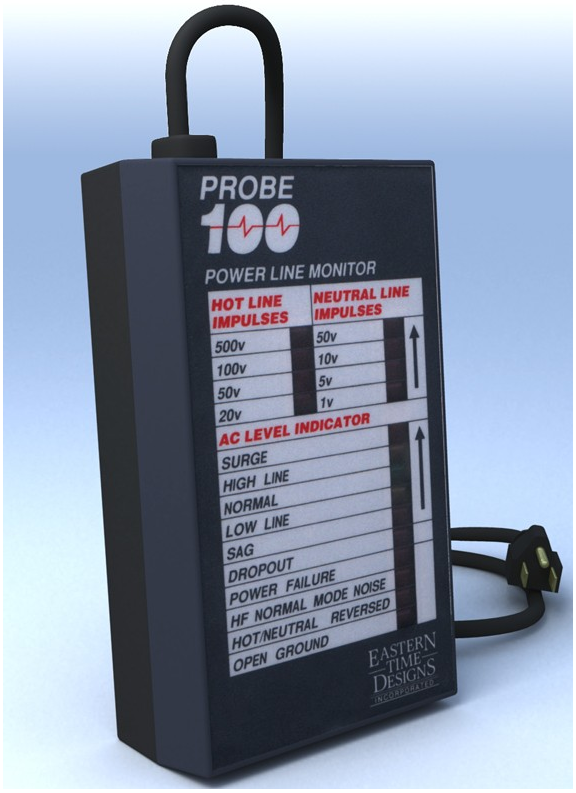
PowerTronics

Probe 100 + Datalogging



User's Manual

PowerTronics
143 Raymond Road
Candia, N.H. 03034

http://www.powertronics.com

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.

SAFETY NOTICE

The power cable attached to the device is supplied with a safety and reference ground. Do not use the Probe 100 Plus 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.

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18 MONTH WARRANTY

Eastern Time Designs, Inc. (PowerTronics) warrants to the original retail purchaser that each Probe 100 Plus Series Power Line Analyzer 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. (Powertronics) may replace the defective product with a new or re-manufactured functionally equivalent product of equal value.

To return a product for repair, ship the product and a note with a description of the problem, your return shipping address and contact information 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 (Powertronics) product or component thereof resulting from accident, abuse or misapplication of the product, and Eastern Time Designs (Powertronics) 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.

INTRODUCTION

This reference guide is designed to aid Probe 100 Plus users in the interpretation of AC power line problems.

The Probe 100 Plus monitor is made in the U.S.A. by PowerTronics. It is the first practical power line monitor designed and priced to be outfitted to everyone who services or installs electrical and electronic equipment. This unit incorporates the latest technology in surface mount assembled circuit boards to provide the user with information describing all types of power line disturbances. It will detect a wide range of disturbances including dropouts, sags, surges, impulses, high frequency noise, and common mode noise on a single phase power line. The Probe 100 Plus detects these disturbances and reports them via LEDs located on the front panel. If connected to a PC, the Probe will also output these events to the Probe Communications Software for analysis. Yet, weighing in at only one pound, this unit fits in the palm of your hand or conveniently in your tool box.

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 Probe 100 Plus 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. We believe that it 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 AC line with the Probe 100 Plus simply plug the unit into the grounded outlet to be tested. After running an internal self test, the Power Failure indicator will initially be blinking, informing the user that power has been restored. The unit also provides an immediate analyses of the integrity of the receptacle's wiring by indicating if a Hot/Neutral Reversed or Open Ground wiring problem exists.

The user is then able to diagnose the AC line through the High, Normal, and Low LED indicators and the serial voltage transmissions. Power line monitoring for disturbances is continuous and indicated by LEDs (that flash until the operator pushes the reset button) and broadcast transmissions via the serial port to the PC.

It is recommended that the unit test the power source for at least a 24 to 72 hour period.

CALIBRATION

The PowerTronics Probe 100 Plus Power Line 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 periodic calibration. The procedure typically takes three days and will be provided upon request for a nominal fee.

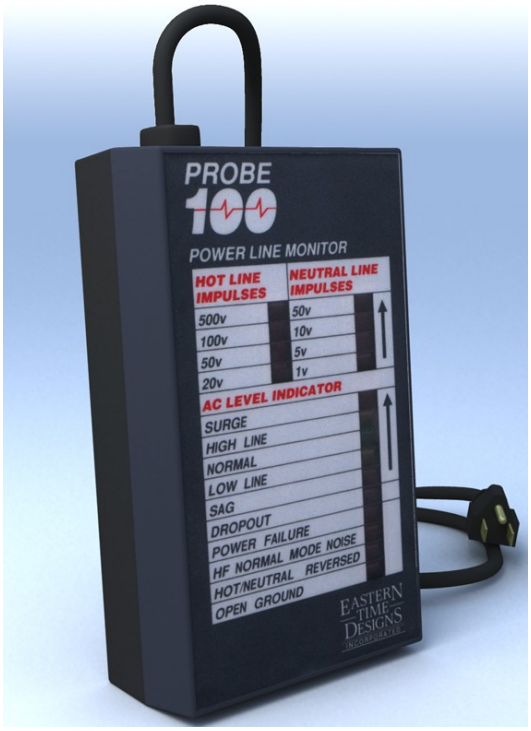
To request a calibration please go to the Powertronics.com web site and select the calibration option on the support page. After scheduling the calibration ship the Probe 100+ with a copy of the invoice to:

Powertronics
143 Raymond road
Attn: Calibrations
Candia, NH, 03034

MONITOR SINGLE PHASE POWER

FEATURES

- User-Friendly
- Light-weight & Inexpensive
- Fits easily in a Tool Box or your Hand
- Easy Power Line Analysis
- Serial Broadcast Communications
- Front Panel LED Display
- 50 or 60 Hz operation
- 115 AC RMS voltage measurement
- Fast Impulse Detection - 750 ns
- Stores events until reset
- Eighteen Month Warranty
- Made in the USA



Measures all types of Power Line Disturbances:

- Dropouts
- Power Failures
- Sags
- Surges
- Impulses
- High Frequency Noise
- Common Mode Noise

- Detects power problems quickly and economically

- Continuously monitors for high or low AC line voltage conditions

- Excellent for determining if an outlet is properly wired

OVERVIEW

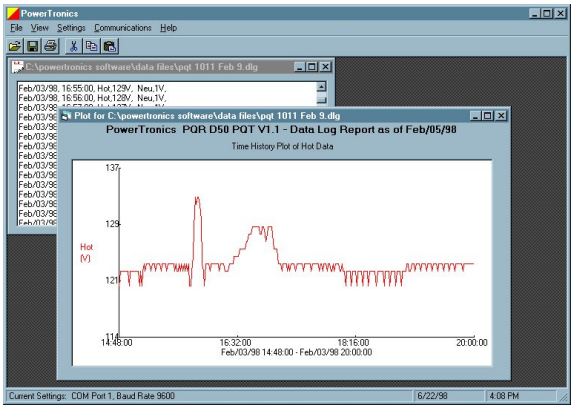
The Probe 100 Plus Power Line Analyzer provides a complete analysis of your AC Power for a fraction of the cost of other Monitors**.** It is useful in identifying the types of power disturbances on the line.

Voltage readings and disturbances on the AC line can be obtained from the data broadcasted on the unit's serial port. Alternately, the LEDs on the front panel can be used like a snapshot of the specific power problems on the line. If you are having a problem with a computer system or peripheral, the Probe can be plugged into the same circuit and left for a period of time. When a problem is experienced with the equipment, immediate checking of the Probe's LEDs will indicate the worst case power problem. The LEDs that are illuminated indicate the types of disturbances that may be affecting the equipment. If none of the LEDs are illuminated then the problem may be with the hardware.

The power to operate the unit comes from any standard 115 V AC outlet. Once plugged in, the Probe 100^{+} runs an internal test and then begins testing the Hot and Neutral lines for voltage faults and disturbances.

Communications Software Included!

Provided with the **Probe 100^{+}** is the **Probe Communications Software**. This software facilitates the accumulation of the AC line voltage and Disturbances as they are broadcast by the Probe 100^{+}. These can then be plotted or stored on the PC for future analysis. The software is capable of generating voltage **DATALOG** charts and disturbance **CHARTS** from the received data.



Simple to operate:

- Plug unit into the outlet
- Press and briefly hold the reset button
- Connect to PC for collection of Broadcast data

  or
- Periodically check the LEDs for disturbances

Serial Broadcast Transmissions to PC

- Line Voltage Readings once per second
- Power Line Disturbances as they occur

Easy to Understand Front Panel Display

- LEDs blink when an event is detected
- LEDs stay lit until reset by operator

Power Up Sequence

The Probe 100 Plus Power Line Monitor is designed to operate from a single phase 115 V AC power line. To begin testing your AC line:

1) Remove the Probe from its packaging

2) Plug the Probe into a grounded outlet. It will then automatically run internal diagnostics to confirm it's status is OK. While running these diagnostics, the LEDs will be cycled on and off several times.

   Notice that when this diagnostic test is completed the POWER FAILURE LED will be blinking. An unplugged Probe indicates this condition once plugged in.

   Impulse disturbances may also be latched. This is an indication of arcing as the unit is plugged in and is not a true representation of an impulse condition. The Probe must be reset before impulses and other events can be properly captured.

3) Press and hold the reset button located at the top right corner of the Probe. This will cause all of the LEDs to flash. Release when all LEDs have turned off. Performing this operation will clear all of the latched fault conditions, leaving the Probe monitoring the AC line. The only LED remaining on will be the one indicating the AC Voltage Level (one of the three AC Voltage Level Indicators: HIGH LINE, NORMAL, or LOW LINE).

4) Connect the Probe to a PC, running the PowerTronics Probe Communications Software, using the included PowerTronics Stereo Phone Communications Cable. This will allow voltage readings (once per second) and disturbances (as they occur) to be received from the Probe. Note that this step is optional but will increase the usability of the data obtained from the unit.

5) Leave the Probe plugged into the outlet to be tested. The unit will latch on to the disturbance levels as indicated by the LEDs that stay lit at the front of the unit.

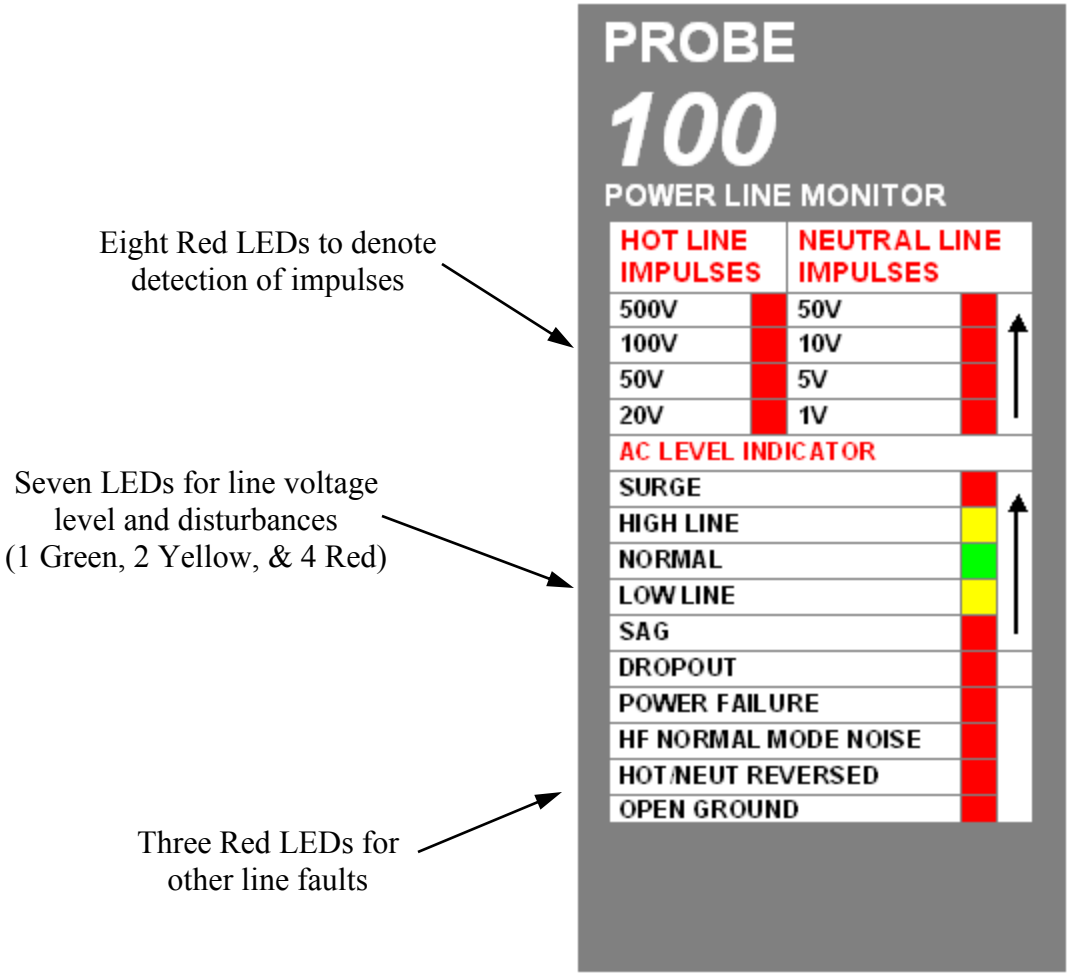
The recommended testing time is 24 to 72 hours in order to determine the suitability of an outlet for powering electronic equipment.

Interpreting the LEDs

Located on the front panel of the Probe 100 Plus are 18 LEDs. This front panel display is used to denote the status of the AC power line test under progress and is used as the primary means of analysis. This line status includes both the present power line voltage level and any disturbances detected since the Probe was last reset. The Probe's front panel is shown below with the appropriate LED locations and labeling.

The LEDs on the Probe "latch" in the ON position when the device receives a disturbance. They will generally remain thus until the Probe is powered down or reset by the user.

The purposes of these LEDs are as follows:



The full meanings of these LEDs is discussed in the following pages

Line Impulse Indicators

At the top of the Probe 100^{+} Front Panel are located two columns of four Red LEDs each. These are used to denote the occurrence of impulses on the Hot and Neutral lines for the left and right columns respectively.

The Probe 100^{+} will latch impulses on both the Hot and Neutral lines. The Probe uses a sine wave tracking design to capture all impulses as measured from their location on the AC sine wave, thereby affording the user with a highly accurate impulse magnitude measurement. Note that only the highest impulse for each line will be maintained on the Probe's LEDs. (For the recording of all impulses over a period of time it is necessary to use the Probe Communications Software on an appropriately connected PC.)

The values of the impulses are labeled next to each LED. They are 20, 50, 100, and 500 V for the Hot Line and 1, 5, 10, 50 V for the Neutral Line. Note that these values are threshold values. If the 20 V LED for the Hot Line is lit, it means that an impulse of greater than 20 V (but less than 50 V) was detected.

An LED will commence blinking, when an impulse of that specific magnitude is detected on the corresponding line, and become 'latched' in the ON position. This will continue until a larger impulse occurs (in which case a higher level LED will commence blinking), the unit is powered down, or the user resets the device via the reset switch located at the top of the Probe.

AC Voltage Level Indicators

The AC Voltage Level Indicators on the Probe 100^{+} are used to indicate the RMS Line Voltage measured from Phase (Hot) to Ground. There are one green and two yellow LEDs for this purpose. Their meanings are outlined below in the order they appear on the Probe 100^{+} Front Panel. Note that the unit, in continuously monitoring the AC line voltage, will adjust which Level Indicator is on. Thus the three LEDs will fluctuate accordingly with only one being on at a given time. Also, the LEDs do not become 'latched' on thereby providing the user with an accurate reading of the **current line voltage**.

HIGH LINE: **(Yellow LED)**

This LED indicates that the RMS line voltage is above the threshold of 125 volts.

NORMAL: **(Green LED)**

This LED indicates that the RMS line voltage is reading normal (between 107 and 125 volts).

LOW LINE: **(Yellow LED)**

This LED indicates that the RMS line voltage is below the threshold of 107 volts.

RMS (Root Mean Square) Line Voltage is the average line voltage as measured at the outlet. RMS is the standard, most commonly known reference for line voltage in the United States. Typically, a normal AC line voltage ranges from 107 volts to 125 volts RMS.

AC Voltage Disturbance Indicators

The AC Voltage Disturbance Indicators are used to indicate that a voltage level disturbance has occurred in the line voltage. These are different from the Voltage Level Indicators in that the Surge, Sag, Dropout, and Power Failure LEDs will latch and remain latched until the unit is reset by the user. These event are also classified as line disturbances as they fall outside of the acceptable operating range and may indicate a power line problem. Explanations of each are given below.

SURGE: **(Red LED)**

This LED latches sags during which the RMS line voltage falls below 107 V.

SAG: **(Red LED)**

This LED latches surges during which the RMS line voltage falls reaches 135 V or higher.

DROPOUT: **(Red LED)**

This LED latches a dropout when the AC RMS line voltage drops below 10 V for 8 ms (half a cycle).

POWER FAILURE: **(Red LED)**

This LED is lit when the AC RMS line voltage at the outlet being tested drops below 10 V for at least 80 ms.

Power Fault Indicators

The Power Fault Indicators inform the user of the presence of other faults or disturbances in the power line. An explanation of each of these is given below.

HF NORMAL MODE NOISE: (Red LED)

The High Frequency Noise LED becomes latched when there is noise superimposed on the AC Hot line and will remain thus until the unit is reset. To trigger the latching, the noise must have a magnitude of at least 2 volts peak-to-peak, and a frequency of 10 KHz to 10 MHz.

HOT/NEUTRAL REVERSED: (Red LED)

This LED is latched when the outlet being tested is reverse wired (the Neutral line exceeds the Hot line by at least 90 V). It will remain lit until such time as the unit is unplugged.

OPEN GROUND: (Red LED)

This LED turns on when the test outlet being used lacks a proper ground. It will remain lit until such time as the unit is unplugged or an appropriate ground connection is made.

Connecting to the Probe 100 Plus

In addition to the Front Panel LED Display, the Probe 100 Plus is equipped with a Serial Broadcast port for analyzing the Power Line. The Probe's Serial Broadcast port is designed for interface to a PC running the PowerTronics Probe Communications Software. This port connector on the side of the Probe is a 9 pin DB Serial Port connector.

A Serial Communications Cable must be used to establish the connection between this port and a PC. This type of cable connects the Receive Data pin on the PC to the Transmit pin of the Probe. It also connects the Ground pins together. Note that the PC end of the cable is a standard 9 pin DB style RS232 serial connector. This will interface with a typical PC COM port.

The Probe 100^{+} is configured to broadcast serial transmissions at 19,200 baud, with 8 data bits, 1 stop bit, and no parity checking. Voltage Readings are transmitted once every second while Disturbances are transmitted as they occur. The PowerTronics Probe Communications Software is designed to facilitate the collection and analysis of this data.

Voltage Specifications

RMS Line Voltage

- Range: 90 to 135 Volts RMS
- Accuracy: +/- 1.5%
- Response Time: 100 ms

Impulses

- Range Hot Line: 20 V to > 500 V peak
- Resolution: Thresholds at 20, 50, 100, and 500 V
- Range Neutral Line: 1 V to > 50 V peak
- Resolution: Thresholds at 1, 5, 10, and 50 V
- Accuracy: +/- 10%
- Pulse Detection: 1 µs

Sags

- Threshold: Less than 95 V RMS
- Duration Limits: Longer than 100 ms
- Accuracy: +/- 1.5%

Surges

- Threshold: Greater than 135 V RMS
- Duration Limits: Longer than 100 ms
- Accuracy: +/- 1.5%

Dropouts

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

Power Failure

- Threshold: Less than 10 V RMS
- Duration Limits: Longer than 80 ms

High Frequency Noise

- Range: 2 to 20 V peak, 10 KHz - 10 MHz
- Accuracy: +/- 10%
- Resolution: 2 V
- Response Time: 100 ms

Hot / Neutral Reversed

- Range: Neutral Line Voltage exceeds the Hot Line by at least 90 Volts
- Accuracy: +/- 1.5%

Open Ground

Detection: When AC is present on the Hot line and there is no connectivity on the Ground pin

RMS Line Indicators

- Normal Range: 107 V RMS to 125 V RMS
- Low Range: Less than 107 V RMS
- High Range: Greater than 125 V RMS
- Accuracy: +/- 1.5%
- Response Time: LEDs updated every 1/2 second

Mechanical Specifications

- Weight: 1 pound
- Size: 3.25 wide x 5.625 deep, x 1.5 high
- Power Cord: 6 feet

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: 45Hz - 70 Hz

Interface Specifications

Serial Connector

- Connector: DB9 - RS 232C (w/ cable included)
- Baud Rate: 19,200
- Protocol: 8 Data, 1 Stop, No Parity bits
- Type: Serial Broadcast
- Interval: Once per second (Line Voltage)
  On occurrence (Disturbance)

Status LEDs

- Line Voltage: 1 Green, 2 Yellow LEDs on front display
- Disturbances: 15 Red LEDs on front display

Types of Power Problems
and what they look like.

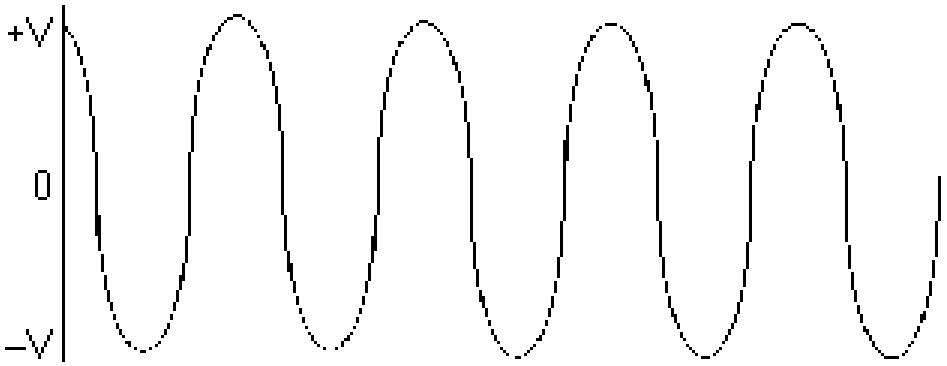
Over the recent decades, electronic components have been drastically reduced in size to produce increased speed and storage capacity. As a result of this decrease in size, these components have become many times more susceptible to AC power disturbances than similar devices of the past. PowerTronics 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

Figure PT 1 - Typical AC Waveform



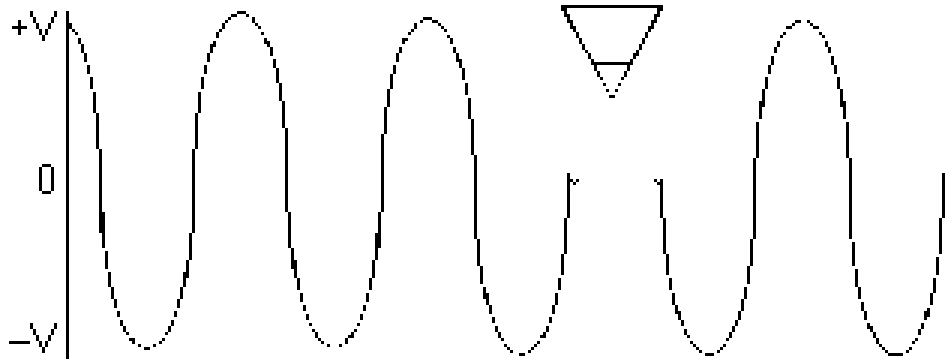
DROPOUT
(NOTCH)

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
(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.

Figure PT 2 - Dropout

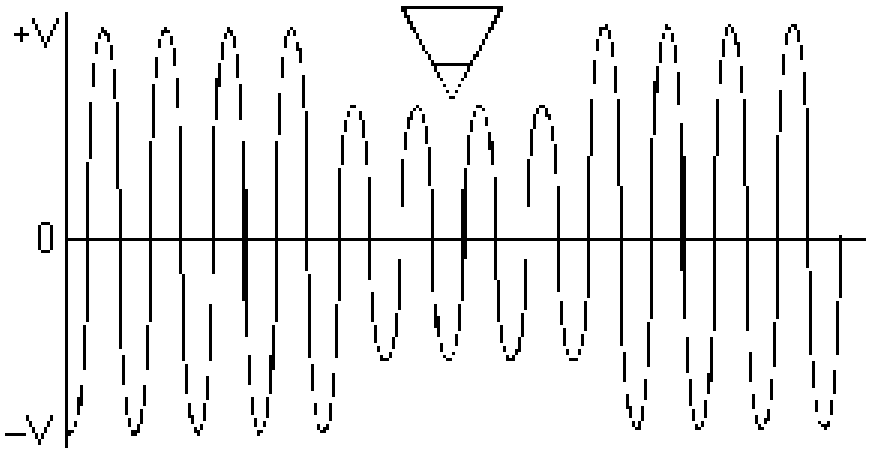


SAG
(UNDER-VOLTAGE, DIP, BROWNOUT)

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.

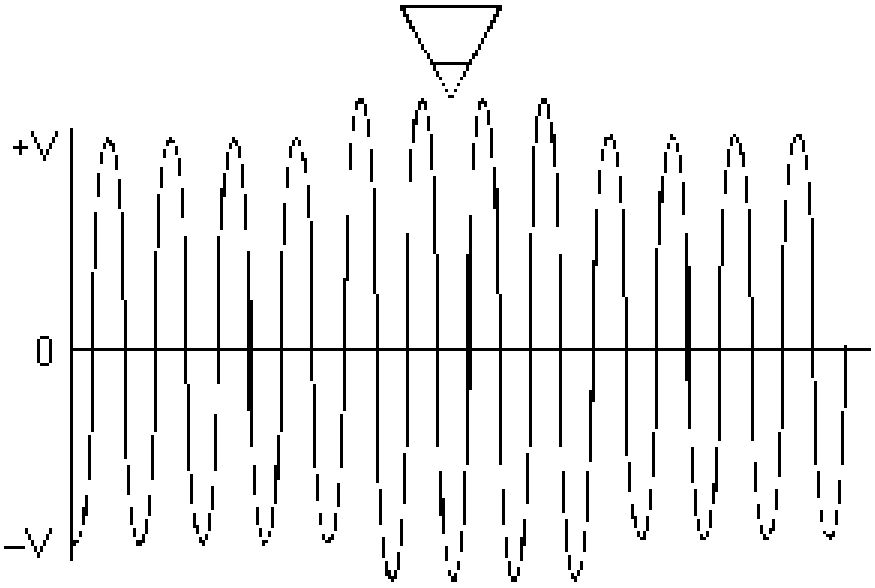
Figure PT 3 - Sag



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.

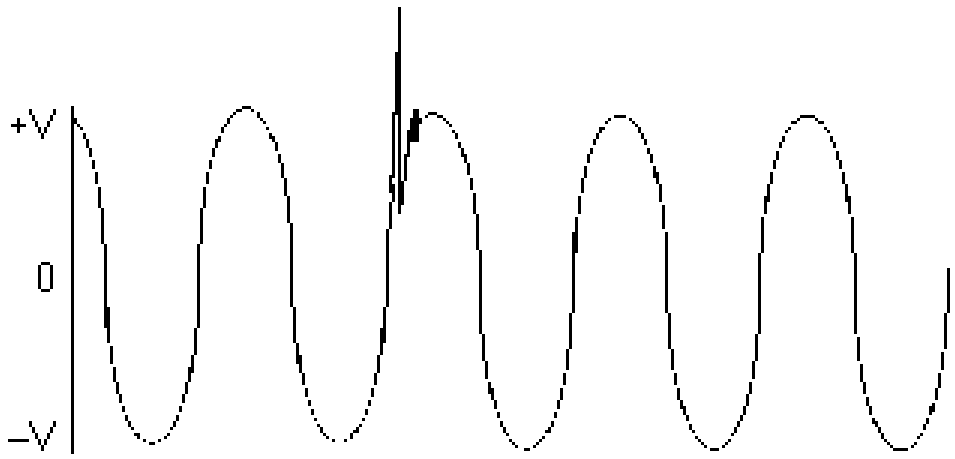
Figure PT 4 - Surge



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.

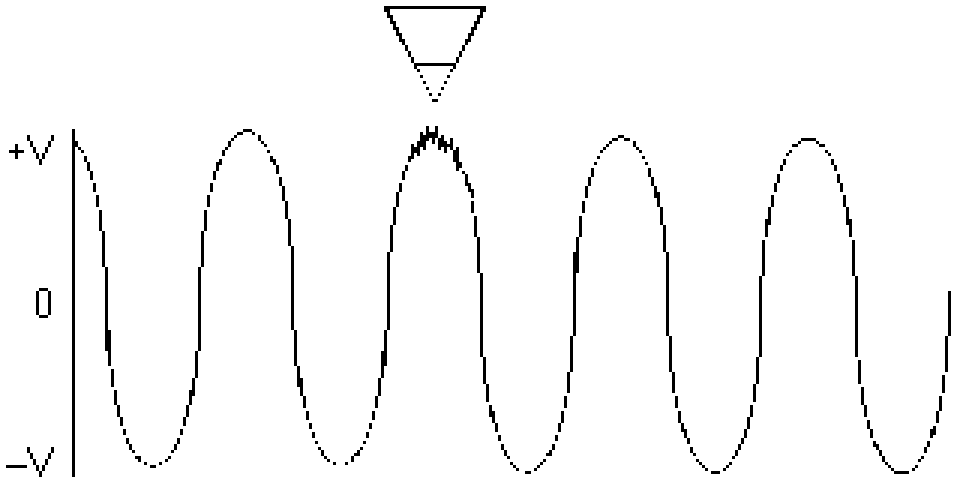
Figure PT 5 - Impulse



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.

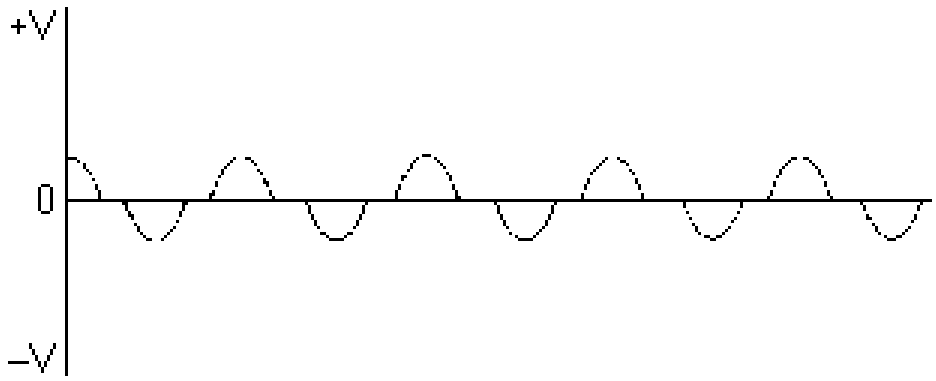
Figure PT 6 - High Frequency Noise



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.

Figure PT 7 - 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.