Case Study Installation of Onics Ground and Neutral Filters and Energy Analysis with EMPATH During Installation

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With the increase of nonlinear loads in commercial and industrial facilities an increase in current flow and resulting kilowatt losses in grounds and neutrals are on the rise. These generate I2R, false loads, and add in the cores of sub and main transformers which have a direct impact on energy costs and resulting greenhouse gas emissions (GHG). The potential impact can be measured with portable and continuous monitoring EMPATH electrical signature analyzers through a variety of metering points as well as a pre and post monitoring at utility meters and switchgear. In this case study a mid-sized biodiesel facility we pre-selected based upon power harmonics, ground and neutral analysis is evaluated during Onics installation. EMPATH was connected at switchgear and monitored via the MotorDoc® cloud-system with AI analytics for anomalous activity and energy forecasting (note: for actual energy savings calculations utility kWh data is utilized with MotorDoc data providing granular data for unusual variations).

Onics Energy ground and neutral filters were installed across a two-day period at panel neutrals, grounds, MCC grounds, VFDs, PLCs and other electronic systems. For the case study the facility maintained standard loads until noon and then phased systems out of service for an outage. During the four-hour period about 1/3rd of Onics devices were installed and both the MotorDoc system and an installed Eaton energy monitor were used to observe kilowatt demand changes. This case study will be used to observe the immediate impact of the use of these filters with past experience, based on design, showing a 'burn-in' period of up to 30 days to fully realize savings associated with the application.

Figure 1: MotorDoc(r) ECMS Energy Data Science Dashboard. Red circles represent EMPATH installation outage and outage following April 17 noon outage production changes.

The first four hours of installation during the immediate evaluation period involved lighting-type neutral loads, multiple grouped VFD cabinet grounds, and panels closest to sub and main transformers. Figure 1 shows the history of data to the point of installation and plant shutdown. Figure 2 shows the exported kilowatt demand data from the prior day at 8 am through until noon the day of evaluation. The demand drop is approximately 70 kW from an average of 650 kW resulting in a drop of ~10% usage which is equivalent to kWh.

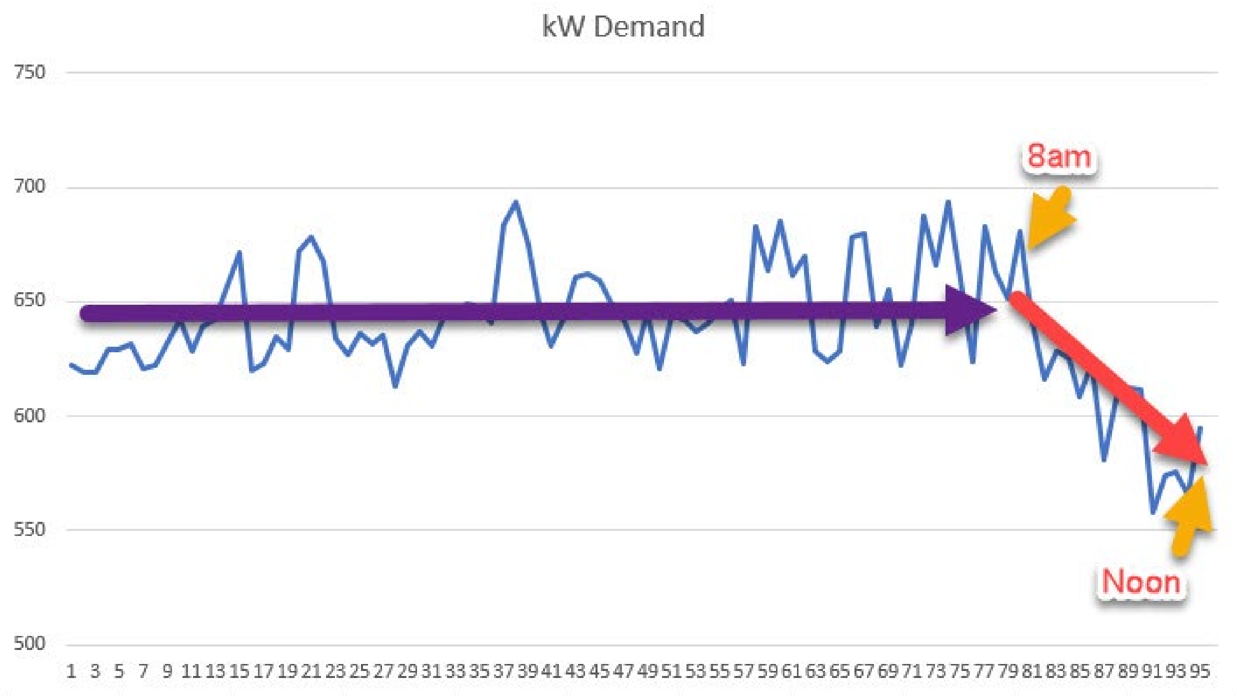

Figure 2: Exported MotorDoc Cloud Monitoring data across the 28-hour period. Average loading calculated by the historical data from the AI. Shutdown starting after noon confirmed following installation.

Following are before and after examples of neutrals and grounds as found through the facility. For purposes of this case study waveforms and values will be presented. An upcoming white paper will provide more in-depth information including post outage values compared to historical data.

MotorDoc® Cloud AI dashboards and analysis are MotorDocAI.io features, functions and algorithms that work with EMPATH, ECMS, and other technologies with anomaly detection, Time to Failure Evaluation (TTFE), energy and GHG forecasting. Energy AI systems focus on power studies and data science while Equipment AI systems relate to a hybrid expert and AI system developed by MotorDocAI.io for technologies such as the EMPATH system. MotorDoc Cloud AI systems are designed for minimized cloud (data center) losses and high efficiency and utilize edge-based pc data analytics to reduce energy-hog online machine learning loads and the customer owning their own data. Contact info@motordoc.com for more information.

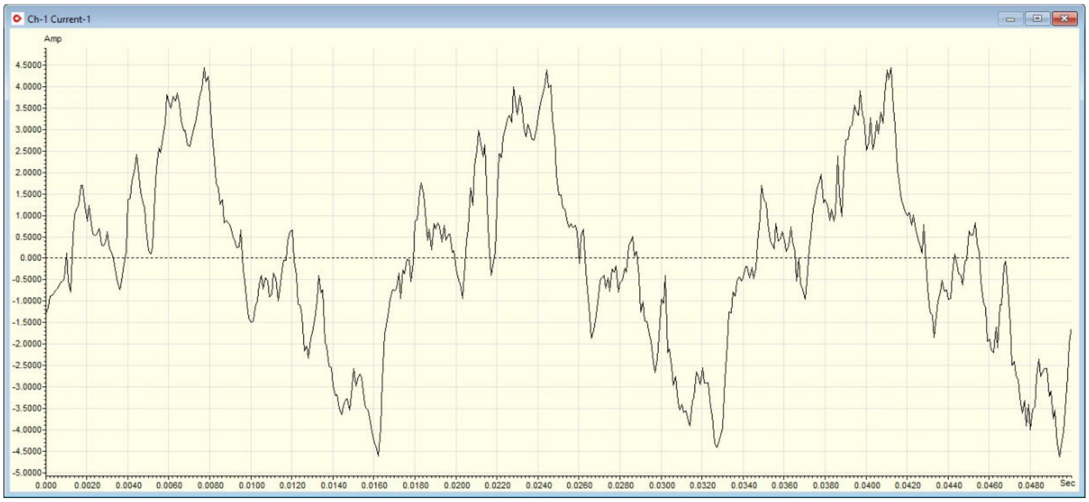

Figure 3: Average current waveforms from lighting-only panels – most read '0' after installation.

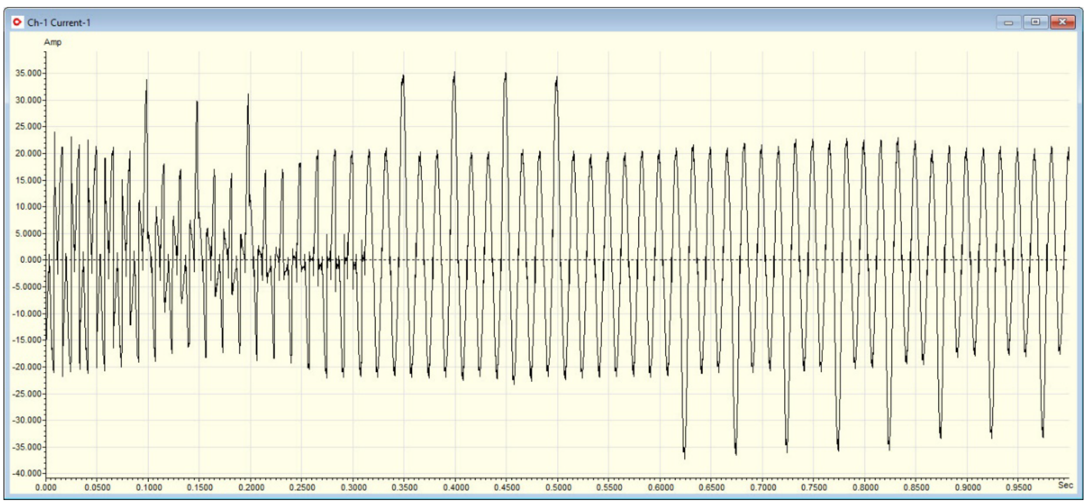

Figure 4: Neutral current on lighting panel that feeds on-site server and related cooling loads before Onics installation.

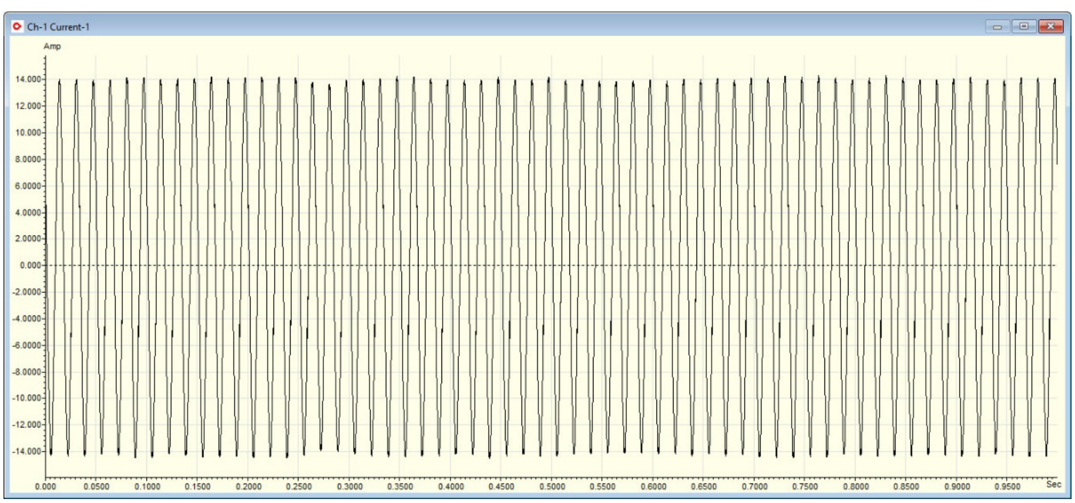

Figure 5: Same panel as Figure 4 immediately after Onics installation.

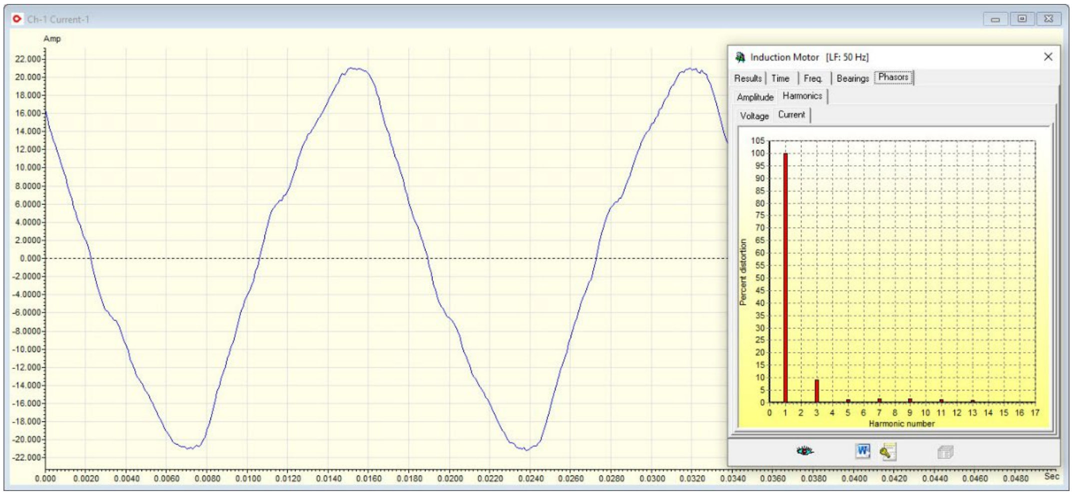

Figure 6: Heat trace panel neutral current before Onics installation.

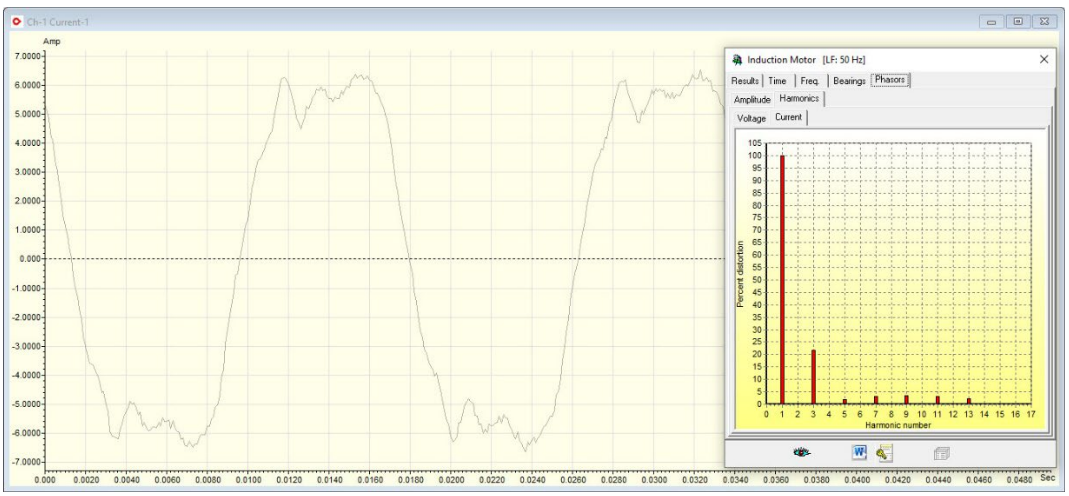

Figure 7: Heat trace panel neutral after Onics installation.

Figure 6 shows a 22 Amp peak while Figure 7 shows that the Onics dropped the current to ~6.5 Amps immediately upon installation. Based on past experiences, as the Onics device operates the tops of the waveform will return to sinusoidal, usually within 72 hours. See Energy-Savings-through-the-Application-of-Neutral-Harmonic-Filter.pdf (motordoc.com) for the case study example demonstrating the change to neutral currents during a burn-in period.

Figure 8: Onics installation on ground in drive panel.

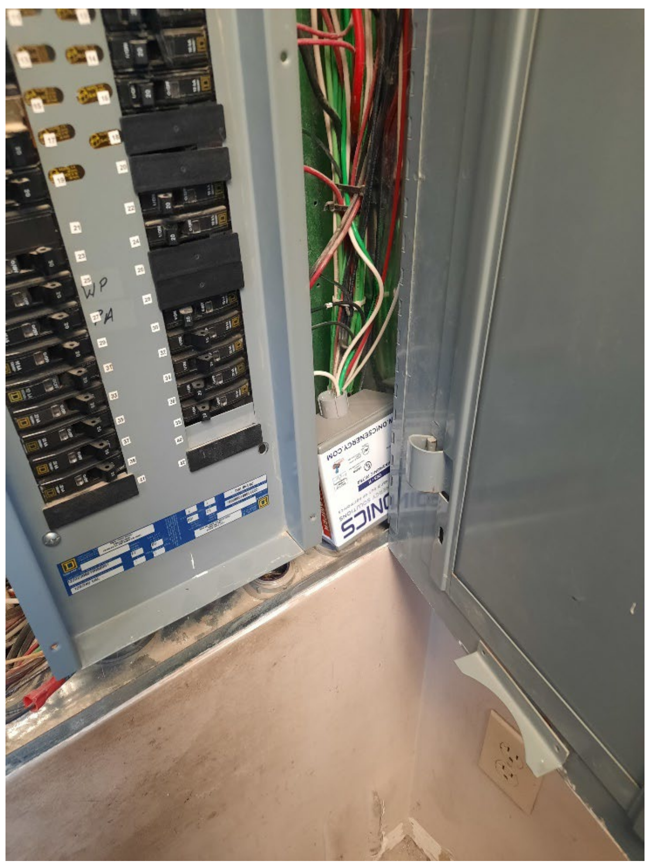

Figure 9: Onics device being installed in lighting panel.

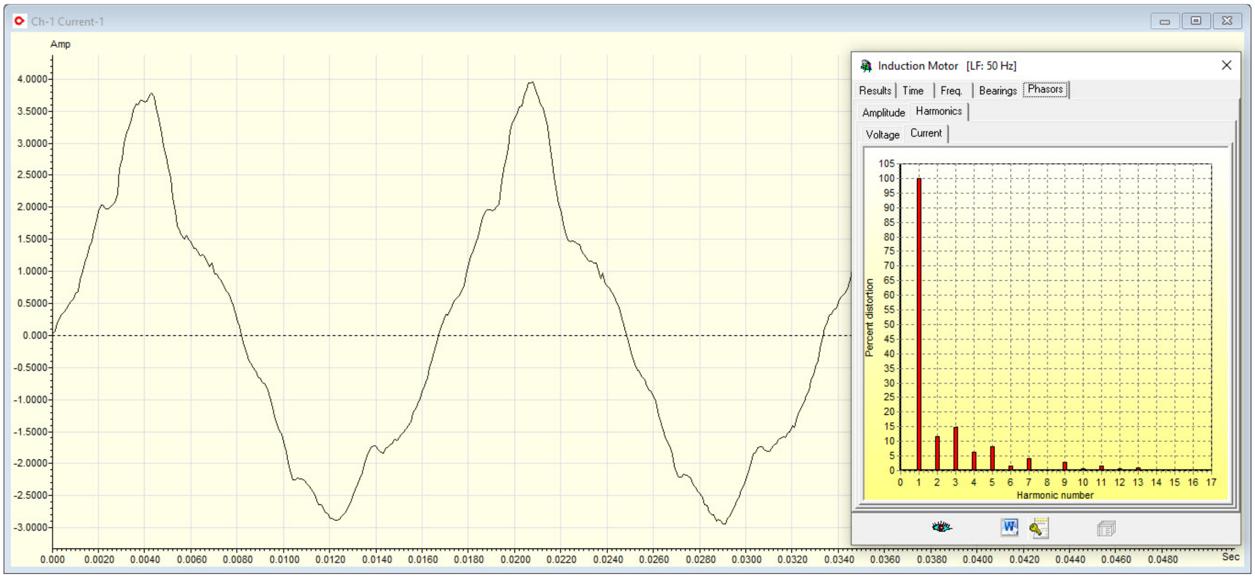

Figure 10: Ground current before Onics installation.

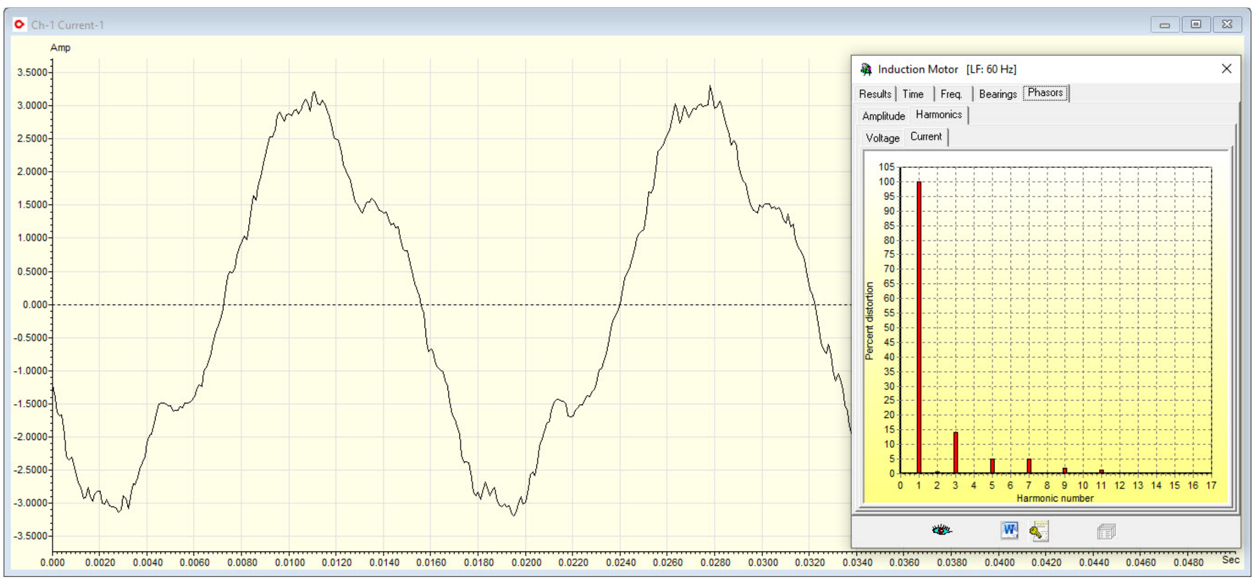

Figure 11: Ground current immediately after Onics installation.

All of the comparisons above are immediately before and after Onics installations with no change in loads. Historically, the changes will continue over 2-4 weeks as the harmonic filters 'burn in' to their applications. The combined use of EMPATH systems, MotorDocAI, and Onics Energy Solutions. Onics devices have been applied across a variety of applications from food processing to hospitals and energy to commercial facilities with similar results. A proper pre-evaluation of the site is necessary to confirm the potential energy impact of ground and neutral applications. These have been found to occur regardless of power harmonic correction and power factor correction systems. The energy reduction in this application for the partial installation is at least 613,200 kWh/year and ~435 metric tonnes CO2 emissions per year. Final results are expected to be much higher.

For more information contact either info@motordoc.com or team@onicsenergy.com