

## Troubleshooting made simple with the Fluke 190 Series II ScopeMeter®

### Application Note

There's probably not a service engineer on the planet that wouldn't agree that intermittent electrical faults are the most difficult and frustrating to trace and solve. Although these may seem like random disasters sent to test our patience, invariably they have a sound physical cause. The trick, of course, is to discover what this could be without spending hours monitoring the offending equipment until the elusive fault finally chooses to show itself. In this article, Henk ter Harmsel, Senior Product Specialist at Fluke Industrial, The Netherlands, explains how the service engineer's life can be made infinitely easier with the powerful troubleshooting features of Fluke's 190 Series II ScopeMeter.

Although usually highly complex, modern electrical and electronic equipment is also incredibly robust, with masses of protection circuitry to guard against breakdown induced by, for example, current and voltage surges, mains harmonics, EMI... you name it! This complexity, of course, also has its down side when it comes to maintenance. Intermittent faults in particular, always the curse of the service engineer or technician, can become a major headache to trace in today's ultra-sophisticated systems with their fast and complex control signals.

Fortunately the situation is far from hopeless since intermittent faults share one infuriating characteristic—despite their apparent randomness, they all fall into several well-defined categories. This offers an important clue to tracing and solving them; a fact recognized by Fluke when designing its 190 Series II ScopeMeter.

### Troubleshooting with the Fluke 190 Series II ScopeMeter

Any number of factors can lead to spurious signals that may cause equipment to suddenly drop out for no apparent reason. Some of these are equipment related, for example, defective circuitry, dry solder joints, dust or corrosion, and overheating. Others, such as mains fluctuations and voltage spikes due to systems switching on, are related to the mains supply. Identifying the most likely cause requires experience and intuition and, in many instances, a lot of luck.

Now, however, with the Fluke 190 Series II ScopeMeter, luck doesn't have to enter the equation. This family of handheld test tools combines the functions of digital multimeter with a digital storage oscilloscope in bandwidths up to 200 MHz and with up to 2.5 GS/s real-time sampling per channel. The series also offers highly innovative trouble-shooting features found in the past only on very expensive desktop oscilloscopes. Available for the first time in a portable instrument, these features make the job of a service engineer much easier, enabling him or her to trace and solve all manners of intermittent faults.

### Tracking down faulty wiring

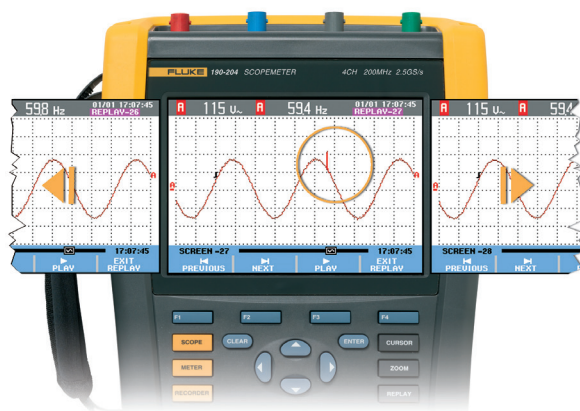
The scope continuously records the last 100 screens in First-in/ First-out (FIFO) memory. As soon as you spot an anomaly on the scope or suspect something has occurred that you might have missed, the

Replay button can be pressed to freeze the last 100 screens and allow you to play them over again. The feature, in fact, allows two sets of 100 screens with individual time stamps to be stored for later recall or downloaded to a PC for a more detailed analysis.

The last 100 screens are available for scroll-through picture by picture, or replayed as a "live" animation.

### Catching signal transients with capture and replay

If you're looking for a voltage spike on the mains, for example, the instrument should be set to trigger on positive- or negative-going voltage pulses with amplitude slightly larger than mains voltage.



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This method can't be used, however, to capture glitches that do not have voltage levels higher than the signal level. The solution then is to use pulse-width triggering set to capture, for example, negative-going pulses with duration less than a specified time. With the 200 MHz version (190 Series II ScopeMeter), which has rise and fall times of 1.7 ns, pulses as narrow as 3 ns can easily be captured using pulse-width triggering. Setting the trigger to capture negative-going pulses that last longer than 20 ms can also capture missing cycles on the mains.

To see how often the event occurs, just leave the ScopeMeter connected to the circuit for as long as you like then press the Replay key to see and analyze the captured events.

## Looking for sags and swells with TrendPlot™

The 190 Series II ScopeMeter's TrendPlot feature is used specifically for occasions in which relatively long-term monitoring is needed. Operating in the ScopeMeter's digital multimeter mode, TrendPlot offers the ideal way to locate causes of intermittent problems that occur perhaps only once an hour or once a week. Besides ambient temperature fluctuations, voltage sags or swells on the mains or a failing power supply are other intermittent problems that can be traced with TrendPlot. In this mode, the ScopeMeter acts in effect as a paperless recorder, plotting for more than 22 days the average, minimum, and maximum values of any selected scope or meter measurement. Using this feature, long-term irregularities can easily be spotted. TrendPlot also offers the important advantage of accurate time stamping with a resolution down to 0.2 seconds to show exactly when an irregularity occurs. This can be displayed as either time-of-day or elapsed time, depending on the nature of the change you're trying to monitor.

While TrendPlot is running, the ScopeMeter operates unattended, continuously recording the required data while dynamically setting the vertical amplitude scale to display the maximum and minimum values, and automatically compressing the time scale to show the complete trend from the start.

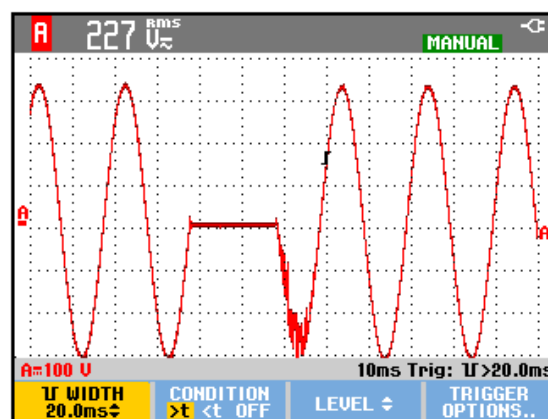
## Analyzing fast, complex electrical processes

Here's where the 190 Series II ScopeRecord mode comes in handy. This is a continuous-sampling mode in which the scope records points (consisting of minimum and maximum values) at a rate of 125 MS/s. With a 30,000-point deep memory, the ScopeMeter can record continuously in this mode for up to 48 hours, capturing glitches as short as 15 ns. What's more, a 100x zoom function makes the smallest details visible, such as the shape of an individual power cycle.

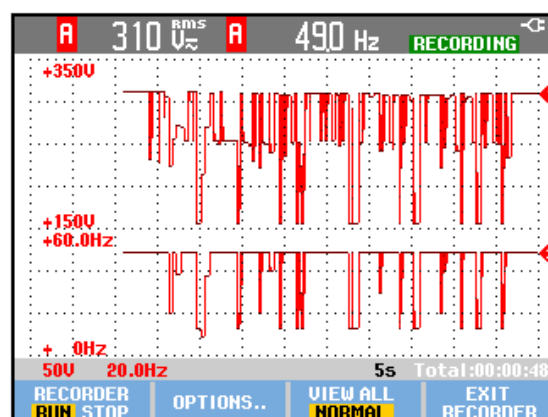
The figure shows what happens when an UPS switches over from the inverter to mains supply. Although the switchover would not be visible with a normal display of say 200 ms/div, captured with ScopeRecord; the switchover is clearly visible using a 100x zoom factor. In this case, the display clearly shows that no interruption in supply has occurred, with the mains voltage connected and in phase within just a few milliseconds.

## An ideal partner

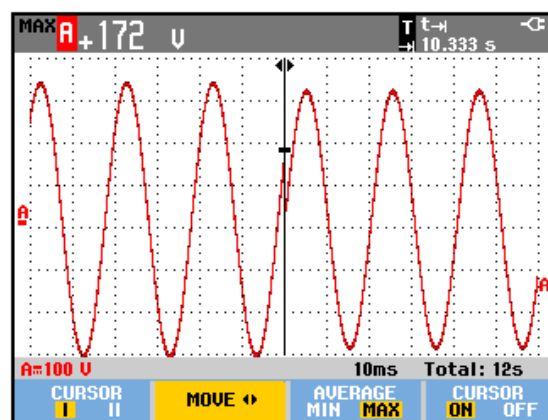
With the modern trend toward ever faster, more complex electronic control systems, the need for sophisticated test tools can only increase. While advanced benchtop instruments may offer an impressive array of troubleshooting features, their price and lack of portability generally preclude their use by mobile service engineers. They need an instrument that can be easily carried around and, since they never know what to expect on a call-out, preferably one with



Setting the ScopeMeter to trigger on negative-going pulses longer than 20 ms will detect missing cycles on the mains.



Plotting long-term irregularities with ScopeMeter's TrendPlot feature



ScopeRecord shows a voltage irregularity when switching off a UPS

the widest range of troubleshooting features. The Fluke 190 Series II ScopeMeter fulfills these needs perfectly. Combining portability with a range of advanced features that are both powerful and intuitive to use, it's the ideal partner for today's service engineers and technicians who work in the field.



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Fluke Corporation  
PO Box 9090, Everett, WA 98206 U.S.A.

Fluke Europe B.V.  
PO Box 1186, 5602 BD  
Eindhoven, The Netherlands

For more information call:  
In the U.S.A. (800) 443-5853 or  
Fax (425) 446-5116  
In Europe/M-East/Africa +31 (0) 40 2675 200 or  
Fax +31 (0) 40 2675 222  
In Canada (800)-36-FLUKE or  
Fax (905) 890-6866  
From other countries +1 (425) 446-5500 or  
Fax +1 (425) 446-5116  
Web access: <http://www.fluke.com>

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