

CASE STORY

Improving Power Quality in a European Data Center Using Comsys Active Harmonic Filters

» **INDUSTRY**
Data Center

» **LOCATION**
Europe

» **TIMELINE**
2026

BACKGROUND

A large European data center experienced increasing harmonic distortion as IT demand and cooling capacity expanded.

Although the facility remained compliant with IEC 61000-2-4 and EN 50160, the customer aimed to further reduce THDu levels to maintain stable operation and ensure sufficient capacity for future expansion.

Backup power operation was another important consideration. The site required stable voltage conditions during generator operation and load transfer events to protect sensitive IT equipment, cooling systems, transformers, and switchgear.

CHALLENGE

Power quality measurements identified THDu levels between 3.5% and 3.9% during chiller operation. The dominant harmonic components were the 5th and 7th harmonics.

The operating environment was highly dynamic. Chiller loads continuously shifted between partial and full load, while generator operation introduced changing network impedance and lower short-circuit capacity. These conditions increased the risk of unstable harmonic behavior under certain operating scenarios.

The project also revealed measurement deviations at elevated current levels caused by current transformer (CT) saturation within the existing measurement chain. This complicated harmonic analysis and filter tuning during peak operating conditions.

The facility required a harmonic mitigation solution capable of maintaining stable performance under varying load conditions while preserving available capacity for future expansion.



SOLUTION

Comsys supplied and commissioned a harmonic mitigation solution based on nine Comsys Active Dynamic Filters (ADF) installed close to the dominant nonlinear loads within the electrical distribution system.

The Comsys Active Harmonic Filters were configured in impedance control mode, where the ADF behaves like an active impedance on the grid, allowing compensation levels to adapt continuously to changing load conditions and network characteristics. Compensation priority focused primarily on the 5th and 7th harmonics, which represented the dominant distortion components across the installation.

The commissioning process included staged load testing under multiple operating conditions, communication and alarm verification, fine-tuning of compensation parameters, and validation during generator operation and load transfer scenarios.

Particular attention was given to maintaining stable filter performance during backup power operation, where reduced short-circuit strength increases sensitivity to harmonic distortion and control instability.

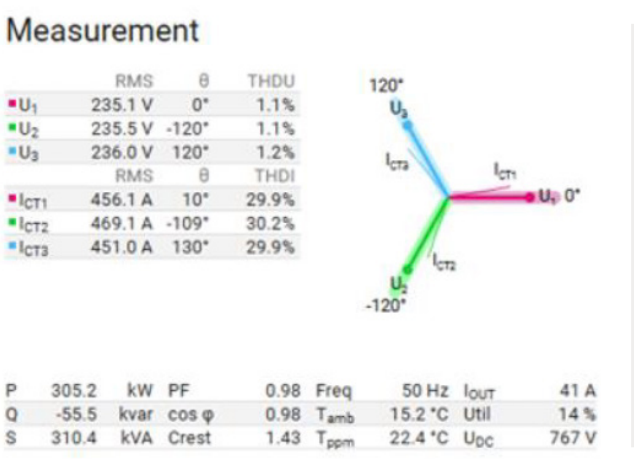
RESULTS

The Comsys Active Harmonic Filters delivered stable harmonic mitigation performance across all tested operating conditions.

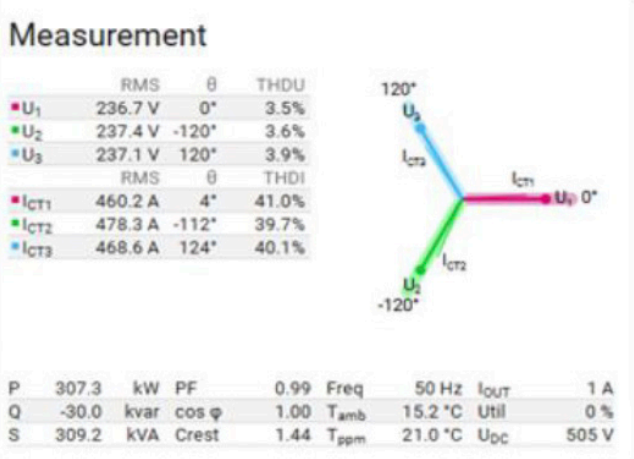
Key outcomes:

- Significant reduction in voltage distortion: THDU decreased from 3.5-3.9% to approximately 1.1% with a single chiller operating at full load.
- Stable performance under partial load conditions: with multiple chillers operating at lower load levels, THDU was consistently maintained around ~1%, demonstrating effective dynamic compensation.
- Controlled distortion at maximum load: at peak system loading, THDU remained within ~5–5.5%, while filter utilization stayed at approximately 50%, confirming substantial remaining capacity for future expansion.
- Reliable operation during backup power scenarios: during generator operation at high load, filter utilization remained below 70%, and the system maintained stable voltage conditions throughout load transfer events, with no adverse interactions observed.

The project demonstrates how active harmonic mitigation can support reliable and scalable operation in modern data center environments with high dynamic load demand and complex backup power requirements.



With the ADF activated and one chiller operating at 100% load, the voltage harmonic distortion (THDU) was reduced to approximately 1.1%.



With the ADF deactivated and one chiller operating at 100% load, the voltage harmonic distortion (THDU) was approximately 3.5–3.9%.



PRODUCT USED IN THIS CASE

ADF P300

- HARMONIC ELIMINATION
- LOAD BALANCING
- DYNAMIC VAR COMPENSATION
- MODULAR & SCALABLE DESIGN
- FLICKER COMPENSATION
- 208-690V NOMINAL VOLTAGE
- CLOSED LOOP, OPEN LOOP & SENSORLESS CONTROL