Case Study

Power Quality Analysis of Transformer Humming Noise

Elspec's advanced power quality analyzer, the G4400, identified the root cause for abnormal humming noise coming from the transformer in Fujian Fuxin stainless-steel plant.

Humming noises can be a symptom of a transformer being under abnormal stress. Steel factories with arc furnaces work under extremely heavy loads and must do so 24/7. Transformer malfunctions are a threat to the whole production-line and can cause heavy losses if the transformer is out of order.

Fujian Fuxin, is one of the largest steel plants in China, invested by the Taiwanese Formosa Plastics Group. It produces super-ferrite, high-nitrogen/nitrogen-controlled austenite, and super corrosion resistant austenite with a capacity of 720 thousand tons per year. Fuxin also has a license agreement with JFE Steel Corporation, the second largest Japanese steel manufacturer.

Investigating the Source of the Abnormal Event

The customer's 180MVA 220kV/35kV transformer had abnormal Humming noise occurring randomly over a span of a few months. The cause couldn't be identified by the customer.

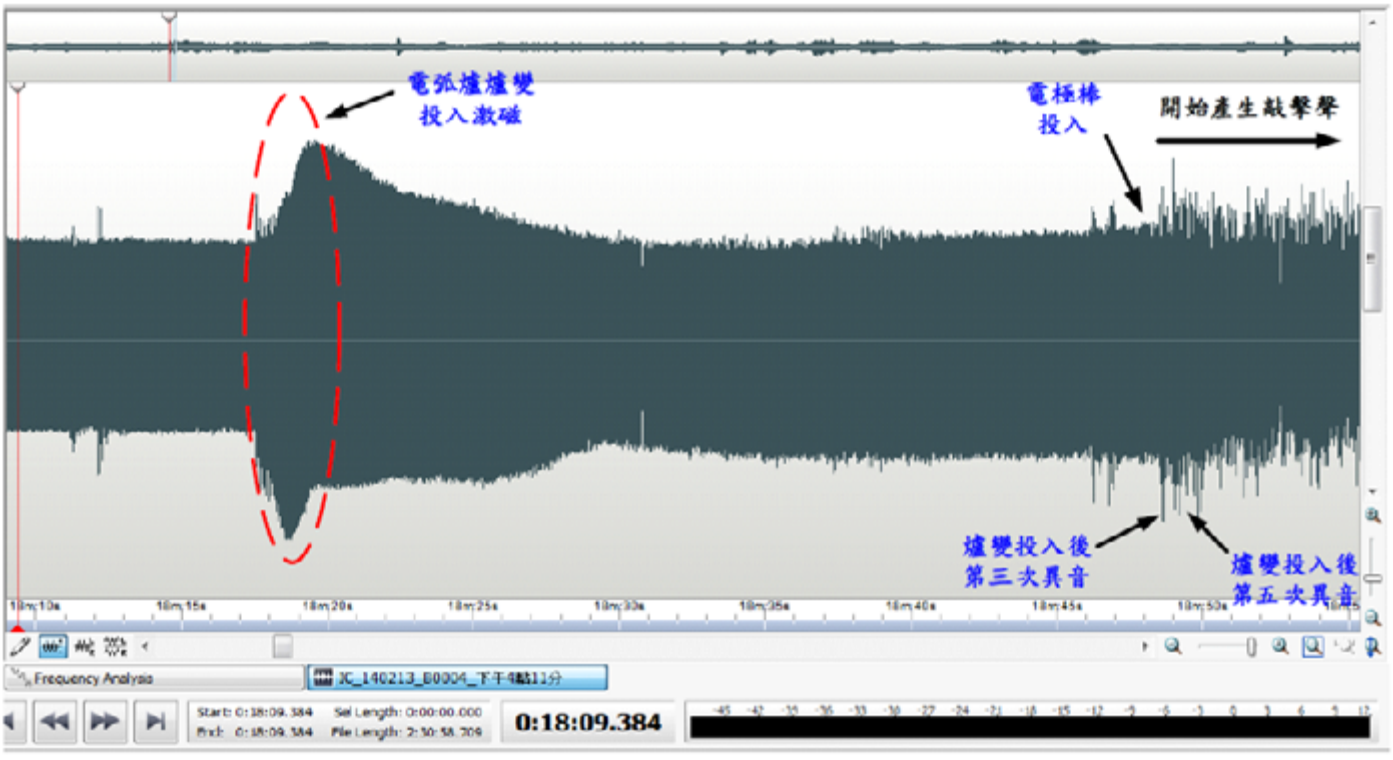
Elspec's agent in Taiwan, PQSense, used a combined method for investigating the problem. The investigation process included the following steps:

1. Continuous audio recording of the transformer's area to identify when the humming noise occurs. The recorder was placed beneath the transformer.
2. Continuously recording the voltages and currents waveform signals with Elspec's G4400 power quality analyzer.
3. Both the audio recorder and the G4400 were synchronized to a real time clock.
4. Cross referencing the audio events with the G4400 recording.
5. Analyzing power quality data during the audio event to identify the root cause.

To make this process possible, a continuous waveform recording was crucial to make sure that waveform data will be recorded during the audio events.

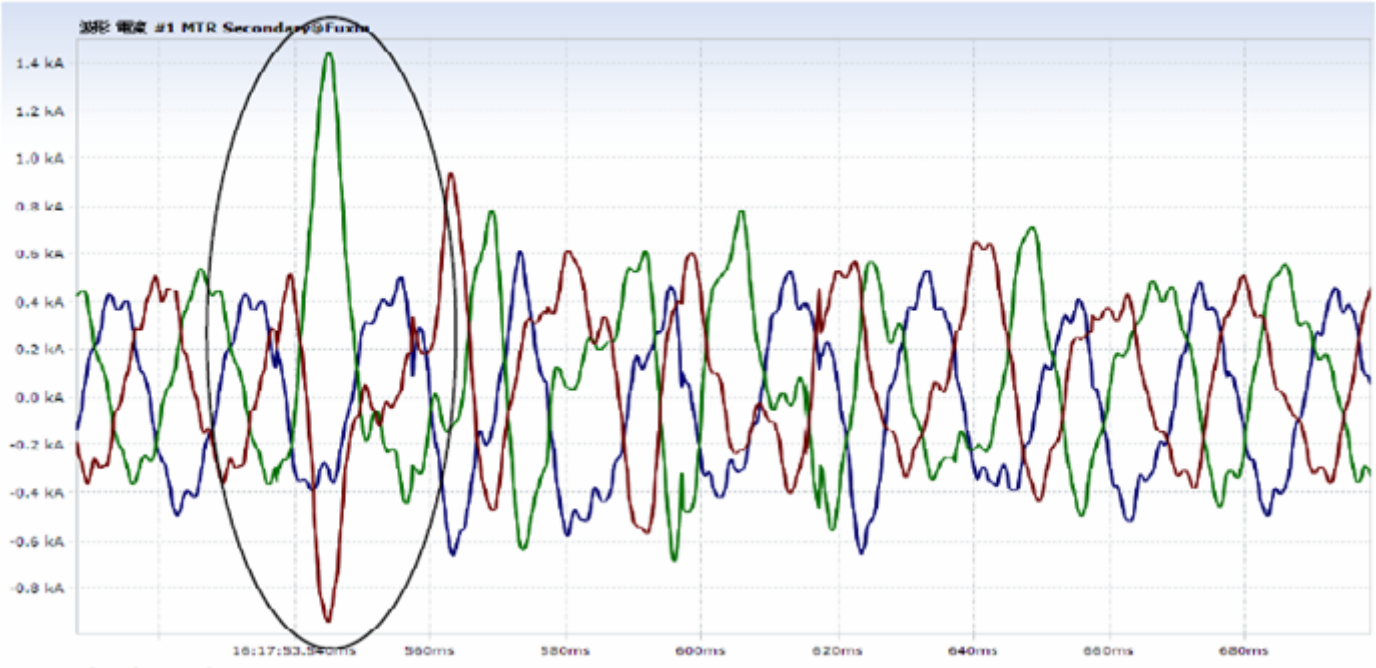
To identify the root cause, it was necessary to have high resolution data during the audio events. During the audio events, typical PQ events were not detected. however, a continuous waveform recording, gave the ability to browse the high-resolution data by time and identify the root cause – inrush Current caused by the SVC.

The results revealed a one cycle current impulse at the times of the humming noise. Further investigation indicated that the customer's SVC system was the cause of this inrush current. SVC systems are crucial for stabilizing the power in industries that work under extremely heavy loads.



Audio recording during the humming sound

½ cycle RMS values during the audio event above



zoom in to the current waveform of the first event above

After the customer SVC system was returned from refinement, additional testing and analysis were performed. No humming noise nor inrush current were detected.

A typical power quality analyzer triggers its high-resolution or waveform recording according to predefined events. Although event thresholds are mostly configurable, lowering the thresholds can result in filling up the memory too quickly while higher thresholds can result with missing events. In addition, as in the case above, in some instances other sensors are required to timestamp the incidence occurrence.

Power quality analyzer with continuous waveform recording eliminates the need for setting up triggers and thresholds and ensures data availability for root cause analysis.