Easy capture of in-rush currents with a Fluke 190 Series ScopeMeter®

The measurement and analysis of in-rush current is a valuable technique in determining a circuit’s parameters. This application note explains the procedures for capturing and analyzing in-rush current with the Fluke 190 Series II ScopeMeter portable oscilloscope. Viewing the captured waveform allows the determination of how fast the current drops from startup current to running current levels. ScopeRecord mode makes it possible to capture the whole in-rush cycle for several seconds and the zooming functions enable it to examine the in-rush current signal in full detail and check on peak currents drawn at start up.

In-rush current
In-rush current is the initial surge of current drawn by a circuit when voltage is first applied. Motors, power supplies, fluorescent lighting and High Intensity Discharge (HID) lamps all have in-rush current characteristics that can be captured and analyzed to help identify circuit problems. Although the example in this application note is based on a motor, the procedure would be the same for any circuit. The measurements shown in the illustrations are actual measurements taken on a three-phase motor with Wye/Delta switch.

Principle of Wye/Delta switched asychone motor
Wye/Delta switching of asychone motors reduces the in-rush current by a factor $\sqrt{3}$.

In the Wye configuration, (Figure 1) the 3 phase voltage is applied to two coils of the motor circuit switched in Wye mode. This means that the star voltage $U_\lambda$ of 230 V (115 V) is available for the motor winding.

In the Delta configuration, (Figure 2) the full phase to phase voltage $U_\Delta$ of 400 V is available for the motor winding.

Setting up the instrument
The ScopeMeter is connected with a 10:1 voltage probe to the supply voltage (Figure 4) and with a current probe to one of the 3 phase current conductors (Figure 5).

Figure 1. Wye configuration.

Figure 2. Delta configuration.

Figure 3. Captured trace with cursor readings. VIEW ALL for a quick impression of the complete inrush current. Zoom range of -100 up to +10. In-rush peak current 30.4 A Wye in-rush current time 6.72 s Delta in-rush after 9 s.

Figure 4. Attenuation factor 10:1.

Figure 5. Current probe setting 100 mV/A sensitivity.
Looking at the peak current drawn at startup (Figure 8), knowledge of the time it takes to go from lock-rotor to normal running current and of the amount of normal running current can help identify excessive loads and defective starter circuits. The Zoom function allows for a more detailed study of the inrush current. Figure 9 shows the details whereby the cursor position reveals the actual current at the specific moment in time.

Conclusion
With the ScopeMeter 190 Series II it is easy to capture in-rush currents in the ScopeRecord mode showing the whole in-rush cycle. The captured data can be saved in the ScopeMeter’s memory on location and examined afterwards with FlukeView software. Current peaks and switch time parameters can be determined with full detail using cursors and zooming functions. These measurements with the ScopeMeter 190 Series allow the determination of circuit design parameters beforehand and provide a check on operating condition afterwards. The ScopeMeter 190 Series with three independently floating isolated inputs is certified for safe measurements in CAT IV environments up to 600 V and CAT III environments up to 1000 V.

Fluke. Keeping your world up and running.

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

Fluke Europe B.V.
P.O. 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

Specifications subject to change without notice.
Pub_ID: 10620-eng, rev 01
Modification of this document is not permitted without written permission from Fluke Corporation.