

Fault Event Analysis with LineIQ

Introduction

LineIQ provides a cost-effective means to achieve not only smart fault detection, but also intelligent line monitoring and advanced fault analysis.

This document provides a variety of examples on the type of field data that LineIQ captures—actionable data that can help power suppliers more quickly and accurately isolate and diagnose faults, thereby avoiding costly outages.



1. Fault with Protection Operation (Fig. 1-3)

LineIQ installed beyond a recloser confirms a 1200Amp fault (Fig.1), a single shot re-close operation, 100ms fault current trip setting (Fig. 2), and the loss of approximately 12Amps of load. Figure 3 displays the event table.

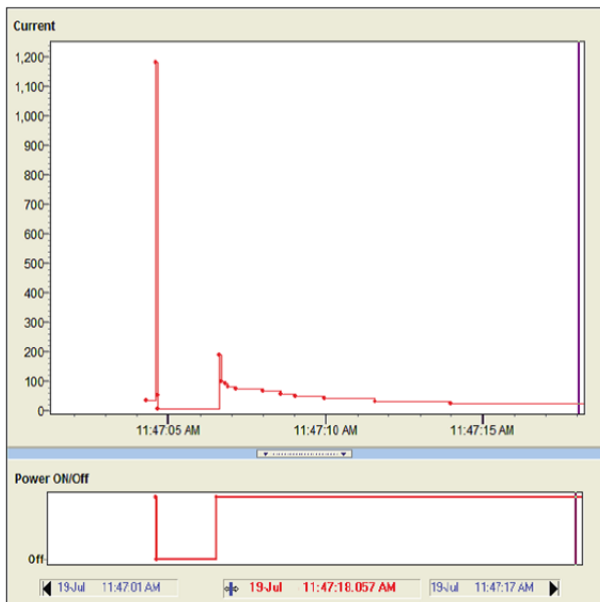


Figure 1. 1200Amp fault confirmation

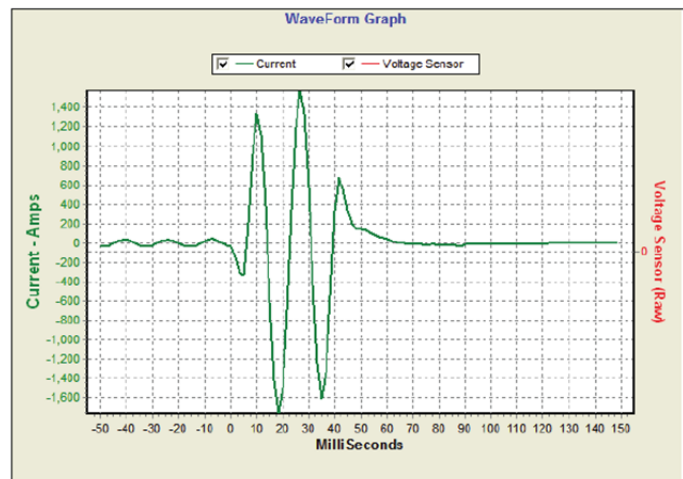


Figure 2. 100ms fault current trip

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Pre Trigger Status	
Power Status	ON
Current	34.9 Amps
Event Trigger	
Trigger	High Current
Trigger Current	1182.3 Amps
Time to Trip	100 milli Sec
Number of Trips	1
Post Trigger Status	
Power Status	ON
Current Steady State	22.4 Amps

Figure 3. Event table

2. Fault Without Protection Operation (Fig. 4-6)

There are many instances in which LineIQ will capture fault currents that do not trip upstream protection devices. This can be valuable since cracked insulators and bushings, or lightening arrestors flashing over might not trip a protection device, but may be warning signs of impending failure. Figures 4-6 demonstrate LineIQ capturing such events. Note that no loss of power occurred (Fig. 6).

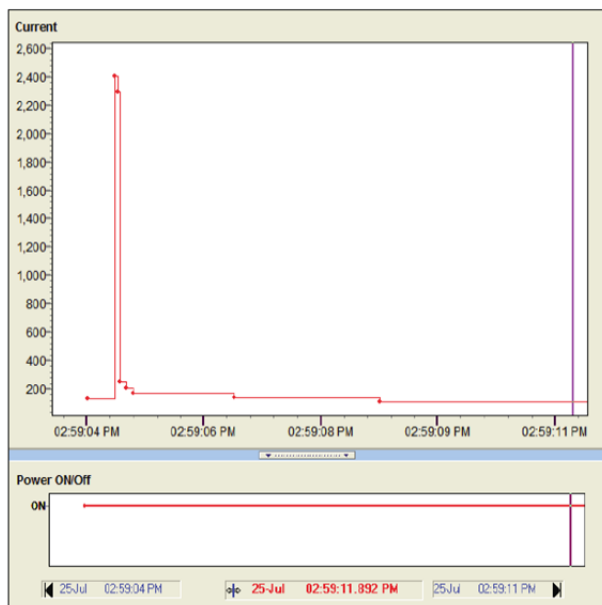


Figure 4.

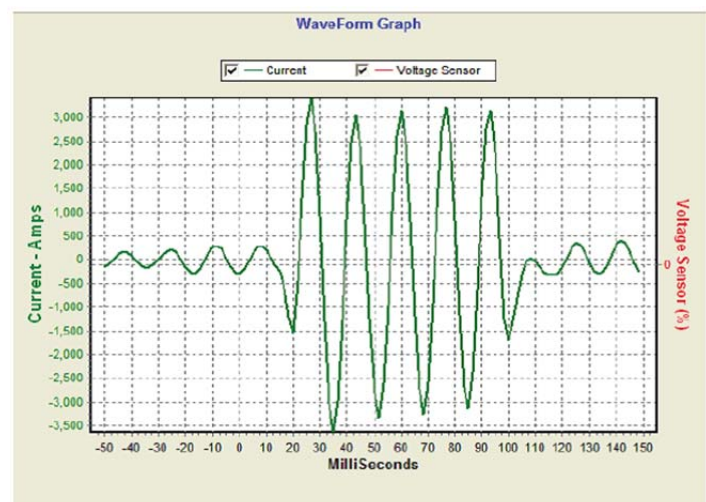


Figure 5.

Pre Trigger Status	
Power Status	ON
Current	137.4 Amps
Event Trigger	
Trigger	High Current
Trigger Current	2403.4 Amps
Post Trigger Status	
Power Status	ON
Current Steady State	95.4 Amps

Figure 6.

3. Fault Clears, and Protection Operates (Fig. 7-9)

This is an example of incorrect protection settings resulting in an unnecessary outage. The initial fault clears itself, and then the protection operates. Subsequent trips lock out as a result of inrush current, not fault current.

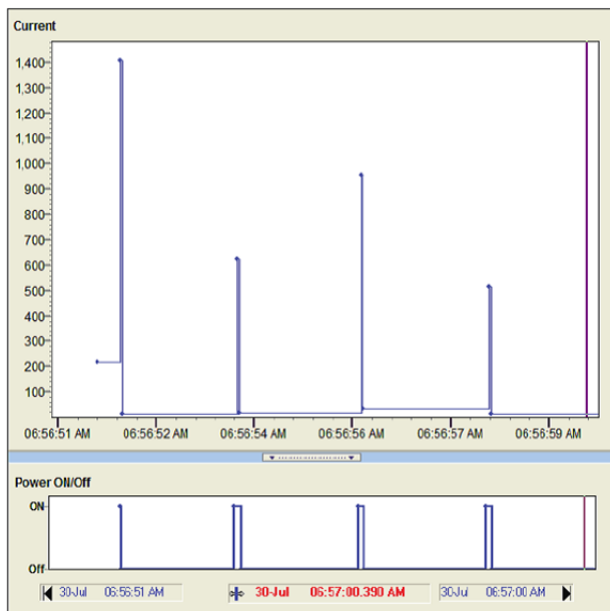


Figure 7.

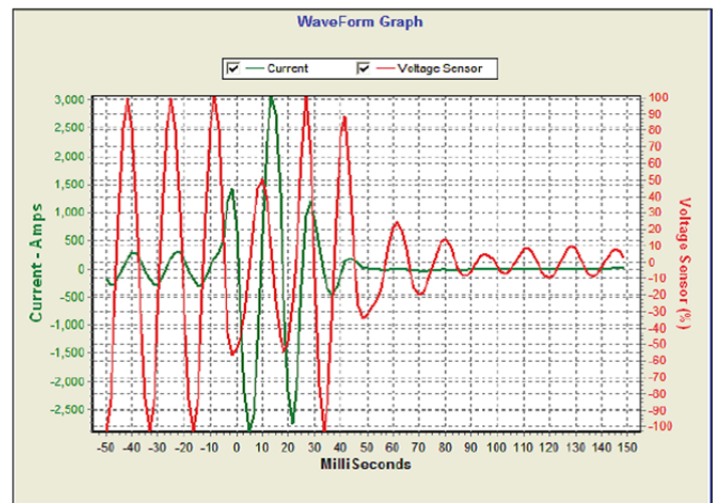


Figure 8.

Pre Trigger Status	
Power Status	ON
Current	219.8 Amps
Event Trigger	
Trigger	High Current
Trigger Current	1407.9 Amps
Time to Trip	79 milli Sec
Number of Trips	4
Post Trigger Status	
Power Status	Off

Figure 9.

4. Fault Cleared by Downstream Protection (Fig. 10-12)

This example shows how the RMS event profile can provide confirmation of downstream protection operations. Note the step down in load from pre-fault to post-fault current, and the inrush pickup current when re-closing in. Also note that no loss of power occurred (Fig. 12).

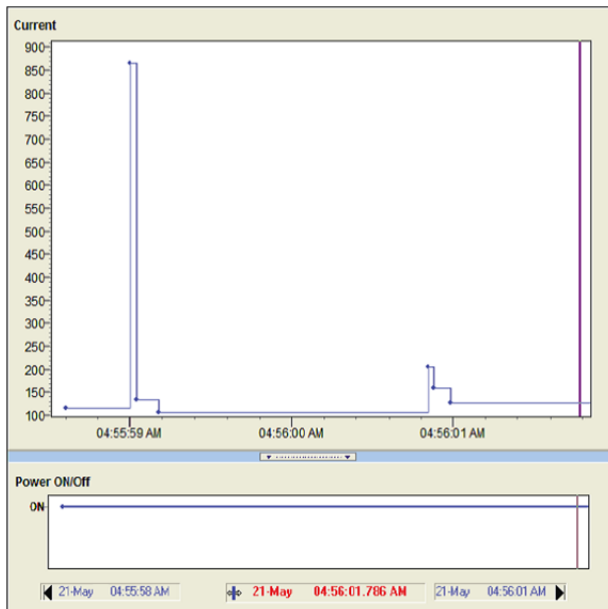


Figure 10.

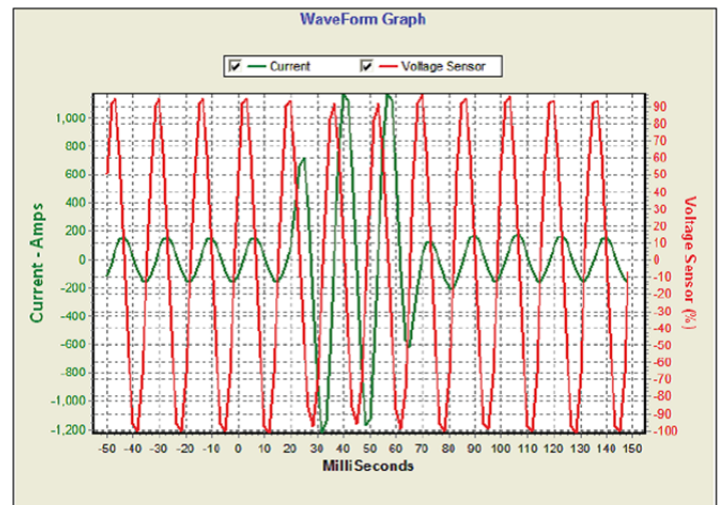


Figure 11.

Pre Trigger Status	
Power Status	ON
Current	116.5 Amps
Event Trigger	
Trigger	High Current
Trigger Current	866.5 Amps
Post Trigger Status	
Power Status	ON
Current Steady State	108.6 Amps

Figure 12.

5. Fault and Protection Lock-out (Fig. 13-15)

In this case, the protection re-closes on a fault and locks out on the fourth attempt. Note that the RMS profile provides information on the protection settings: 2-short and 2-long.

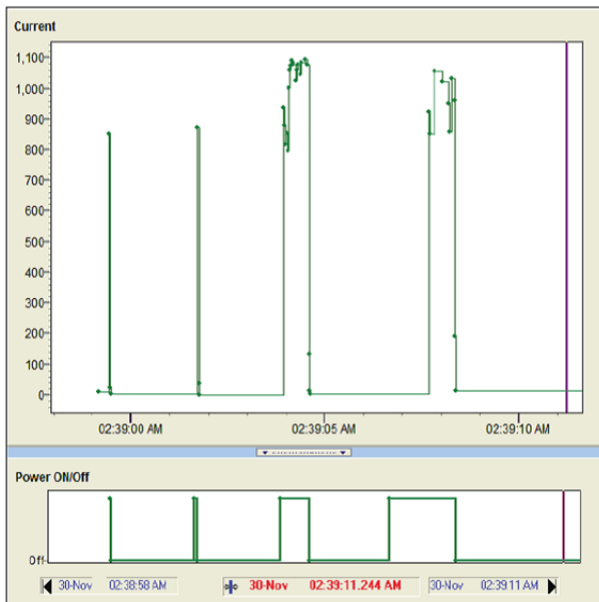


Figure 13.

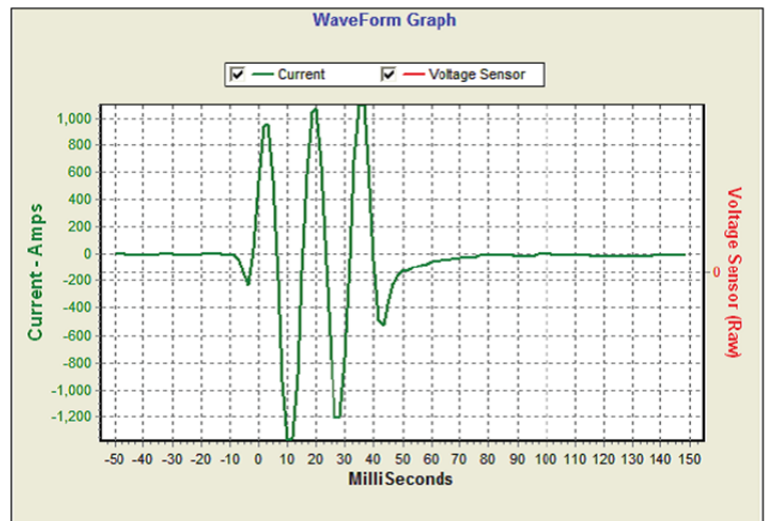


Figure 14.

Pre Trigger Status	
Power Status	ON
Current	10.6 Amps
Event Trigger	
Trigger	High Current
Trigger Current	850.1 Amps
Time to Trip	119 milli Sec
Number of Trips	4
Post Trigger Status	
Power Status	Off

Figure 15.

6. Unsuccessful Line Restoration Attempt (Fig. 16-18)

LineIQ captures events triggered by loss or return of power. This example shows switching onto a fault in an attempt to restore power after a sustained outage.

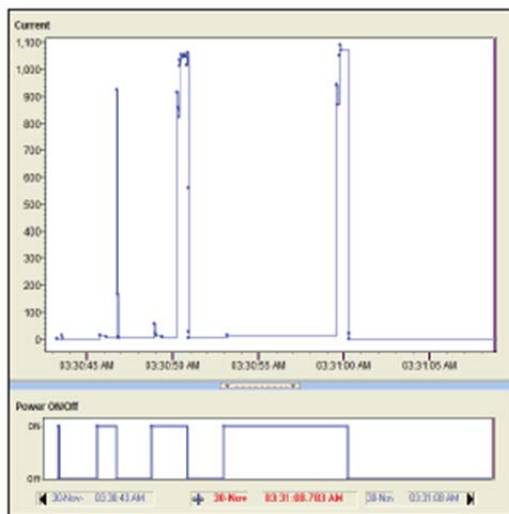


Figure 16.

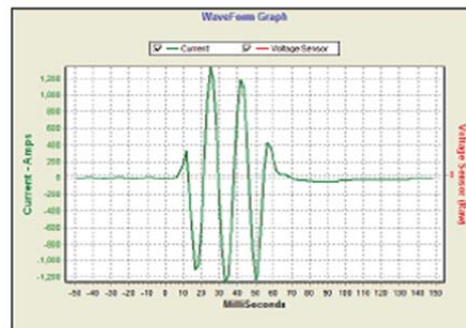


Figure 17.

Pre Trigger Status	
Power Status	Off
Event Trigger	
Trigger	High Current
Trigger Current	925.5 Amps
Time to Trip	3380 milli Sec
Number of Trips	4
Post Trigger Status	
Power Status	Off

Figure 18.

7. Successful Line Restoration (Fig. 19, 20)

In comparison to a failed restoration attempt, the following shows an example of a successful line restoration after a sustained outage. Not the inrush/cold load pick-up current.

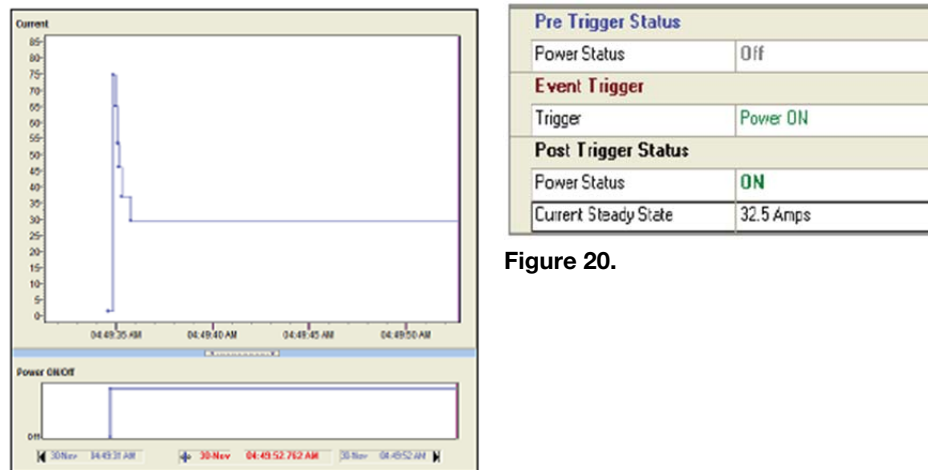


Figure 20.

8. Three-Phase Single Shot Re-Close (Fig. 21, 22)

The example below shows three individual LineIQ data files superimposed verifying a three-phase re-close operation. Fault location would be between the recloser and the LineIQ installation.

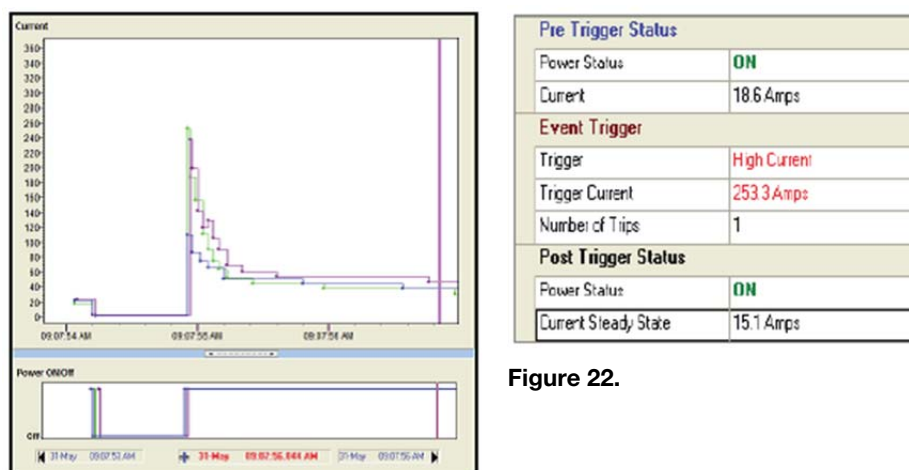


Figure 22.

Figure 21.