

PowerTronics

Probe Plus

User's Manual

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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 Probe 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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24 MONTH WARRANTY

Eastern Time Designs, Inc. (PowerTronics) warrants to the original retail purchaser that each Probe Plus Series Power line analyzer sold by PowerTronics or any authorized representative is free from defects in material and workmanship for 24 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 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.

Before returning a product for repair, the customer must call Eastern Time Designs, INC. (PowerTronics) Customer Service at (603) 483-5876 for a 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 Rd.
Candia, NH 03034.

During the first 24 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 24 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

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INTRODUCTION

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

The Probe Plus monitor is made in the U.S.A. by PowerTronics. This unit will detect a wide range of power disturbances including spikes, sags, surges, common mode noise, dropouts, and high frequency noise. Weighing in at only one pound, it fits in the palm of your hand or conveniently in your tool box.

The Probe Plus is the first practical power line monitor, designed and priced to be outfitted to everyone who services or installs electronic equipment.

Electronic 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 Probe Plus is easy to use and provides immediate and long term information for the technician and customer to understand power line disturbances.

To monitor the AC line with the Probe Plus simply plug the unit into the grounded outlet to be tested. After running an internal self test, the Power Failure indicator will be blinking. The unit provides an immediate analyses of the integrity of the receptacle's wiring by indicating if there exists a Hot/Neutral reversed wiring problem, or Open ground.

The user is then able to diagnose the AC line through the High, Low, and Normal LED Indicators. Power line monitoring for Sags and Surges is continuous, and is indicated by LED lights that light and stay lit until the operator pushes the reset button.

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CALIBRATION

The Probe Plus 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 3 days and will be provided upon request for a nominal fee.

Mention CALIBRATION PROCEDURE when calling for an RAM number.

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FEATURES

- ☞ User - Friendly
- ☞ Light weight & Inexpensive
- ☞ 50 or 60 Hz operation
- ☞ Voltage: 110 Rms AC
- ☞ Fast Impulse Detection: 750 Nano seconds
- ☞ Easy to Understand Display
 - LEDs blink when an event is detected
 - LEDs stay lit until reset by operator
- ☞ Twenty Four Month Warranty

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The Probe Plus has the following features:

PROBE 100	
<i>HOT LINE</i>	<i>NEUTRAL LINE</i>
<i>IMPLI SES</i>	<i>IMPLI SES</i>
500V	50V
100V	10V
50V	5V
20V	1V
AC LEVEL INDICATOR	
SURGE HIGH LINE NORMAL LOW LINE SAG DROPOUT POWER FAILURE HF NORMAL MODE NOISE HOT/NEUT REVERSED OPEN GROUND	

Impulses on the Hot and Neutral Lines:

The Probe Plus latches spikes on both the Hot and Neutral lines and measures them from their location on the sine wave, thereby affording the user with an accurate impulse reading.

AC Level Indicators:

Indicates the RMS LINE VOLTAGE measured from Phase to Ground.

RMS (Root Mean Square) LINE VOLTAGE is the average line voltage as measured at the outlet. This is the most commonly known reference for line voltage in the United States, with the normal

range of AC line voltage from 107 volts to 125 volts.

SURGE:

THE PROBE Plus latches surges on the AC RMS line which reach 135 volts and above.

HIGH LINE VOLTAGE: (Yellow LED)

On THE PROBE Plus, this LED indicates that the RMS line voltage is above the 125 volt threshold.

NORMAL LINE VOLTAGE: (Green LED)

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This indicator is lit when the RMS line voltage reads normal (between 107 and 125 volts)

LOW LINE VOLTAGE: (Yellow LED)

This LED is lit when the RMS line voltage falls below 107 volts.

SAG:

The Probe Plus latches sags on the AC line which fall below 95 volts.

DROPOUT:

The Probe Plus latches a dropout when the AC RMS line voltage drops below 10 volts for 8ms (half a cycle).

POWER FAILURE:

This Probe Plus LED is illuminated and latched when the RMS AC line voltage at the outlet being tested drops below 10 volts for at least 80 milliseconds.

HIGH FREQUENCY NOISE:

The Probe Plus latches the HF NOISE LED when there is noise superimposed on the AC hot line. The LED is lit when the noise has a magnitude of at least 2 volts peak to peak, and a frequency of 10 khz to 10 Mhz.

HOT/NEUTRAL REVERSED:

This LED is illuminated continuously when the outlet being tested is reverse wired. The LED will remain lit until such time as the unit is

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unplugged.

OPEN GROUND:

The Probe Plus latches this LED when the test outlet lacks proper ground. This LED will remain lit until such time as the unit is unplugged.

All IMPULSE, SAG, and SURGE LEDs will latch and remain lit until the unit is reset. The AC LEVEL INDICATOR (HIGH LINE, NORMAL, and LOW LINE) will continuously monitor the AC RMS line voltage and fluctuate accordingly, thereby giving the user an accurate information about the current line voltage.

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POWER UP PROCEDURE:

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

- 1) Remove the Probe Plus from it's packaging
- 2) Plug the Probe Plus into a grounded outlet. Upon plugging the Probe Plus in, it will 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. Once completed, the power failure LED will be blinking.
- 3) Press and Hold the Reset switch (located at the top of the unit) until all the LEDs turn off. This will clear all the latched fault conditions, leaving the Probe Plus monitoring the AC line. The only LEDs remaining on will be those indicating the AC Level. (HIGH LINE, NORMAL, or LOW LINE)
- 4) Leave the Probe Plus plugged into the outlet to be tested. The unit will latch on to the disturbance levels as indicated by the LEDs that stay lit on the front of the unit.

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

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Voltage Specifications

RMS Line voltage:

- ☞ Range: 90 to 135 volts rms
- ☞ Accuracy: +/- 1.5%
- ☞ Response time: 100 milli seconds

Impulses:

- ☞ Range Hot Line: 20V to > 500 V_{peak}
- ☞ Resolution: thresholds at 20, 50, 100, and 500V
- ☞ Range Neutral Line: 1V to > 50 V_{peak}
- ☞ Resolution: thresholds at 1, 5, 10, and 50V
- ☞ Accuracy: +/- 10%
- ☞ Pulse detection: 1 micro second

Sags:

- ☞ Threshold: Less than 95 V_{rms}
- ☞ Duration limits: Longer than 100 milliseconds
- ☞ Accuracy: +/- 1.5%

Surges:

- ☞ Threshold: Greater than 135 V_{rms}
- ☞ Duration limits: Longer than 100 milliseconds
- ☞ Accuracy: +/- 1.5%

Dropouts:

- ☞ Threshold: Less than 10V rms
- ☞ Duration limits: Longer than 8 ms, Shorter than 80ms

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Power Failure:

- ☞ Threshold: Less than 10V rms
- ☞ Duration limits: Longer than 80ms

High Frequency Noise:

- ☞ Range: 2 to 20 volts peak, 10 Khz - 10 Mhz
- ☞ Accuracy: +/- 10%
- ☞ Resolution: 2 volts
- ☞ Response time: 1 milli second

Hot / Neutral Reversed:

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

Open Ground:

- ☞ Detection: With AC on Hot line and no connectivity on the Ground pin

RMS Line Indicators:

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

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Mechanical Specifications

Weight:	1 pounds
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

Status LEDs:	18 Red LEDs on the front display
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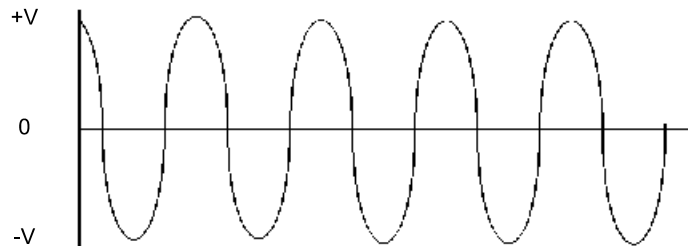
Types of Power Problems and what they look like.

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



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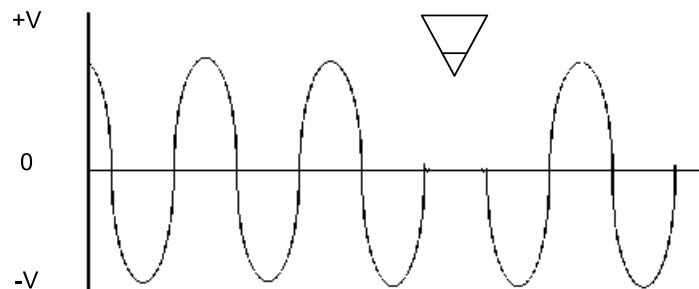
DROPOUT (NOTCH)

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

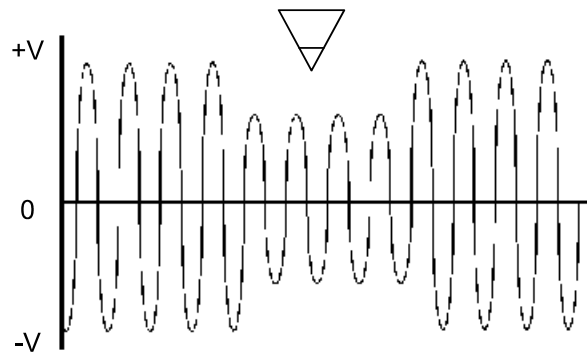


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SAG **(UNDER-VOLTAGE, DIP, or BROWNOUT)**

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

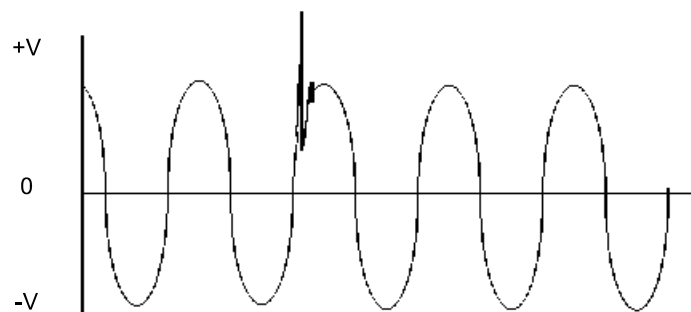


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IMPULSE (SPIKE, SURGE)

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

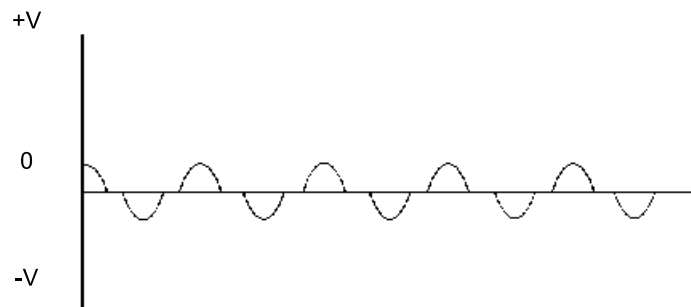


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COMMON MODE NOISE

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.

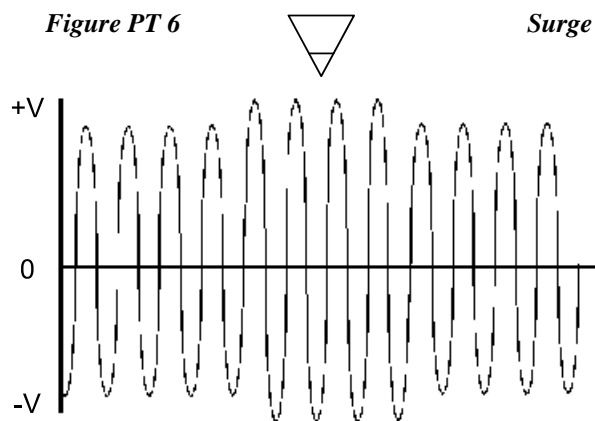
Figure PT 5 - Common Mode Noise



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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.



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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

