

Model PST 100

by PowerTronics

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PUBLICATION HISTORY

Date	Notes
9-98	Preliminary Publication (PST 100 first release)

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

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SAFETY NOTICE

Do not use the PST 100 when powered from an ungrounded outlet.

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

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18 MONTH WARRANTY

Eastern Time Designs, Inc. (PowerTronics) warrants to the original retail purchaser that each PST 100 SERIES Power line analyzer sold by PowerTronics or any other authorized representatives is free from defects in material and workmanship for 18 MONTHS from 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 options, 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.

Before returning a product for repair, the customer must call Eastern Time Designs, Inc. (PowerTronics) Customer Service at (603)483-5876 for RMA return authorization number. This number should be included with the customer's mailing address and telephone number when the product is returned. Products should be returned to:

PowerTronics RMA #
Attention : CUSTOMER SERVICE DEPARTMENT,
143 Raymond Road
Candia, NH 03034.

During the first 18 months after the date of purchase, all labor and materials will be provided without charge. There shall 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, Inc. assumes no liability as a consequence of such events under the terms of this warranty. Some states do not the exclusion of implied warranties, so the above exclusion may not apply to you. This warranty gives you specific legal rights and may also have other rights which vary from state to state.

INTRODUCTION

This reference guide is designed to aid PST 100 users in the operation and interpretation of the results of the PST100 AC voltage disturbance recorder and voltage logger for a single phase power.

The PST 100 monitor is made in the U.S.A. by PowerTronics. This unit will detect a wide range of power disturbances including sags, surges, impulses, dropouts, power failure, high frequency noise, live voltage, and frequency.

The PST 100 is one of a series of practical power line monitors, designed and priced to be outfitted to everyone who services or installs single phase electrical, and electronic equipment.

Electrical equipment is damaged more often by power disturbances than by fire, theft, and vandalism combined. Intermittent power problems are the most expensive hidden expense to the owners of microprocessor based equipment..

The PST 100 is easy to use and provides immediate and long term information for the technician and customer to understand power line disturbances.

To monitor and test the single phase AC line with the PST 100, plug the unit into any grounded outlet. When testing prior to installing new equipment, test the outlet that the equipment will be running on for at least 3 days. When trying to identify power quality for existing equipment, plug the PST 100 into the outlet beside the one the equipment is plugged into. Once connected, the PST 100 will start to record the line voltage on the Hot and Neutral lines, and any power disturbances that occur. After the test period is complete, connect the PST 100 to your PC computer, and download the data for analysis.

CALIBRATION

The PST 100 monitors 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 calibration. The procedure typically takes seven days and will be provided upon request for a nominal fee. Mention CALIBRATION PROCEDURE when calling for a RAM number.

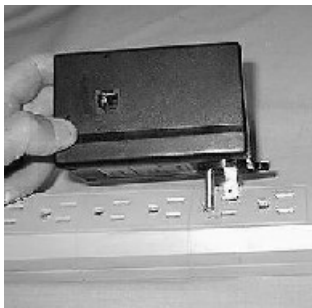
Single Phase AC Voltage Disturbance Recorder and Voltage Logger

- User-friendly
- No Programming-the unit is pre-set to factory settings
- Prove Power problems exist
- Reduce Down-time
- Reduce service calls
- Perform Pre-site testing

In today's competitive business world, pre-installation testing is often overlooked. Wiring and power problems cause expensive repeat technical calls and lost customer confidence. The PST 100 is economical as a technicians trouble-shooting tool, or a permanent monitor at critical sites. By using the data collected from the PST 100, the CIO or the technician can correlate network and system problems to short term disturbances, or long term trends. One can also document and verify that the site is in or out of compliance for issues of warranty repair.

The PST 100 can monitor for very fast voltage transients (micro-second) and very long term voltage changes. The unit is a very compact design, approximately 2 by 3 inches, that plugs into the wall outlet communications through a standard serial port.

Disturbance events from the PST 100 are easy to understand and interpret. Each event is spelled out in plain English with its own time and date stamp. With a few keystrokes the user can plot or graph the disturbance on an x/y chart for easy display and reporting to others.

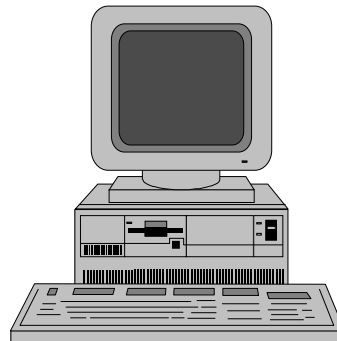


Features

- ◆ Measures all kinds of disturbances on each input
 - * Sags
 - * Surges
 - * Impulses
 - * Dropouts
 - * Common Mode Noise
 - * High Frequency Noise
 - * Power Failure
 - * High Frequency Noise
 - * Line voltage & frequency
 - * AC Voltage
- ◆ Simple to operate:
 - 1) Plug unit into any grounded outlet, preferably next to the equipment that is having the problems or next to the server.
 - 2) Periodically connect to a computer for reports.
 - 3) Once connected, the unit will start to record according to factory default parameters.
- ◆ The PST monitors independently
 - The PST will record events at a stand-alone recorder.
 - The unit can record events unattended.
- ◆ Stores events in non-volatile RAM
 - 1500 Event Storage per input (Hot and Neutral)
 - 3,000 Events in all
 - Stores the voltage every minute for up to 4 days per channel.

The PST time and date stamps power disturbances so the user can correlate power problems to system problems.

The PST 100 Power Line Analyzer provides a complete analysis of your AC power for a fraction of the cost of other Monitors.



Testing Voltage with the PST 100

The PST 100 Single phase Voltage Power Quality Recorders are designed to obtain the maximum amount of useful data from the circuit under test, while requiring the minimum amount of setup time.

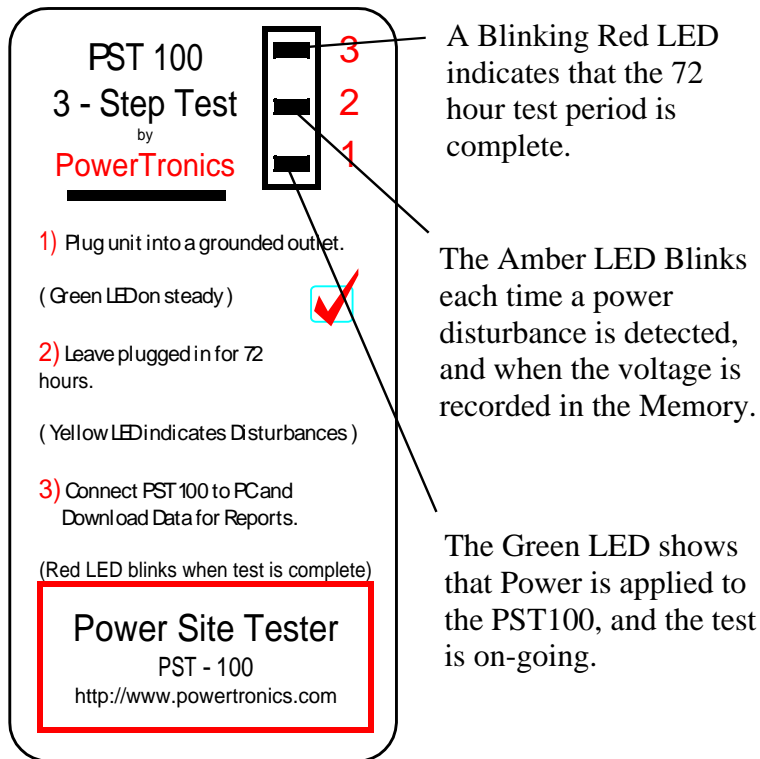
Data from the HOT and the Neutral line starts being collected as soon as power is applied to the AC power connector located on the back of the unit. Data will continue to be gathered until the unit is unplugged.

Long term voltage testing is known as Data Logging. The PST 100 samples the voltage on each of the 2 inputs continuously, and stores the average once each minute. There is enough data storage capacity in the unit to collect these readings on both Hot and Neutral for 11 days.

The PST 100 will continuously test the Hot and Neutral inputs for Sags, Surges, Power Failures, Dropouts, Impulses, High Frequency Noise, Line Frequency, and Phase changes. Any power quality problems that exceed the preset thresholds will be recorded in battery backed RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect up to 1500 of these readings on each channel.

As soon as the PST 100 is plugged into the outlet to be tested, it begins to acquire and save the the voltage properties of the Hot and Neutral Line. The time, date and type of all disturbances are recorded in RAM, as well as a datalog of the voltage each minute.

After the 72 hour test, connect to a PC to download the data, and interpret the results.



PST 100 Front Panel

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Connecting to the PST 100

DIRECT:

The serial port connector on the side of the PST 100 is a 6 pin RJ11 style RS232. the pinout is as follows:

Pin 2	Receive Data
Pin 3	Transmit Data
Pin 5	Ground

To establish a connection with this port and a PC, a Null modem cable must be used (as shipped from the factory with the unit). This type of cable connects the Transmit Data pin on the PC to the Receive Data pin on the PST 100, and the Transmit Data pin on the PST 100 to the Receive Data pin on the PC. It also connects the Ground pins together.

The PST 100 is configured to operate at 19,200 baud, with 8 data bits, 1 stop bit, and no parity checking.

MODEM:

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

Power the PST 100 and the Modem up at the same time after connecting the cable, and the PST 100 will auto configure the Hayes compatible Modem for auto answer mode, at 19,200 baud. If the modem is not Hayes compatible, configure it to answer the phone on 2 rings, with a Baud rate of 19,200, 8 data bits, 1 stop bit, and no parity checking.

Commands:

The PST 100 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.

The commands are as follows:

```
C 0 - Display this Command List
C 1 - Display the 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 - Set the Time and Date
C X - Hang up
```

After the PST 100 has completed the task initiated by the operator command, it returns on-line to it's monitoring duties. Each of the commands is detailed in the following pages.

C1 - Transmit the 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 PST 100 will respond with:

```
PowerTronics, PST 100
Version, 1.1
2 Channels
Hot, 2, Volts, V, 250, 0, Frequency, Hz, 70, 40
Neut, 1, Volts, V, 250, 0
END C1
```

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.

C2 - Transmit a Summary Report:

Transmit or type: **C2**

The PST 100 will respond by transmitting a report that is a count of all the disturbances detected since the unit was put on-line, and the RAM was cleared:

PowerTronics PQR D50 V1.7 - Summary Report as of Oct/13/98

Hot Line, Impulse, 25V, 2
Neutral, Impulse, 10V, 1
Neutral, Impulse, 5V, 4
Hot Line, Power Fail,, 1
Hot Line, Sag, 10%, 1

Each event type is described by the Channel Number, Event Type, Magnitude, and Quantity of that disturbance.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report.

C3 - Transmit a Detail Report:

Transmit or type: **C3**

The PST 100 will respond by transmitting the Detail Report of all disturbances saved since the unit was put on-line, and the RAM was cleared:

PowerTronics PQR D50 V1.7 - Detail Report as of Oct/13/98

Oct/10/98, 03:50:58, Neutral, Impulse, 5V, 200 Degrees
Oct/10/98, 09:00:58, Neutral, Impulse, 5V, 120 Degrees
Oct/11/98, 08:13:42, Hot Line, Impulse, 25V, 330 Degrees
Oct/11/98, 08:59:14, Hot Line, Impulse, 25V, 184 Degrees
Oct/11/98, 15:56:25, Neutral, Impulse, 5V, 200 Degrees
Oct/12/98, 09:30:33, Neutral, Impulse, 10V, 220 Degrees
Oct/12/98, 11:48:09, Neutral, Impulse, 5V, 302 Degrees
Oct/12/98, 16:22:27, Hot Line, Sag, 10%,
Oct/13/98, 10:23:50, Hot Line, Power Fail,,

Each event is described by the Time, Date, Channel Number, Event Type, and Magnitude of that disturbance.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report.

Typing the Space bar will Pause or re-start the report.

C4 - Transmit a Data Log Report:Transmit or type: **C4**

The PST 100 will respond by transmitting the Listing of the voltages measured on all input channels each minute since the unit was put on-line, and the RAM was cleared:

PowerTronics PQR D50 V1.7 - Data Log Report as of Oct/13/98

```
Oct/10/98, 13:44:00, Hot,118V, Neut,1V,  
Oct/10/98, 13:45:00, Hot,118V, Neut,0V,  
Oct/10/98, 13:46:00, Hot,118V, Neut,0V,  
Oct/10/98, 13:47:00, Hot,118V, Neut,0V,  
Oct/10/98, 13:48:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:49:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:50:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:51:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:52:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:53:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:54:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:55:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:56:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:57:00, Hot,118V, Neut,0V,  
Oct/10/98, 13:58:00, Hot,120V, Neut,0V,  
Oct/10/98, 13:59:00, Hot,120V, Neut,0V,  
Oct/10/98, 14:00:00, Hot,120V, Neut,0V,  
Oct/10/98, 14:01:00, Hot,120V, Neut,0V,  
Oct/10/98, 14:02:00, Hot,120V, Neut,0V,  
Oct/10/98, 14:03:00, Hot,120V, Neut,0V,  
Oct/10/98, 14:04:00, Hot,120V, Neut,0V,  
Oct/10/98, 14:05:00, Hot,118V, Neut,0V,  
Oct/10/98, 14:06:00, Hot,120V, Neut,0V,
```

Each line of the transmission has the Time and Date that the data was recorded, and the sample of the average reading summed for one minute.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report.

Typing the Space bar will Pause or re-start the report.

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 Battery backed RAM. The summary report quantities will be reset to zero, and the Data Logging will start tracking voltage again.

Transmit or type: **C5**

The PST 100 will respond by transmitting the following message

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

To clear the data, answer this question with a **CAPITAL Y**

The unit will then test and clear all internal RAM.
The following text will be transmitted during the RAM clear operation.

```
Are You Sure you want to CLEAR ALL DATA on this board ? Y
Testing RAM |-----| - Ram test Passed
Clearing Ram ..... Done
```



C6 - Set the Date and Time:

This Command allows the operator to change the Time and Date setting inside the PST 100.

Transmit or type: **C6**

The PST 100 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, Feb = 02, Mar = 03, Apr = 04, May = 05, Jun = 06, Jul = 07, Aug = 08, Sep = 09, Oct = 10, Nov = 11, Dec = 12
DD = Day	1st = 01, ... 31st = 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.

CX - Hang up the phone:

This Command allows the operator to disconnect the signal from a phone line on a Modem attached to the PST 100.

Transmit or type: **CX**

The PST 100 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.

PST 100 (Power Site Tester)

Specifications

The PST power tester is designed as a plug-in power monitor to record power disturbances on 110 Volt outlets.

Mechanical Specifications:

Weight: 1 pound

Size: 2.3" wide x 4.5" deep, x 2.7" high

Operating Specifications:

Temperature: 0 - 50 degrees C

Humidity: 10% to 80% (non condensing)

AC Voltage : 90 - 135 volts AC

Current : 0.1 amp

Line Frequency: 40 Hz - 400 Hz

Interface Specifications:

3 LEDs on the front panel indicate:

green - Test is on-going

yellow - An event has been detected

red - Test is completed

Serial Port

9600 Baud, No Parity, 1 Stop bit, 8 Data bits

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Data Specifications:

Data Logging

72 hours of data - RMS Voltage on Hot, and Neutral

Time, Date and amplitude of the first 256 of all event types

Voltage Specifications:

Power Failure:

Threshold: Less than 10V RMS

Duration: Longer than 80ms

High Frequency Noise:

Range: 2 volts peak:, 10 kHz - 10 MHz

Accuracy: +/- 10%

Response time: 1 milli second

RMS Line voltage:

Normal Range: 107V RMS to 125V

High Range: Greater than 125V

Low Range: Less than 107 V

Accuracy: +/- 1.5%

Impulses:

Range Hot Line: 20V to > 500 Vpeak

Resolution: thresholds at 20, 50, 100, and 500V

Range Neutral Line: 1V to > 50 Vpeak

Resolution: thresholds at 1, 5, 10, and 50V

Pulse detection: 1 micro seconds

Accuracy: +/- 10%

Sags:

Threshold: Less than 95 Vrms

Duration limits: Longer than 100 milliseconds

Accuracy: +/- 1.5%

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Surges:

Threshold: Greater than 135 Vrms
Duration limits: 1 cycle or 20 milliseconds
Accuracy: +/- 1.5%

Dropouts:

Threshold: Less than 10V RMS
Duration limits: Longer than 8 ms, Shorter than 80ms

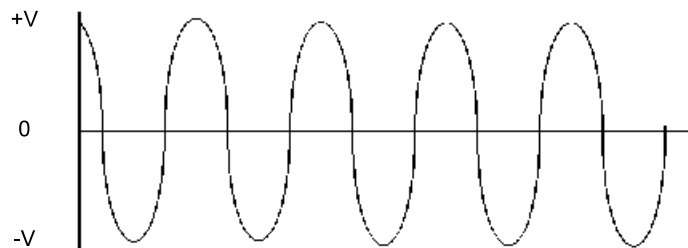
Types of Power Problems and what they look like.

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.

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
- ◆ Impulse
- ◆ Common Mode Noise
- ◆ Surge
- ◆ High Frequency Noise

Figure PT 1 Typical AC Waveform



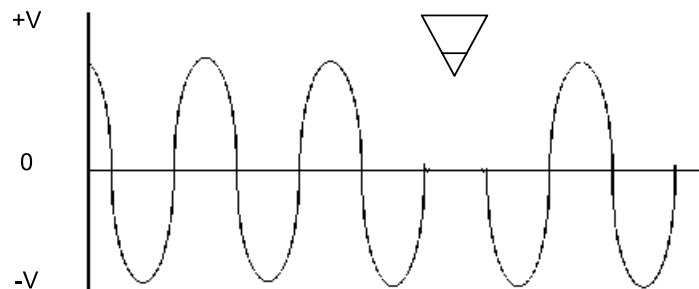
DROPOUT (NOTCH)

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

When the duration of a dropout exceeds 1 cycle it is usually referred to as a Power Failure, or Blackout. This problem is the easiest to observe.

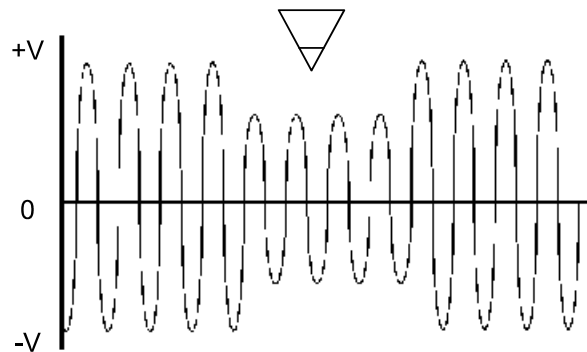
Figure PT 2 - Dropout



SAG **(UNDER-VOLTAGE, DIP, or 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.

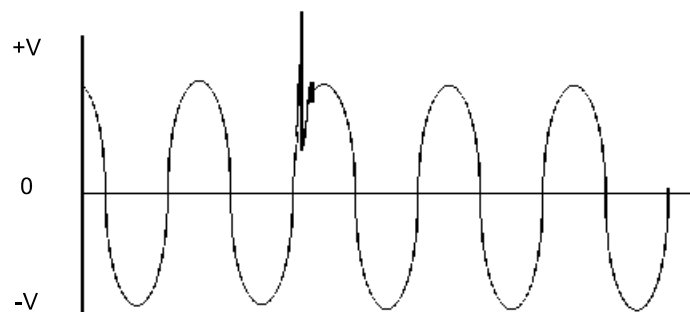
Figure PT 3 - Sag



IMPULSE (SPIKE, SURGE)

The spike is a surge of energy superimposed on the AC line, usually with a relatively short duration. Spikes 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 spikes, such as lightning bolts, utility grid switching, switching inductive loads on and off, and SCR (Silicon Control Rectifier) dimmers. Although properly designed equipment has some built-in spike protection, repeated hits by high energy spikes can eventually render these components useless.

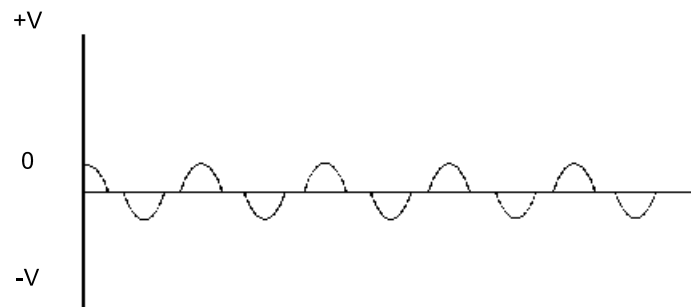
Figure PT 4 - Impulse



COMMON MODE NOISE

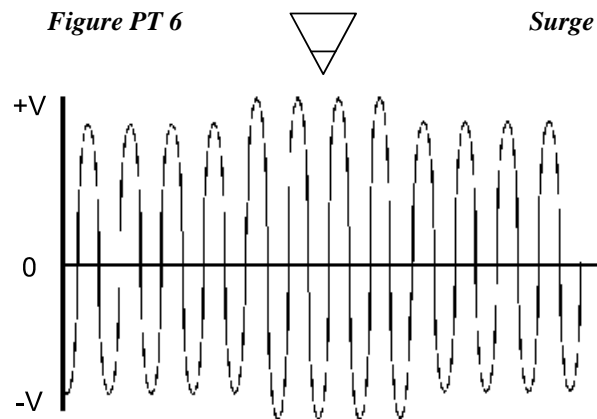
In single phase power systems, as found in many countries such as the USA, the load (computer or equipment) is connected between the hot and neutral line. Usually the neutral line is connected to earth ground at the service entrance, so that in effect the neutral line should have 0 volts at the load. 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.

Figure PT 5 - Common Mode Noise



SURGE **(SWELL OR OVER-VOLTAGE)**

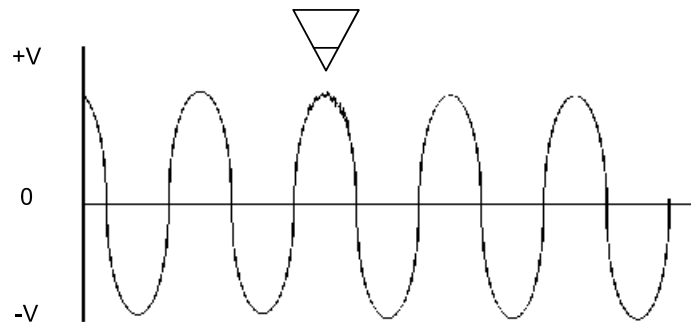
A power surge is the opposite of a sag and is often referred to as "High Line Voltage". A surge is defined as an increase in line voltage above 128 volts (on a 115V Line) for a half cycle or longer. Like the sag, the power surge is often caused by large inductive loads being applied on the same line.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



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 will increase.

Figure PT 7 - High Frequency Noise



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