Even though these power supplies can remedy many of the small AC disturbances and protect your equipment to a small degree, they cannot begin to filter everything the AC line has to offer. Repeated hits of spikes and noise will break down the efficiency of the minimal built-in power protection.

SPIKE AND SURGE PROTECTORS

By far the least expensive types of power protection, spike and surge protectors (or “clippers”) act by cutting off voltage when it exceeds a certain level and sending this offending voltage away from the sensitive circuits of electronic equipment. This excess voltage is sent to devices called Metal-Oxide Varistors (MOVs) which take the voltages and convert it to heat which dissipates over time. Whereas these surge protectors are good for short-term use and are inexpensive (usually under \$50), the MOVs inside them degrade after a relatively short period of time due to repeated heating and cooling. Also, these protectors will function only as long as the voltage does not exceed the specifications of the components inside.

There are basically two types of spike and surge protectors: tracking and non-tracking. The difference between the two is that the tracking device will “clip” a spike to a certain limit anywhere on the sine wave whereas the non-tracking protector will clip a spike only when its magnitude reaches the clamping level, regardless of its position on the AC waveform. The tracking surge protector is the more expensive of the two.

POWER LINE FILTERS

Power line filters are designed to suppress spikes, surges, and noise before they get to the clipping level of common surge protectors. Instead of clamping the voltage when it exceeds the cutoff, the power line filter limits noise and spikes to a safe level by slowing down the rate of change of these problems, thereby keeping electronic systems safer than the surge protectors can. Of course, these filters are more expensive.

COMPUTER GRADE TRANSFORMERS

These power protecting devices are multiple shielded transformers whose job is to suppress spikes and common mode noise. Although this seems much like power line filters, they are different in that they isolate primary and secondary AC, thereby establishing a safe and reliable ground for the electronic device they are protecting. Computer Grade Transformers are ideal for use when grounding is a problem because of an industrial environment.

LINE VOLTAGE REGULATORS

Voltage regulators maintain voltage to within a very narrow tolerance regardless of how much the AC line varies in terms of voltage. While these regulators offer some surge protection, they do not provide good isolation like computer grade transformers.

POWER LINE CONDITIONERS

These are excellent power protection devices as they are essentially a combination of computer grade transformers and line voltage regulators. They provide spike, sag, surge, and noise suppression while isolating the AC lines and providing an excellent system grounding point.

UNINTERRUPTIBLE POWER SUPPLIES (UPS)

These are the most complete power protection devices available. They operate by providing continuous, uninterrupted AC power from an isolated, regulated source regardless of the quality of the primary AC line. These power supplies are constantly supplying the system with clean AC power. Small UPSs contain built-in batteries which supply the system with DC power when a complete power failure occurs. Larger units use an external battery allowing for orderly shutdown of all systems during a power failure, or for activating backup generators. All UPSs provide very significant protection against all power problems, the better models approaching absolute protection.

STANDBY POWER SUPPLIES (SPS)

These units differ from Uninterruptible Power Supplies in that the AC power is connected through a power line filter to the computer system. The SPS only begins to supply the computer with clean AC power when it senses a voltage interruption. At this time it activates an outside AC source and transfers its output to it. These SPSs are less expensive than UPSs, however, for most small systems they can still be used in place of a UPS and still gain the same benefits. The reason for this is that it takes only a few milliseconds for an SPS to switch to the alternate AC source, and most small systems do not notice this short gap without power.

PowerTronics

Power Quality & Environmental Monitors

Your Solution to Power Problems!

When it comes to Power Quality, You Need Answers ...

With our equipment, you can get them!

Since 1988, PowerTronics has been manufacturing tools to help identify and solve power quality related problems. A wide range of power line monitors and data loggers are available directly from our PowerTronics website store or from our distributors and catalogs. The following pages provide an overview of the available PowerTronics Devices for monitoring Power Quality and Environmental Conditions.

For the very latest information, visit our website at:

<http://www.PowerTronics.com>



We support you, our customer, with on-line and telephone technical support. You can email your reports to us and one of our service engineers will look at it and help you determine what your power problems are.

You can reach us via email, phone, fax and mail. We want to be your partner in problem solving! For questions or concerns, please email us at info@PowerTronics.com or call us toll-free at 1-800-746-9586. We are there for you!