

ADVANCED STRAY VOLTAGE ANALYSIS

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Madison, Wisconsin

Developed by

University of Wisconsin
Biological Systems Engineering Dept.

Public Service Commission of Wisconsin

Wisconsin Department of Agriculture,
Trade and Consumer Protection

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Types of Isolators in use today

Ronk 11 volt unit and Ronk 22 volt unit

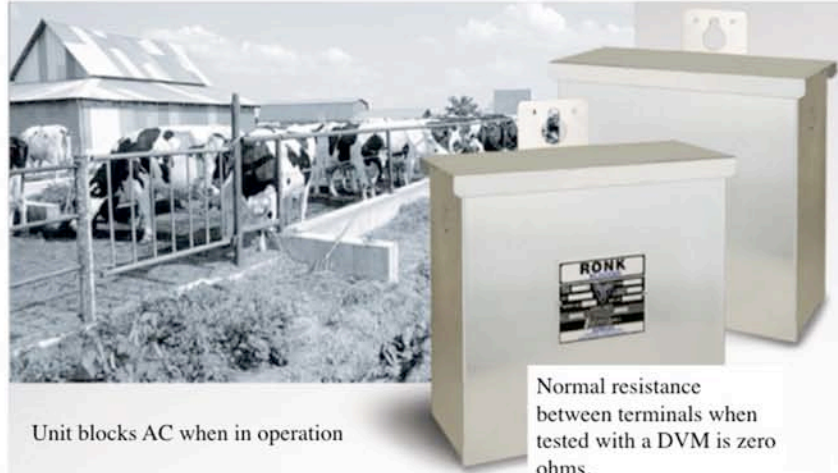
Dairyland Electrical Industries unit

Spark gap units or (lightning arresters)

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Ronk Blocker



Unit blocks AC when in operation

Available in 11 and 22 rms volt models

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Dairyland Electrical Industries

Unit reconnects at 28 vac rms
or about 40 volts peak

Normal resistance between terminals when
tested with a DVM is greater than 5,000 ohms

Unit blocks AC and DC when in operation



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Testing an Isolator

Per the manufacturer

This only tests the device, not the entire isolation system.

Field Testing

VT/NI's can readily be tested to verify operability using a standard DC ohmmeter:

If R (ohmmeter) > 5,000 ohms between terminals, the unit is likely functional.

If R (ohmmeter) < 1 ohm, unit is not functional, contact factory for repair.

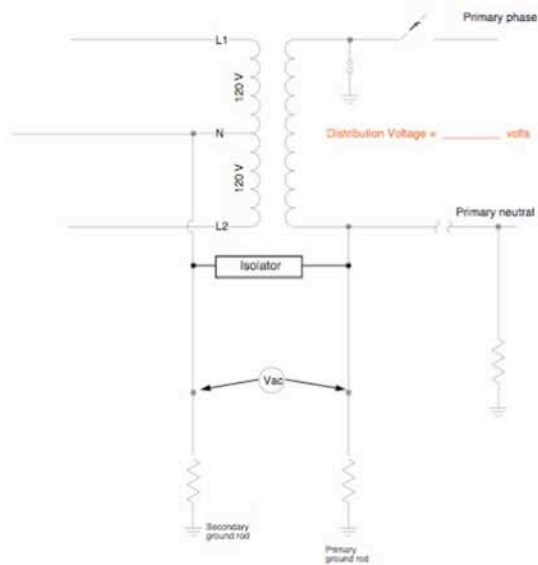
If the unit is installed, remove one lead before conducting this test. If there is any question on whether a unit is functional, contact DEI.

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Testing the Isolation System Version 1.0

Measure only the voltage across isolator

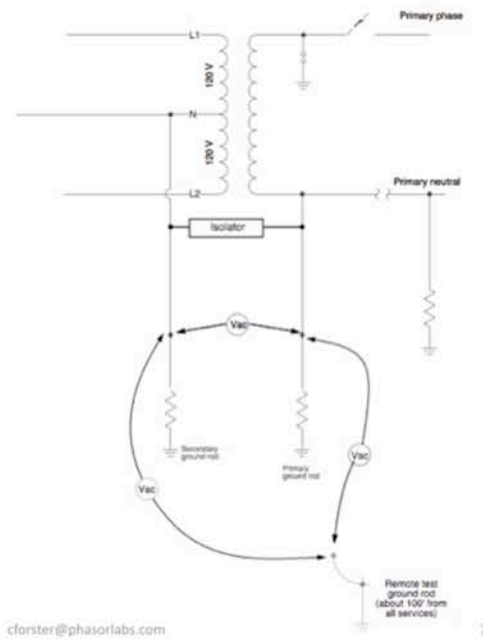


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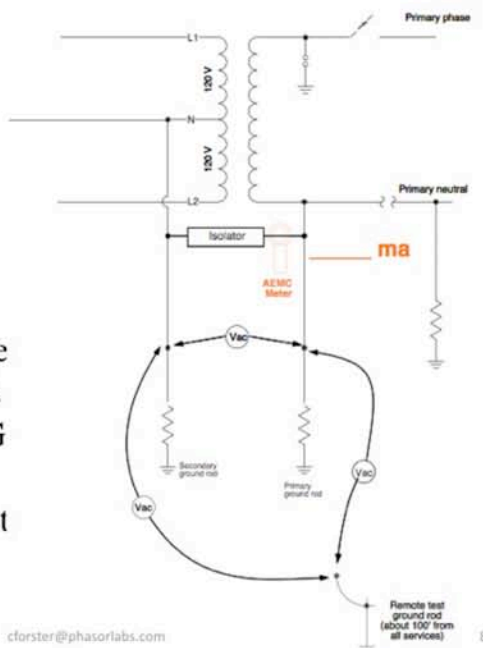
Testing the Isolation System Version 2.0

Measure the voltage across isolator plus PN-RG and SN-RG



Testing the Isolation System Version 3.0

Measure the voltage across isolator plus PN-RG and SN-RG
And
Measure AC current through isolator



Checking Rsource

Typical method is to use a DVM, measure voltage across Cow Contact without a 500 ohm resistor and the measure voltage with a 500 ohm resistor.

$$R_{\text{source}} = (\text{Volts w/o} - \text{Volts with}) * (\text{resistor value in ohms}) / (\text{Volts with resistor})$$

This is good when cow contact voltages are above 20 millivolts or so. At lower cow contact voltages the error rate goes up.

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An Alternate Method

At the recorder end of the 2 wire connection to the cow contact point, short out the wires and use your AEMC to measure source resistance.

Make sure the 500 ohm resistance is out of the circuit!

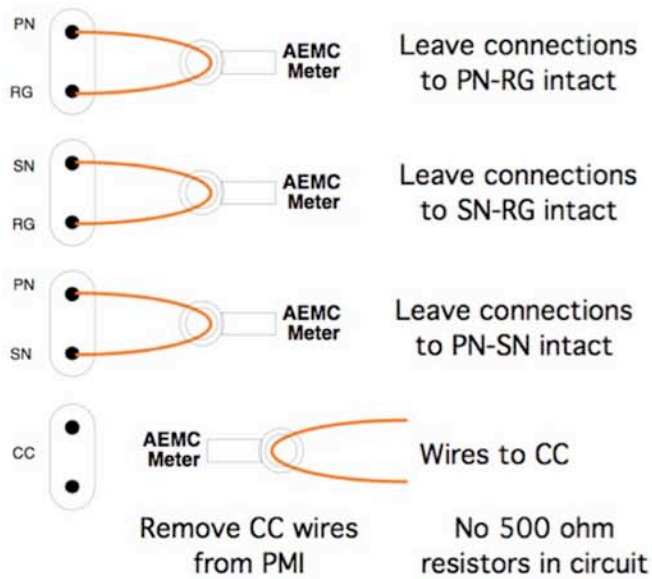
For PMI recorders, unplug the cow contact wires from the unit since it may have an internal 500 ohm resistor.

If you used two (2) single conductor wires to connect to the cow contact point and left excess wire wrapped on a spool, this method will not work, go back to the DVM method.

Better yet use 2 conductor twisted pair cables to the cow contact points. You can leave excess cable on the spool, but I prefer to cut the wire to length.

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**Measuring
Rsource**

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Typical Rsource Values

Rsource values using AEMC will be +/- 25% of those using DVM

Rs for PN-RG = 25 to 250 ohms

Rs for SN-RG = 25 to 250 ohms

Rs for PN-SN = 3 to 20 ohms

Rs for CC = 50 to 500 ohms

When measuring PN-SN on an isolated farm you will be bypassing the isolation. It is polite to notify the farmer that this will occur. Later when your monitor is logging, bypass the farm for about 2 minutes and record the changes.

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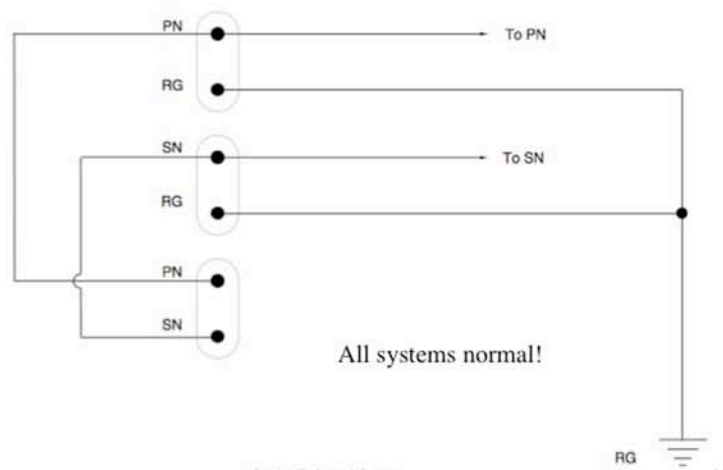
Why measure R_{source} for connections to PN – SN – RG?

The following discussion assumes you are using a stray voltage logger with isolated inputs for each channel. Examples are PMI, WaveRider, Metrosonics or a similar unit.

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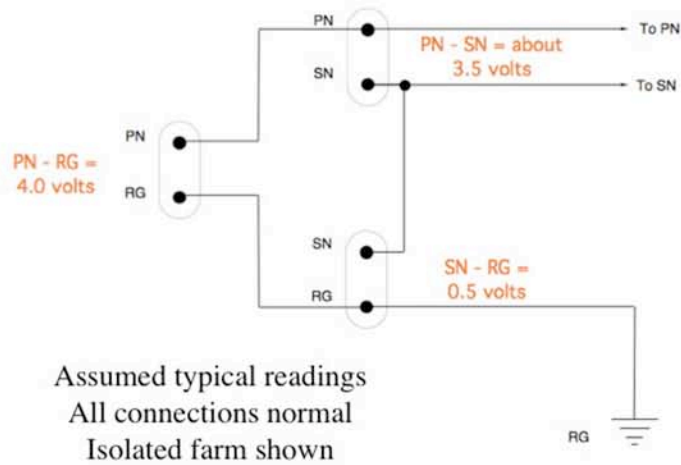
Typical Connections to your logger



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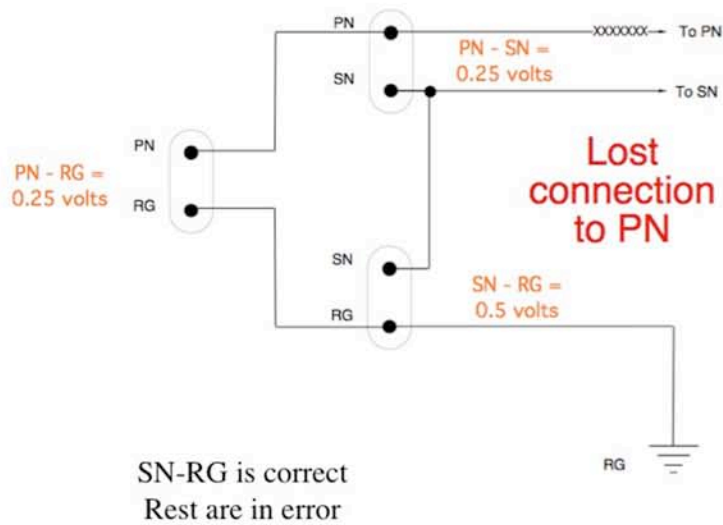
Normal Connections Arranged In Schematic Form



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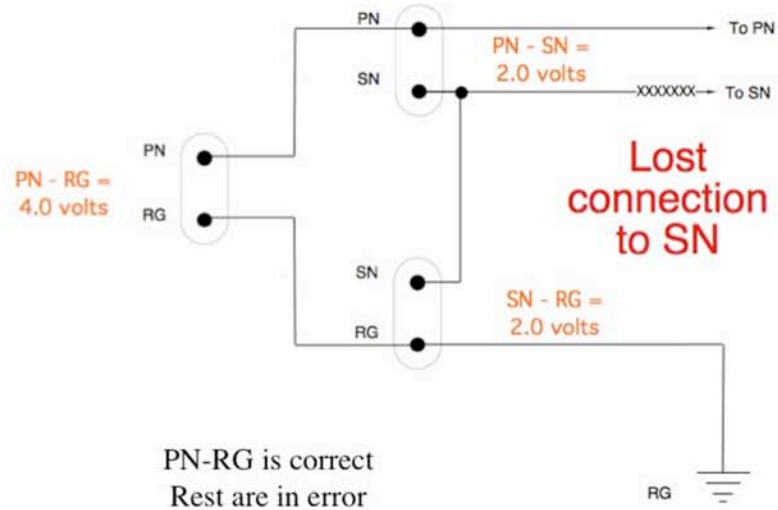
Oops – Lost my connection to PN



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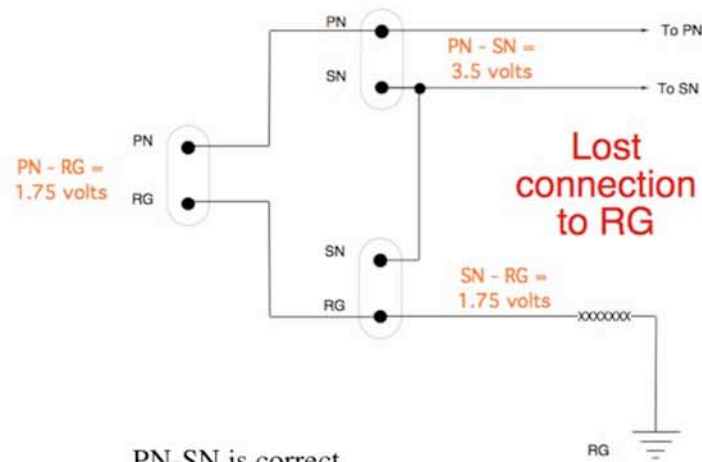
Oops – Lost my connection to SN



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Oops – Lost my connection to RG



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Some more reasons to perform the PNEV profile

Detect cut pole ground wires below grade and at top of the pole where they may go undetected.

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An alternate Unbalanced test

With your logger running, go to every 120 volt outlet you can find and run a 1200-1500 watt heat gun for about 5 seconds.

If you are using a PMI or other unit with an averaging interval of more than 1 second, make sure you let the load run for twice the interval period.

Also check the "max" charts on your logger printout.

Set your watch to the logger time and note the Exact time you were in the shed, milkroom....

Check the recorded data to see if any unusual events happened at the cow contact points.

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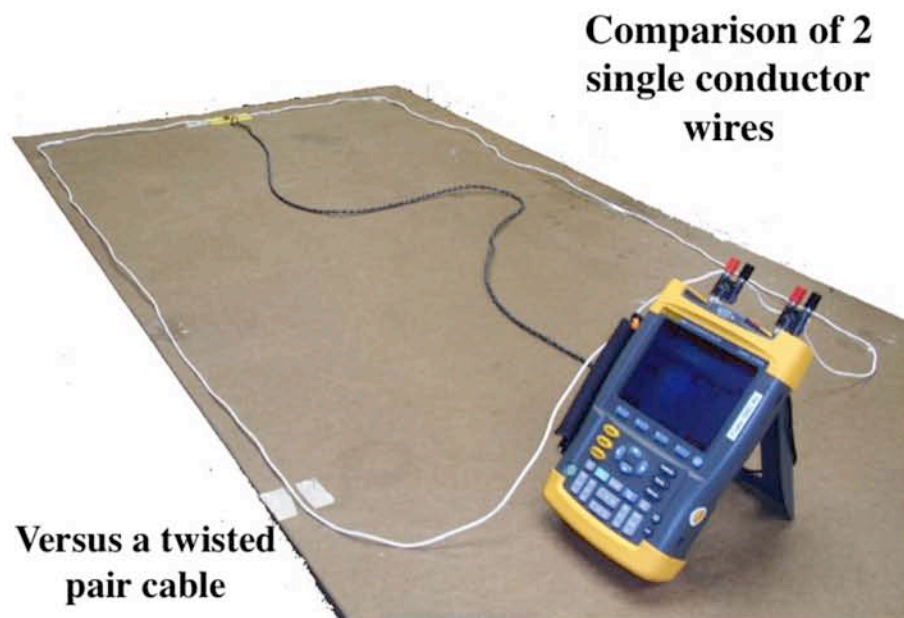
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Short Duration Electrical Measurements

The cable connections matter

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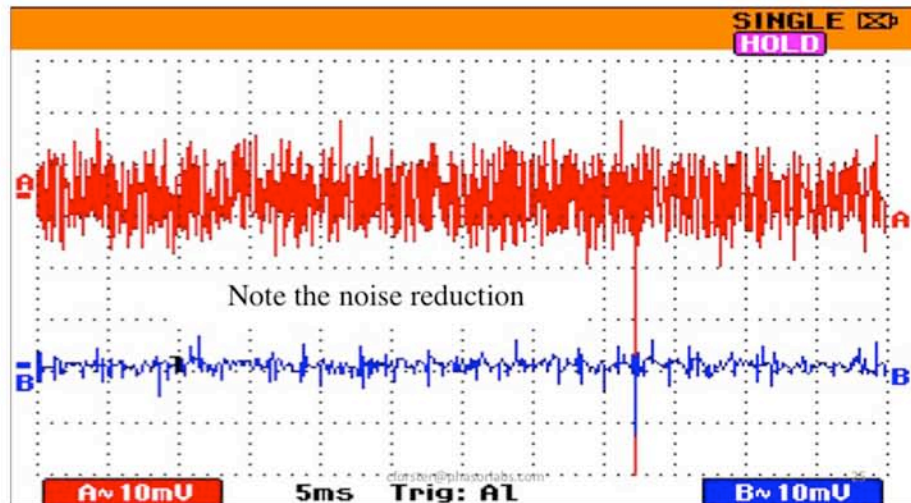




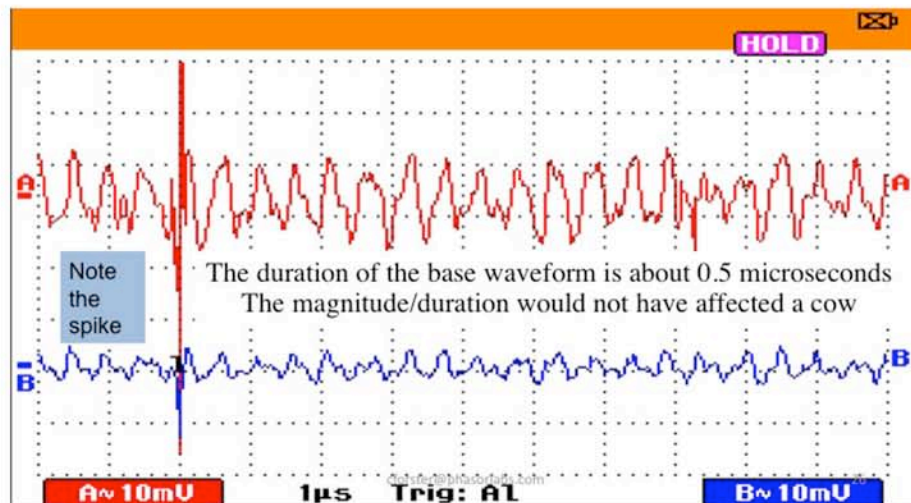
The 250 Ohm Resistor Load



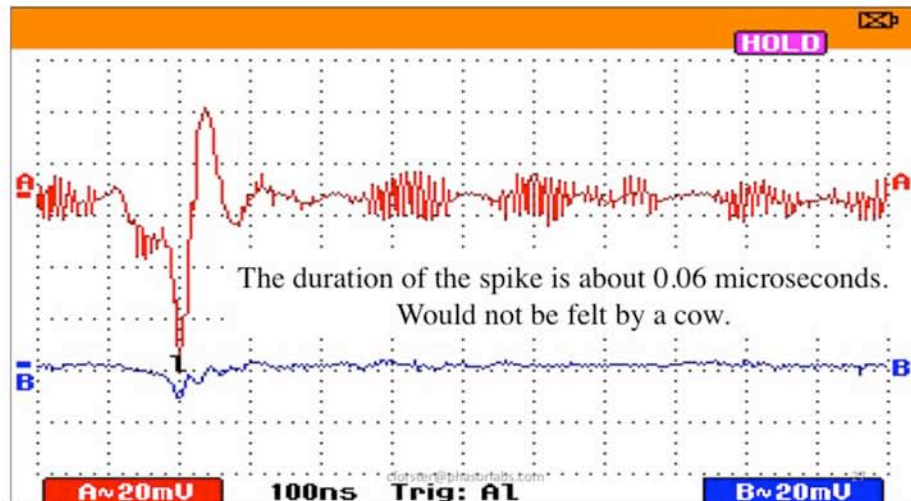
**Channel A is the single wire loop
Channel B is the twisted pair**



Zooming to 1 microsecond/division

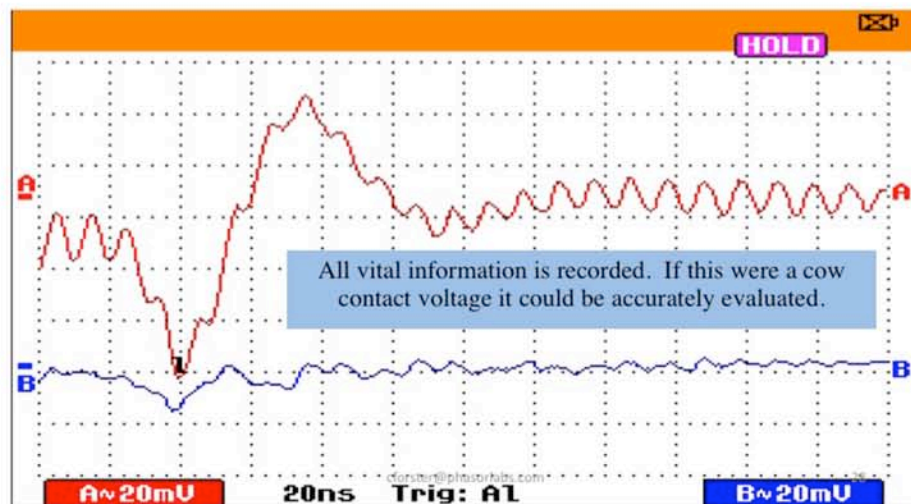


Zooming to 0.1 microsecond/division



This example makes two points:

1. Shielding your wire connections is important
2. Using a scope properly can help you analyze short duration events



Using the Fluke 199C improperly

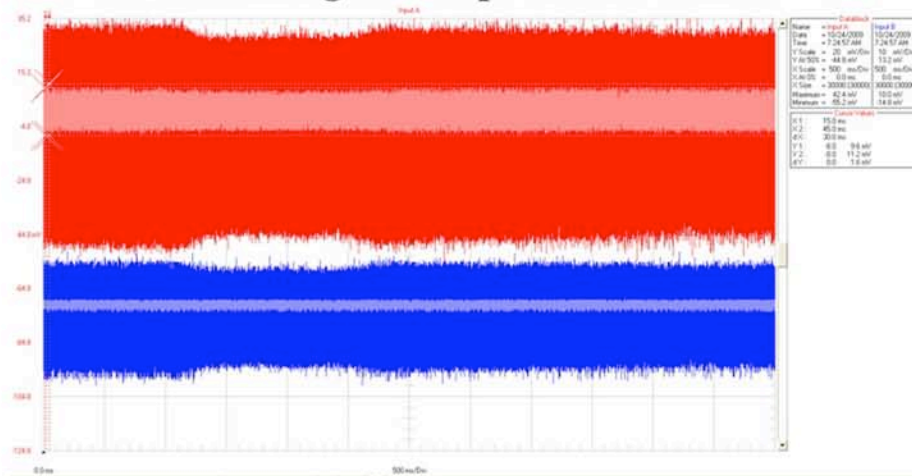
The Fluke 190 series scope meters have additional built-in recording modes:

1. A “Scope Record” mode.
2. A “Trend Plot” mode.

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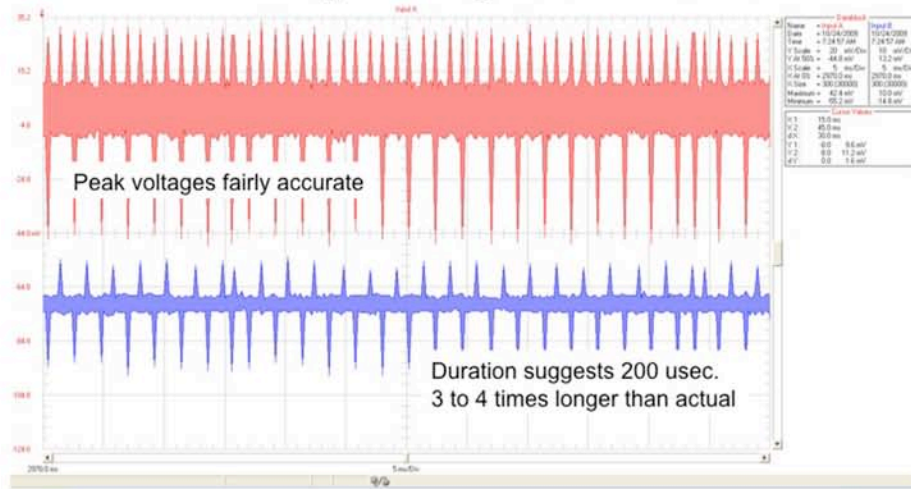
Recording in “Scope Record” mode



This file is fully compressed in the “X” (time) axis
X axis is 500 milliseconds per division

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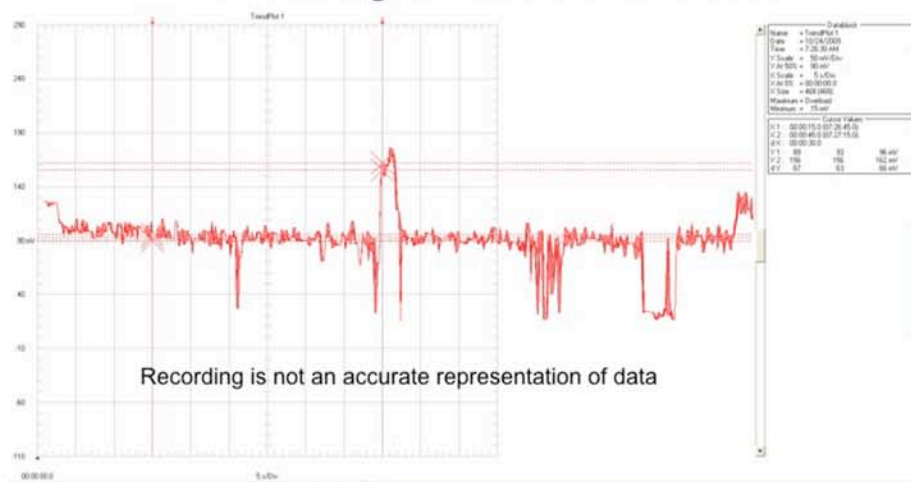
Recording in "Scope Record" mode



This file is expanded in the "X" (time) axis
X axis is 5 milliseconds per division

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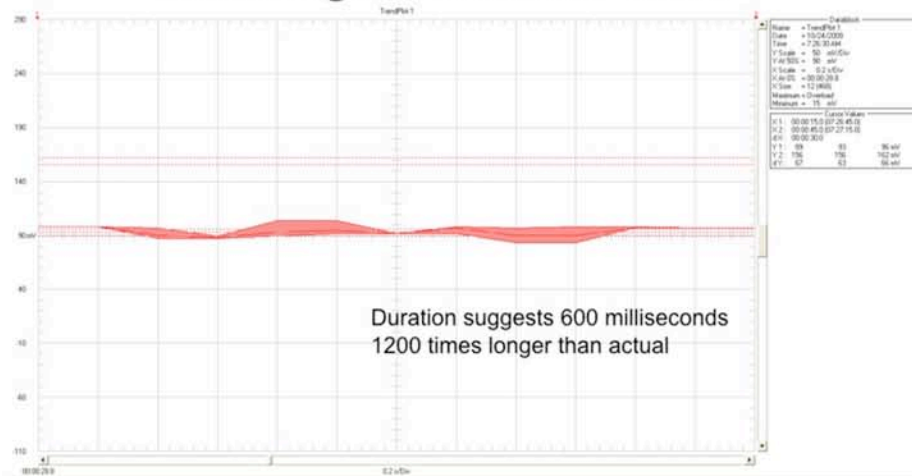
Recording in "Trend Plot" mode



This file is fully compressed in the "X" (time) axis
X axis is 5,000 milliseconds per division

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Recording in "Trend Plot" mode



This file is expanded in the "X" (time) axis
X axis is 200 milliseconds per division

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Thank You

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