FREQCON

Innovative Grid & Storage Solutions

German Engineering
to energize the World

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The integration of high levels of renewable energy requires decisive measures regarding **Grid Stabilization**. The traditional power network faces complex challenges as wind and solar penetration increases. Our Grid & Storage solutions are designed to play a vital role in future smart grids to ensure system stability of the electrical network while at the same time allowing project developers to harvest additional value streams from grid support services. Our power converter systems are tested and certified based on the German and several European grid codes. We are also compliant with the new VDE guidelines (VDE-AR-N 4105, 4110 and 4120) which govern the implementation of the 2019 EU guidelines.

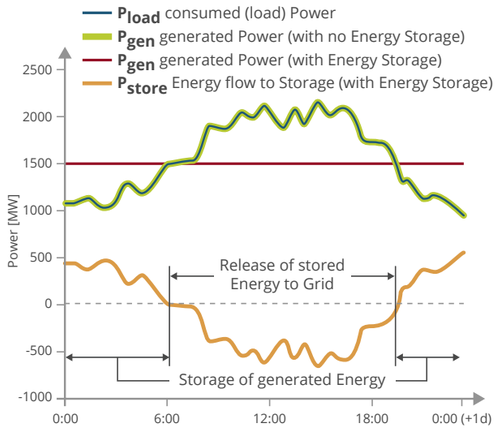
Properties and Capabilities

Functions at a glance

Highest quality, efficiency and reliability

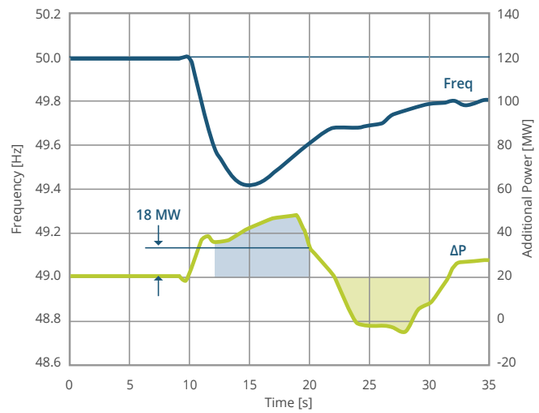
Peak-Load Shifting

Energy Storage offers the possibility to reduce the energy load by shifting it from peak to off-peak hours. This allows for optimized sizing and reduced operation hours of generation assets. During low load phases the batteries are charged by the generator, during peak load the generator supplies the load together with the batteries.



Fast Frequency Response

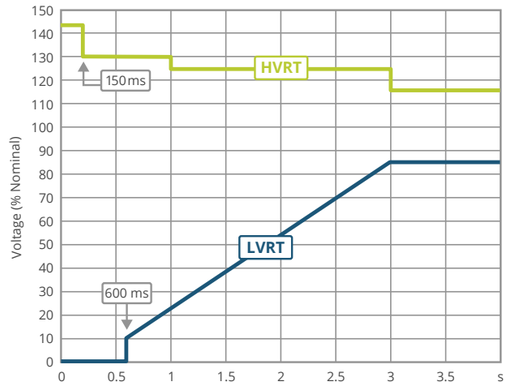
Fast Frequency Response (FFR) is defined as active power support to the grid that is available within 2 seconds of the start of a frequency event and is sustained for at least eight seconds. (EirGrid Grid Code). FFR stabilizes the grid in case of frequency drops and allows a higher level of renewable penetration.



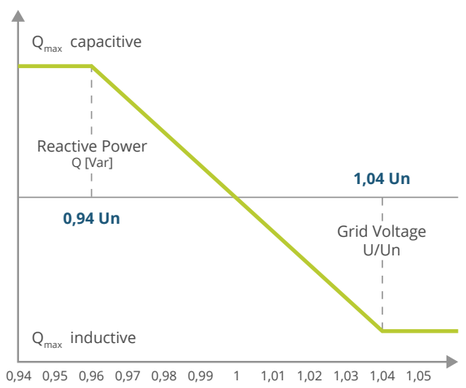
Reactive Power Compensation

The reactive power capability of the power converter enables fulfillment of severe grid code requirements regarding different “Fault-Ride-Through” scenarios. It also allows voltage stabilization by delivering capacitive or inductive reactive power.

Low (LRVT) / High (HRVT) Voltage Ride Through



Voltage Regulation



Battery-to-Grid Converter (B2G)

The **B2G Converter** is a highly efficient modular full power converter for battery storage systems with liquid-cooled IGBT-power-stacks and ultra-fast control system in the power range 250 kW to 6.0 MW+.

The **B2G Converter** provides advanced grid support services, e.g. **Enhanced Frequency Response** (UK) and **Primary Operating Reserve** (IRL) as well as **Reactive Power Compensation** for highly **Dynamic Grid Voltage Control.** Suitable for large-scale battery storage plants up to 100 MW through modular and containerized design.

Data Sheet

	B2G 250	B2G 500	B2G 750	B2G 1000	B2G 1500	B2G 2000	B2G 3000	B2G 4000	B2G 4500	B2G 6000
Rated output power (kW)	250	500	750	1000	1500	2000	3000	4000	4500	6000
Rated output current (A)	235	465	700	930	1395	1865	2795	3725	4190	5585
Rated output frequency (Hz)*	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Number of DC-Inputs **	1	1	2	2	3	4	6	8	10	12
Total weight (kg)	1800	2000	2200	2400	2800	3600	4800	6200	7600	8800
Number of cabinet units	1	1	1	1	1	1	1	2	2	3
Converter dimensions (WxDxH) in mm	2400	2400	3000	3000	3400	4200	4800	2 x 4200	2 x 4800	2 x 4800
	600	600	600	600	600	600	600	600	600	600
	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
Rated output voltage AC	620 V									
Range input voltage DC	200 ... 1200 V DC									
Power factor range	0.9 cap ... 0.9 ind									
Total harmonic distortion	< 3%									
Maximum efficiency	> 98%									
Principle	IGBT									
IGBT switching frequency (kHz)	2 ... 4 kHz									
Protection class	IP 54									
Temperature range	-20°C ... +50°C									
Cooling principle	liquid cooling									
Main controller	Siemens Simotion P320-4 or similar									
Internal communication bus	Profinet IRT									
External communication interfaces	Ethernet / TCP/IP									

* project-specific DC-Inputs possible

Battery Energy Storage System (BESS)

The **BESS** consists of battery-to-grid converter, rack-mounted batteries, battery management system, control system and fire suppression system. For most applications li-ion batteries are the preferred choice and FREQCON co-operates with several tier-1 battery manufacturers. The **BESS** comes either as a containerized solution for outdoor deployment or in multiple cabinets for indoor installation.

Respecting all relevant grid code requirements the **BESS** allows the operator to provide a number of grid support services and harvest multiple value streams.

Data Sheet

	BESS 250	BESS 500	BESS 750	BESS 1000	BESS 1500	BESS 2000	BESS 3000
Rated output power (kW)	250	500	750	1000	1500	2000	3000
Storage capacity (kWh)	250	500	750	1000	500	750	1000
Rated output current (A)	235	465	700	930	1395	1865	2795
Rated output frequency (Hz)*	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Weight (kg)	7950	11900	15850	21500	12700	18950	23900
Container	20ft	20ft	20ft	40ft	20ft	40ft	40ft
Battery Chemistry	Lithium-Ion						
Rated output voltage AC	620 V						
Power factor range	0.95 cap ... 0.95 ind						
Total harmonic distortion	< 3%						
Maximum efficiency	> 98%						
Principle	IGBT						
IGBT switching frequency (kHz)	2 ... 4 kHz						
Protection class	IP 54						
Temperature range	-20°C ... +50°C						
Cooling principle	liquid cooling						
Main controller	Siemens Simotion P320-4 or similar						
Internal communication bus	Profinet IRT						
External communication interfaces	Ethernet / TCP/IP						

Multi-Source Converter (MSC)

The **MSC** is a hybrid power converter based on the Multi-Source Concept. Multiple energy sources can be connected to the DC-link of the power converter, thus reducing installation costs and achieving a higher level of system integration in **Grid Stabilization** projects.

In a hybrid flywheel-battery project the **MSC** can connect both the flywheels as well as the batteries to the grid, ensuring optimized power flows and a unified control system.

In a hybrid ultracapacitor-diesel-generator project the **MSC** can connect both energy sources to the grid, ensuring immediate active power injection and seamless transition from ultracapacitor to generator-operation.

Data Sheet

	MSC 250	MSC 500	MSC 750	MSC 1000	MSC 1500	MSC 2000	MSC 3000
Rated output power (kW)	250	500	750	1000	1500	2000	3000
Rated output current (A)	235	465	700	930	1395	1865	2795
Rated output frequency (Hz)*	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Number of DC-Inputs **	1	1	2	2	3	4	6
Weight (kg)	1800	2000	2200	2400	2800	3600	4800
Number of cabinet units	1	1	1	1	1	2	2
Converter dimensions (WxDxH) in mm	3000	3000	3000	3600	4200	2 x 3600	2 x 4200
	600	600	600	600	600	600	600
	2200	2200	2200	2200	2200	2200	2200
Rated output voltage AC	620 V						
Range input voltage DC	200 ... 1200 V DC						
Power factor range	0.9 cap ... 0.9 ind						
Total harmonic distortion	< 3%						
Maximum efficiency	> 98%						
Principle	IGBT						
IGBT switching frequency (kHz)	2 ... 4 kHz						
Protection class	IP 54						
Temperature range	-20°C ... +50°C						
Cooling principle	liquid cooling						
Main controller	Siemens Simotion P320-4 or similar						
Internal communication bus	Profinet IRT						
External communication interfaces	Ethernet / TCP/IP						

* project-specific DC-Inputs possible

Ultracapacitor Grid Stabilizer (UGS)

The **UGS** combines the STATCOM capabilities of an IGBT-power converter with active power support based on high-power Maxwell ultracapacitors. The UGS can provide voltage and frequency stabilization in transmission or distribution networks with high renewable penetration.

Respecting all relevant grid code requirements the **UGS** allows the operator to provide a number of grid support services and harvest multiple value streams.

Data Sheet

	UGS 250	UGS 500	UGS 750	UGS 1000	UGS 1500	UGS 2000	UGS 3000	UGS 4000
Rated output power (kW)	250	500	750	1000	1500	2000	3000	4000
Storage capacity (MWsec)*	2.5	5.0	7.5	10.0	15.0	20.0	30.0	40.0
Rated output current (A)	235	465	700	930	1395	1865	2795	3725
Rated output frequency (Hz)**	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Weight (kg)	3700	4800	5900	8400	10600	14900	19700	24400
Container	10ft	10ft	10ft	20ft	20ft	40ft	40ft	40ft
Rated output voltage AC	620 V							
Active Power Support *	Rated power for 10 seconds							
Power factor range	0.95 cap ... 0.95 ind							
Total harmonic distortion	< 3%							
Maximum efficiency	> 98%							
Principle	IGBT							
IGBT switching frequency (kHz)	2 ... 4 kHz							
Protection class	IP 54							
Temperature range	-20°C ... +50°C							
Cooling principle	liquid cooling							
Main controller	Siemens Simotion P320-4 or similar							
Internal communication bus	Profinet IRT							
External communication interfaces	Ethernet / TCP/IP							

* project-specific dimensioning possible

Uninterruptible Power Supply (UPS)

The **Ultracapacitor UPS** provides short-term back-up power and can mitigate process disruptions from frequency or voltage dips based on ultra-fast detection of grid events and successive injection of active or reactive power. The Ultracapacitor UPS System can provide transition power up to 30 seconds until a longer-term back-up source like diesel generator is up and running, thus replacing lead-acid batteries with their limited life expectancy.

Data Sheet

	U-UPS 250	U-UPS 500	U-UPS 750	U-UPS 1000	U-UPS 1500	U-UPS 2000	U-UPS 3000	U-UPS 4000
Rated output power (kW)	250	500	750	1000	1500	2000	3000	4000
Storage capacity (MWsec)*	0.25	0.5	0.75	1.0	1.5	2.0	3.0	4.0
Rated output current (A)	235	465	700	930	1395	1865	2795	3725
Rated output frequency (Hz)**	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Weight (kg)	3300	3600	3900	5300	5900	6700	8600	11800
Container	10ft	10ft	10ft	20ft	20ft	20ft	20ft	40ft
Rated output voltage AC	620 V							
Active Power Support *	Rated power for 1 second							
Power factor range	0.95 cap ... 0.95 ind							
Total harmonic distortion	< 3%							
Maximum efficiency	> 98%							
Principle	IGBT							
IGBT switching frequency (kHz)	2 ... 4 kHz							
Protection class	IP 54							
Temperature range	-20°C ... +50°C							
Cooling principle	liquid cooling							
Main controller	Siemens Simotion P320-4 or similar							
Internal communication bus	Profinet IRT							
External communication interfaces	Ethernet / TCP/IP							

* project-specific dimensioning possible

STATCOM Converter

The **STATCOM Converter** is designed to compensate reactive power created by long transmission cables and transformers in wind farms or solar farms.

The **STATCOM Converter** provides highly dynamic response to be used in voltage control mode in order to stabilize the grid voltage. The voltage control can be performed either in standalone mode or by measuring the medium voltage line.

The **STATCOM Converter** is able to reduce harmonic distortion caused by nonlinear consumers.

Data Sheet

	STC 1000	STC 2000	STC 3000	STC 4000	STC 5000	STC 6000
Rated output power (kVA)	1000	2000	3000	4000	5000	6000
Rated output current (A)	930	1865	2795	3725	4655	5585
Rated output frequency (Hz)*	50/60	50/60	50/60	50/60	50/60	50/60
Weight (kg)	2400	3600	4800	6200	7600	8800
Number of cabinet units	1	1	1	2	2	2
Converter dimensions (WxDxH) in mm	3000	4200	4800	2 x 4200	2 x 4800	2 x 4800
	800	800	800	800	800	800
	2200	2200	2200	2200	2200	2200
Rated output voltage (V)	620					
Power factor range	0.0 ... 1.0 cap / 0.0 ... 1.0 ind					
Total harmonic distortion	< 3%					
Maximum efficiency	> 98%					
Principle	IGBT					
IGBT switching frequency (kHz)	2 ... 4 kHz					
Protection class	IP 54					
Temperature range	-20°C ... +50°C					
Cooling principle	liquid cooling					
Main controller	Siemens Simotion P320-4 or similar					
Internal communication bus	Profinet IRT					
External communication interfaces	Ethernet / TCP/IP					

FREQCON

One of the leading companies in renewable energy integration

FREQCON is one of the leading German manufacturers of power converters and control systems for renewable energy systems and energy storage applications.

The family-owned company was founded in 1988 and trades as FREQCON GmbH since 2005. FREQCON is one of the pioneering companies of the modern wind turbine industry, introducing full-scale power converters to the market almost 30 years ago.

Efficient and reliable grid integration

FREQCON's power converter and control systems allow efficient and reliable grid integration of wind turbines and energy storage systems. We provide solutions for grid-connected systems as well as island grid systems. Our products cover the whole range from kW-size to Multi-MW-systems. Beside our standard product portfolio we also offer customer-specific solutions according to your project requirements.

All our power converters are designed and manufactured in-house and the control software is developed by our own software engineers. This deep knowledge about our own products ensures a high quality standard and professional customer support.

FREQCON has a strong focus on research & development and co-operates with a number of universities and research institutes from all over the world.

Our products are deployed world-wide in applications with more than 45 GW installed capacity.

German Renewables Award

GERMAN RENEWABLES 2014 AWARD

GERMAN RENEWABLES 2016 AWARD

The German Renewables Award competition started in 2012 and is organised by the Renewable Energy Hamburg Cluster Agency. Every year different companies and projects are awarded in 4 different categories for outstanding achievements. FREQCON is proud to have received the award for „product innovation of the year" in both 2014 and 2016.

Wind turbine with integrated battery storage

In 2014 FREQCON and Qreon GmbH jointly developed a 2 MW wind turbine design with integrated battery storage system and won the „innovative product award". The integrated storage system makes the wind turbine very suitable for „weak-grid projects" and allows off-grid operation for extended periods of time.

Ultracapacitor Grid Stabilizer (UGS)

In 2016 FREQCON received the award for the newly developed UGS Ultracapacitor Grid Stabilizer for dynamic voltage and frequency regulation. The UGS combines the STATCOM capabilities of an IGBT-Power Converter with active power support based on high-power Maxwell Ultracapacitors. Compared to other technologies this solution offers improved efficiency, combined with lower investment and operational costs.

The newly developed UGS Grid Stabilizer won the German Renewables Award 2016

Contacts

FREQCON Germany

FREQCON GmbH
Bürgerwiesenweg 5
27336 Rethem, GERMANY
Phone: +49 5165 291760 – 0
info@freqcon.com

FREQCON Ireland + UK

Boyle Enterprise Centre
Quarry Lane, Boyle
Co. Roscommon, IRELAND
Phone: +353 71 9663003
k.harder@freqcon.com

Our partner in Italy

ATME S.p.A.
Via Primo Maggio, 8
20068 Peschiera Borromeo (MI), ITALY
Phone: +39 02 55308392
info@atmespa.it

FREQCON