

## Measurements on UPS systems with a Fluke ScopeMeter® 190 Series

### Application Note

Reliable electrical power supplies have become absolutely essential with the use of electronic systems in virtually every technical field. Computers, communication systems, medical/life support systems, for example, need power that has to be provided either by the line supply or from battery-powered DC supplies. The reliable operation of UPS (Uninterruptible Power Supply) systems is therefore becoming more and more critical. They are designed to provide clean and continuous power to the load under any normal or abnormal utility power condition.

#### Fast, effective service - the key to success

The controlling and synchronization of these systems with the line supply is realized by an additional component, an electronic switching unit, which switches the load directly to the line supply in case of an overload or fault in the inverter. The quality of this switching operation is crucial to the quality of the system. For this reason, an oscilloscope display of the voltage behavior during the switching operation is indispensable during installation and maintenance of these systems.

#### Troubleshooting with a portable oscilloscope

The main problem with oscilloscope measurements of this kind is triggering. Since there is often no voltage level on which to trigger properly when switching from the inverter to mains operation, an external trigger signal was used up to now. The current in the system connections can be used for this purpose, but this means that a current clamp has to be used.



#### ScopeRecord - Fluke sets the standard for portable oscilloscopes

A memory depth of 27,500 points allows up to 100 screens to be stored without interruptions, which represents a recording period of 24 seconds with a 20 ms/div. timebase. After recording, the captured waveform can be studied and analyzed in its entirety, with the ability to zoom-in at any desired point. For detailed analysis of fast changes in the signal, the cursors can be used.

Fluke's ScopeMeter 190 Series using ScopeRecord opens up new application areas. In 'Single Sweep' mode, the scope records

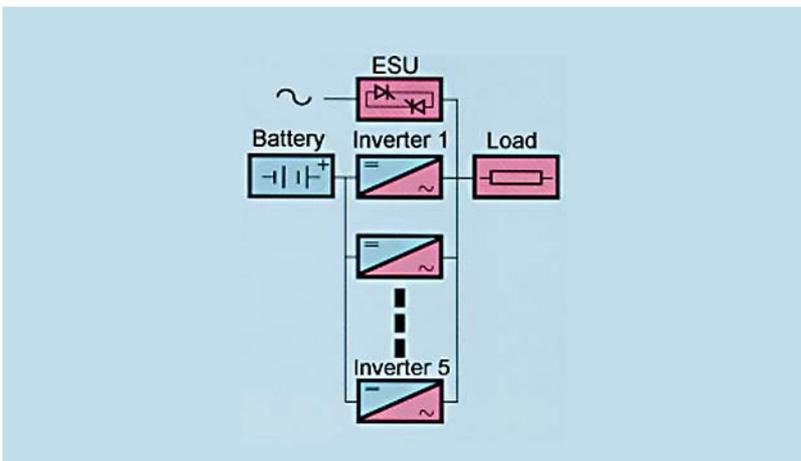


Figure 1: Schematic layout of a UPS system

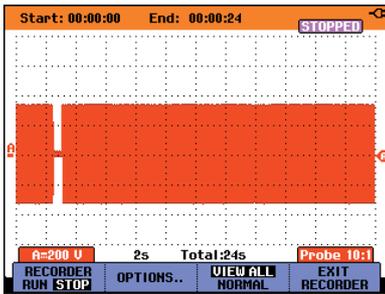


Figure 2: Recording of a 24 seconds period using ScopeRecord (Fluke 199C)

continuously until the memory is full, while in 'Continuous' mode the memory is constantly overwritten by new events.

This means that recording can be stopped after an event has occurred to investigate the signal behavior. With a timebase of 20 ms/div. and simultaneous two-channel recording, there is still a period of 24 seconds during which the recording can be stopped manually, before the event of interest starts to be overwritten (see figure 2). Besides this way of operation, a single sweep can be started or stopped automatically using an external trigger.

## Typical applications in UPS systems

Examples of new applications with the ScopeMeter are measurements on standby power supplies and UPS systems. Instead of spending a lot of time on obtaining and setting trigger signals, all that is necessary is to record the entire event and investigate it in detail afterwards. Whatever the behavior of the signal during the recording period, the ScopeMeter records everything at the selected timebase and with the corresponding detail resolution.

The example of the switchover from inverter operation to the mains supply shows clearly how this technique works in practice.

While the display with a timebase of 2 s/div. or 200 ms/div. shows no

detail of the switchover, the signal behavior can be seen clearly when a zoom factor of 100 (20 ms/div.) is applied. This display shows the exact information that both the system manufacturer and the end-

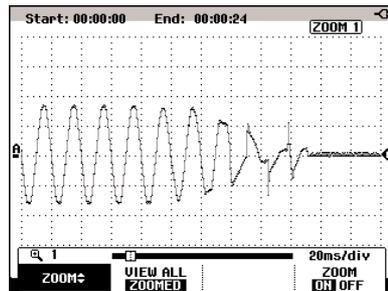


Figure 3: Zoomed detail of a failed switchover (Fluke 199B)

user are interested in (see figure 3). It is particularly important that the load is at no time without power during the switchover from the inverter to the mains supply. This can be seen very clearly in the display (see figure 4) - within just a few milliseconds the mains voltage is connected and in phase.

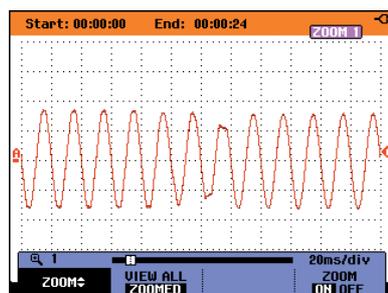


Figure 4: Zoomed detail of a correct switchover (Fluke 199C)

Another application of the Fluke 190C ScopeMeter is to observe the switchover of a UPS by using the Pass/Fail testing feature. The UPS output signal is compared with a stored template and up to 100 abnormalities are stored in the Replay memory without any interaction of the maintenance engineer who may even be elsewhere (see figure 5).

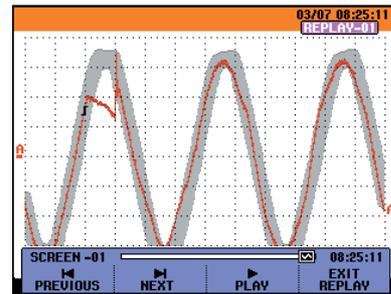


Figure 5: Switchover captured by Pass/Fail using a reference template (Fluke 199C)

## Conclusion

The Fluke 190 Series ScopeMeter has proven to be a very convenient and robust test tool. The combination of a two-channel oscilloscope and a true-RMS digital multimeter, together with the ScopeRecord function (27,500 points memory depth) and the isolated floating inputs, opens up many practical applications for measurements on standby power supplies and UPSes. The tests described in this article are much more than just a substitute for the use of a conventional bench oscilloscope. They demonstrate the suitability of the ScopeMeter for all kinds of electrical and electronic service applications.

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