



YOUR VOLTAGE – OUR PASSION

Case Study

Improving power quality on cruise ships

Case Study



Background

Cruise ships operate while at sea as energy self-sufficient island grids, relying on onboard generators to supply electrical power. Due to limited generator power and high internal impedance, these systems exhibit - compared to an industrial grid (supplied by the public network) - low short-circuit power.

As a result, voltage distortions can occur across a wide frequency spectrum caused by connected loads. Even small capacitive elements, such as those found in EMC filters, can cause resonance phenomena at relatively low frequencies.

In addition, numerous nonlinear loads such as frequency converters, LED lighting, and battery chargers are in use. Their power electronics generate harmonics, which superimpose and distort the supply voltage. The combined effect of harmonics and resonant phenomena can lead to overload or even destruction on connected equipment. This may result in component overheating, erratic behaviour, or even total failure. Such events are especially critical in maritime environments, where reliability and safety are paramount. Electrical disturbances at sea can lead to costly damage, extended downtimes, and disruptions to onboard services and logistics.

- **Where: on board**
- **Industry: cruise ships**
- **Installation date: 2024**
- **Product: SφFIA®-Mod + R&SI-Mod**

Condensator Dominit GmbH

Am Essigturm 14
59929 Brilon, Germany

Phone: +49 2961 782-0
Fax: +49 2961 782-49

info@dominit.eu
www.condensator-dominit.de

Challenges

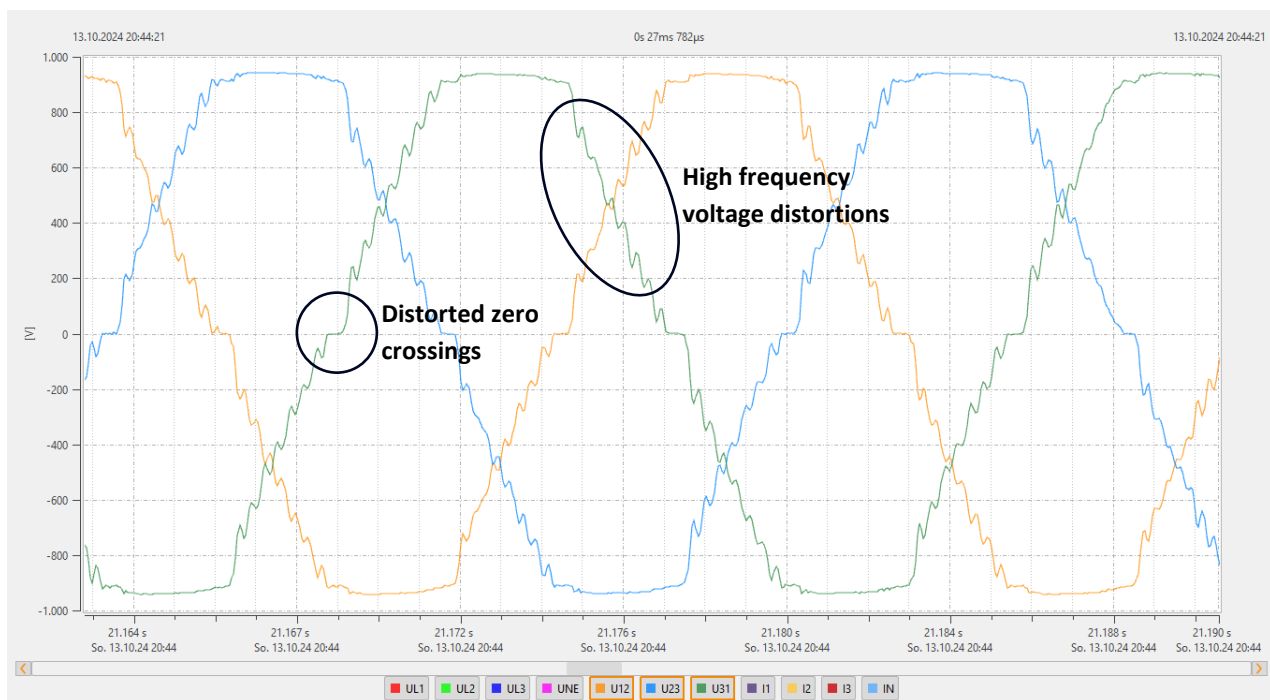
Before installing the modules, there were significant impairments in the voltage quality of the grid (see figure below). Particularly noticeable were overlapping high-frequency voltage distortions. These can place significant stress on network components.

In addition, a flattened voltage peak (so-called Flat-Topping) was observed: for a supply voltage of 690 V (phase-to-phase),

the ideal peak value would be 975 V – however, only 943 V were measured. This deviation can cause problems when recharging the dc link of frequency converters.

Also critical were the clearly distorted zero-crossings with double zero-crossings of the voltage waveform, which can lead to malfunctions of protective systems.

Power quality before installation of the modules



Condensator Dominit GmbH

Am Essigturm 14
59929 Brilon, Germany

Phone: +49 2961 782-0
Fax: +49 2961 782-49

info@dominit.eu
www.condensator-dominit.de

Solution

By using the GridClass® modules the voltage waveform can be effectively smoothed and existing issues fully resolved. With the integration of two SφFIA® modules (voltage-controlled harmonic filters with intelligent adaptation) in the H5 version, the voltage peak is raised to 969 V. In addition, a cleaner waveform is achieved around the zero-crossing points.

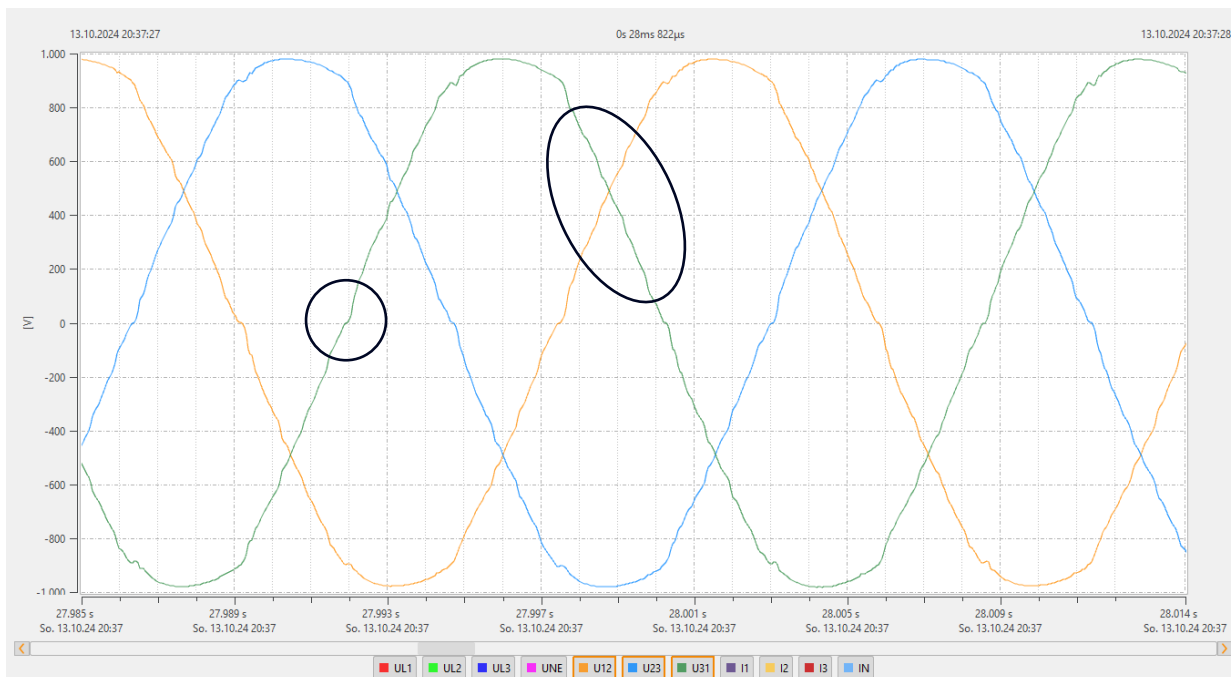
To specifically filter the seventh harmonic, the SφFIA® module in the H7 version is used. All remaining higher-frequency

distortions and resonances are reliably eliminated by one RESI module (Resonance Elimination System).

Thanks to this specific combination the following improvements are achieved:

- **Clean zero crossings,**
- An **increased voltage peak level** and
- **Elimination of high-frequency disturbances** caused by harmonics and resonances

Power quality after installation of the modules



Condensator Dominit GmbH

Am Essigturm 14
59929 Brilon, Germany

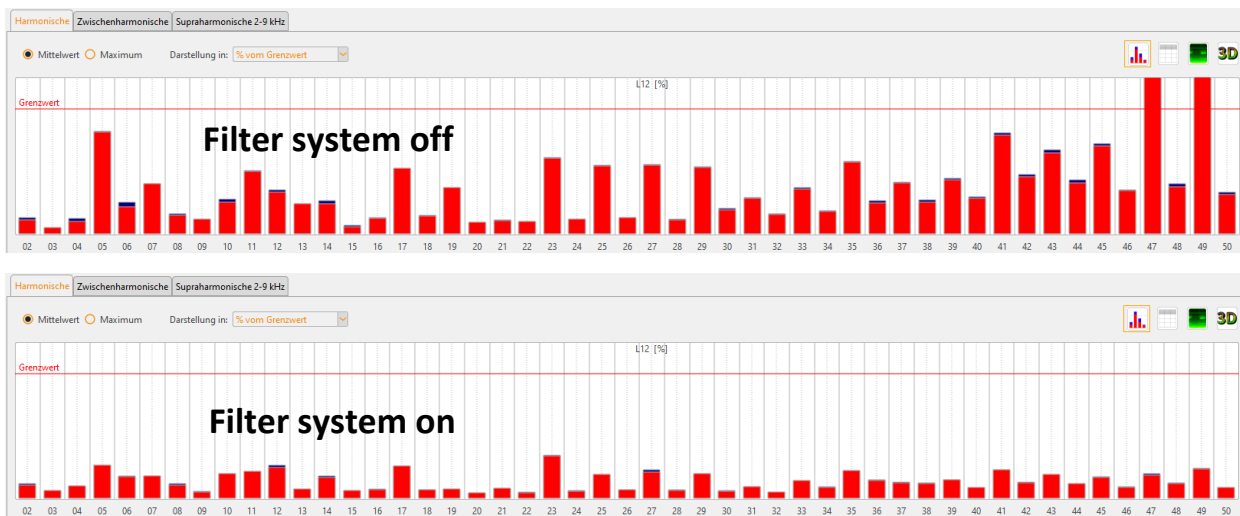
Phone: +49 2961 782-0
Fax: +49 2961 782-49

info@dominit.eu
www.condensator-dominit.de

THD_V before and after switching on the filter modules



Voltage spectrum compared to the limit values according to IEC 61000-2-4, EMV-Klasse 2



Condensator Dominit GmbH

Am Essigturm 14
59929 Brilon, Germany

Phone: +49 2961 782-0
Fax: +49 2961 782-49

info@dominit.eu
www.condensator-dominit.de

Used products



- Filtering higher frequency interferences and resonances
- Passive adaption to network changes
- High performance and reliability
- Easy installation and maintenance

- Filtering of harmonics
- Automatic adaption to network changes
- Overload protection through automatic current limitation
- High performance and reliability
- Easy installation and maintenance
- Low losses



Condensator Dominit GmbH

Am Essigturm 14
59929 Brilon, Germany

Phone: +49 2961 782-0
Fax: +49 2961 782-49

info@dominit.eu
www.condensator-dominit.de