REVCON *Optimizing your drive!*





Product Catalog

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Optimizing your drive!

ELTROPLAN-REVCON

ELTROPLAN-REVCON is a medium sized company located in the western part of Germany. Since more than 25 years, REVCON has been active in the field of drive engineering and stands for innovation, versatility and high performance.

Our product portfolio includes high performance passive and active harmonic filter, regen units and many other components orbit the variable frequency drive. The components can be used with any VFD type and are used in all markets.



REVCON Power Quality and Regen Energy solutions are unique and follow our 3 main principles:

1. Universal: REVCON products are used with all brands on the market, and therefore require to be universal and simple. Just Plug & Play!

2. Efficient: REVCON Focus on the solutions with the highest efficiency. Therefore REVCON solutions create up to 75% less powerloss, at the same or better performance.

3. Durable: Against the trend on most markets, REVCON Produce high quality products, designed for decades, without any predetermined breaking point.

The key advantage of our solutions is a significant size and efficiency benefit.

Our passive harmonic filter RHF-8P and RHF-5P are the leading brand on the market and is used in various HVAC applications around the world. The brand new active filter RHF-Active show some unique advantages compared to other active harmonic filter technologies.

REVCON is cooperating with all mayor drive brands and our products can be REVCON labelled or brand-labelled.

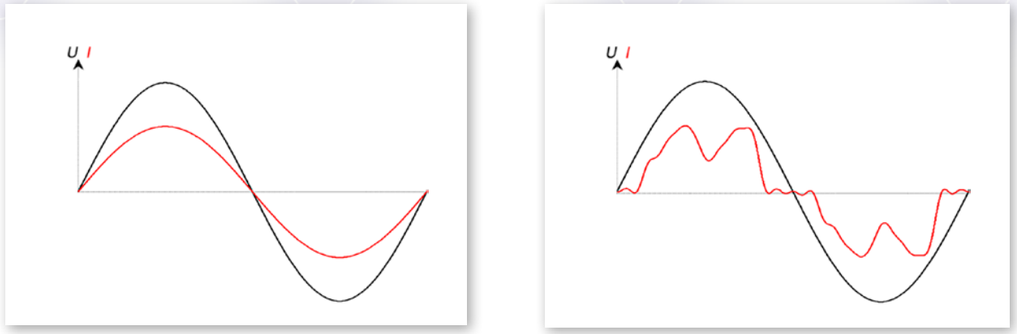
Beside our main principles, another advantage of REVCON is our ability to adapt our products into the needs of the customer while still providing a competitive price.

HARMONIC DISTORTION, one of the biggest POWER QUALITY issues

“Alternating current is the form in which electric power is delivered to businesses and residences […]. The usual waveform of alternating current in most electric power circuits is a sine wave!” (Wikipedia)

Unfortunately, the Wikipedia statement above is incorrect, or at least simplified. The true waveform of our power supply is far away from an ideal sine wave. But how is this possible as most Generators produce a more or less pure sine wave output, who is the bad guy?

The voltage distortion caused by one 200kW drive, is about the same as 7,000 x 10W USB charger. REVCON harmonic solutions may be used in various applications, but are optimized for drive applications.



The red signal in the second picture is showing the input-current-shape of a standard drive with about 4% inductance and clearly, this is far away from sinus. Of course, the input-current-shape of any drive without inductance is significantly worse.

Linear and non-linear load

Electrical loads where the current is not proportional to the voltage are called non-linear loads. Linear loads are pure sinusoidal, and either resistive, inductive or capacitive.

Although there are many different sources of harmonic distortion, a very significant part is caused by variable frequency drives (VFD).

Evaluation of harmonic distortion.

The THD Total Harmonic Distortion is the most used evaluation for harmonic distortion, and is defined for voltage THDv and current THDi, both typically consider the harmonics up to the 40th.

$$THDi = \frac{\sqrt{\sum_{n=2}^{n=40} I_n^2}}{I_1} \cdot 100\% = \frac{\sqrt{I_{h2}^2 + I_{h3}^2 + I_{h4}^2 + I_{h5}^2 + I_{h6}^2 + \cdots + I_{h40}^2}}{I_1} \cdot 100\%$$

Basically the THD is a good evaluation for Harmonic Distortion but it is not sufficient to give a full evaluation of the problems that may be caused by harmonics. Please visit www.revcon.de or read our “Harmonic Solution Guide” for more detailed information.

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Occurring problems

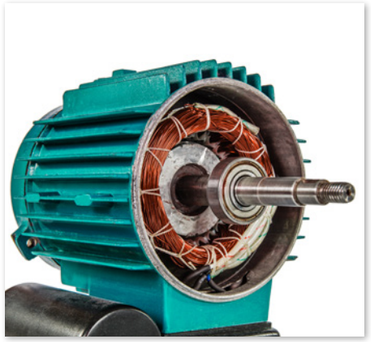
Basically the distortion of the current itself is not a significant problem for the equipment. But due to the impedance of the system, the non-sinusoidal current is causing a distortion one the mains supply. This distortion on the voltage affects each connected equipment.



Transformers and PFC. Significant increase of power loss on any inductances or capacity results in reduced rating, lower expected lifetime, lower efficiency or even damaged equipment.

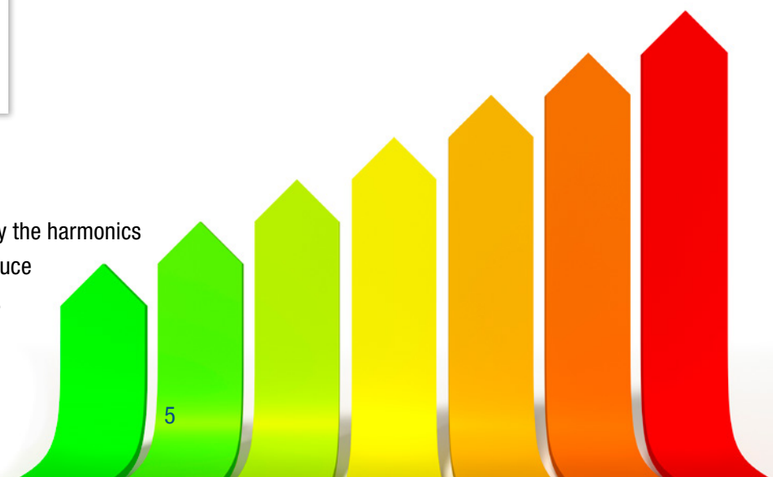


Electronic equipment usually have a rectifier with capacitor input, whose lifetime is significantly affected by voltage distortion. This results in immediate damage or significant reduced lifetime.



Motors and Generators direct on line follow the connected frequency! Supply voltage with additional frequencies (harmonics) are lethal for both mechanical and electrical side.

System Efficiency is directly affected by the harmonics as nearly all equipment and wires produce more heat when voltage distortion rise.



REVCON Harmonic Filter *1.1kW – 800kW*

RHF-8P and RHF-5P are high efficient two-stage passive Harmonic Filter used to avoid mains distortion caused by non-linear loads such as variable frequency drives VFDs.



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HARMONIC DISTORTION

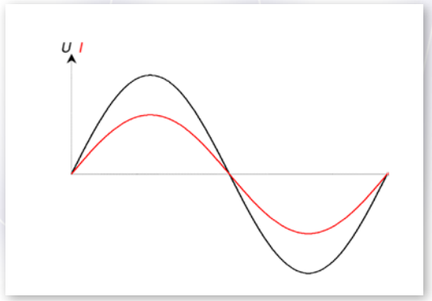
Ideally, all loads and sources have a pure sinusoidal current waveform. But unfortunately the true waveform of most equipment is very different. Nonlinear loads like for example the diode input bridge of a 6-pulse drive are causing a distortion of the mains voltage.

This distortion typically evaluated by the Total Harmonic Distortion THD, evaluates frequencies from the 2nd up to the 50th harmonic. In a 50Hz Network this is the area between 100Hz and 2,5kHz.

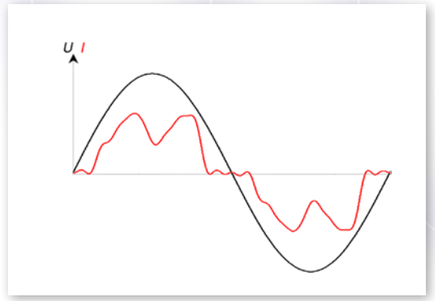


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The impact of the voltage distortion is diverse, and the most typical effect is overheat of transformer and PFC applications (Capacitor banks). An underestimated impact of harmonic distortion is the significantly reduced lifetime expectation of electrical and mechanical equipment.



LINEAR LOAD
Picture 1.1: This picture is showing a pure resistive load. The current (red) is in phase with the voltage (black). Except for the difference in amplitude, the signal of voltage and current are equal.



NON-LINEAR LOAD
Picture 1.4 is showing a typical rectifier input bridge of a B6 diode bridge and a DC choke of ~4%. The current (red) is almost in phase with the voltage (black) but the current waveform is very different from sinusoidal.

REVCON HARMONIC FILTER

The REVCON Harmonic Filter reduces the THDi of nonlinear loads and sources to significantly below 5% (optional <10%) even under realistic circumstances including imbalance and pre-distortion. This is necessary to reach various standards and recommendations, such as IEEE 519-2014. Typically, the filter reduces the THDi from 35% to ~3%, with a smooth damping across the full spectrum.

Typical single stage passive harmonic filters are tuned to 250Hz and therefore focus mainly on the 5th harmonic. The two stage harmonic filter RHF works like a bandwidth filter due to its unique circuit and reduces all harmonics up to ~60. As a bonus, this patented filter circuit do not cause any DC-voltage drop inside the drive. It reaches an efficiency of up to 99.5% and therefore the produced power losses are up to 75% less than those produced by comparable solutions.

~3% THDi
Full DC-Bus voltage
-70% Power Loss!

All our filters are available for all low voltage 3-phase supplies and covers power from 1.1kW up to 800kW, with an open end in parallel setup!

Active REVCON Harmonic Filter

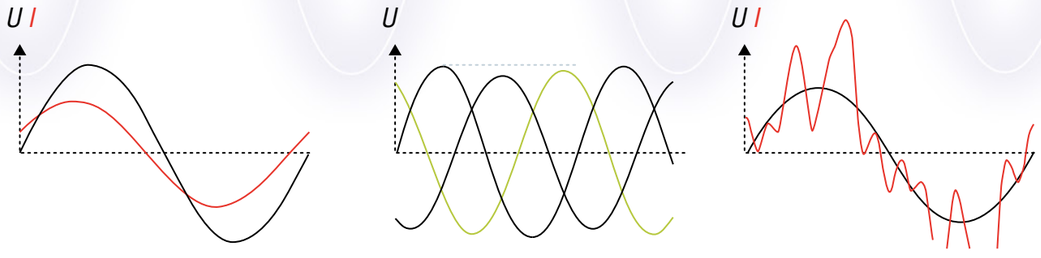
RHF-Active is a high efficient design used to avoid mains distortion caused by any non-linear load

All RHF-Active are available as using a unique Silicon Carbide (SiC) MOSFET topology. This technology offers significant benefits in size, performance and efficiency.

The efficiency of a RHF-Active SiC harmonic filter ~98.4% and therefore produce about 57% less heat than comparable solutions based on IGBT technology. Looking at the RHF-Active as a Harmonic solution for drives, the system efficiency i s >99.5%. This is the most efficient harmonic solution available in the market.

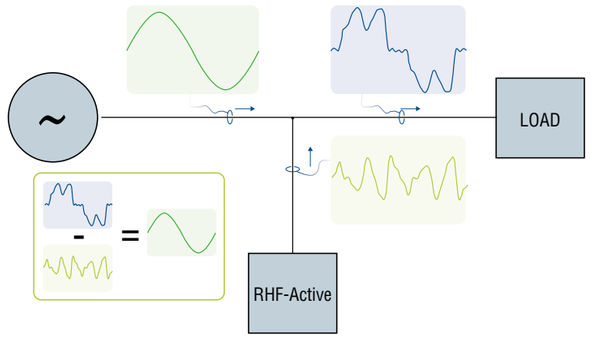
The SiC based acvtive filter are available for every application, starting from 3.5A up to 150A as an individual module. Ratings up to 1500A are realized by parallel Master-Master configurations which ensures a higher reliability of the application.

Due to the high switching frequency of >50kHz, not only the performance of the RHF-Active is unique. In addition harmonics of higher order as created from IGBT based solutions are avoided.



The RHF-Active may be used for pf correction, unbalance compensation, harmonic mitigation or altogether. It reduces the harmonic current distortion of non-linear loads and sources to any required THDi. This is necessary to reach various standards and recommendations, such as IEEE 519-2014.

A high switching frequency allows for efficient and accurate compensation of high order harmonics up to 61st. Due to its unique circuit, the RHF-Active is extremely efficient which allows for a very compact design. All RHF-Active can be used as 3P4W or 3P3W for 380-415V systems (further voltage levels coming soon!). Unlimited current possibilities due to open end in parallel setup!



The working principle of an active REVCON Harmonic Filter RHF-Active is completely different from any other harmonic solution. Instead of working as a line filter with tuned passive filter circuits, the active solution is connected in parallel and injects harmonics. These injected harmonics are of inversed polarity and therefore eliminate the harmonics taken from the supply.

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Regen energy and the law of conservation of energy

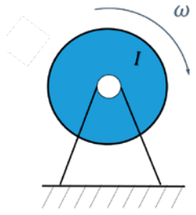
"In physics and chemistry, the law of conservation of energy states that the total energy of an isolated system remains constant; […] energy can neither be created nor destroyed; rather, it can only be transformed or transferred from one form to another." (Wikipedia)

Basically, the above statement means, that we do not consume energy, we just convert it into a form that is technically hard to reach. The purpose of REVCON regen units is to convert this energy into a useable form – electricity - instead of transferring it into heat. Besides the obvious benefit in energy "consumption", this results in a more compact panel design.

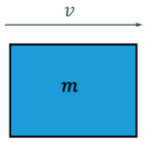
The most typical sources for regen applications are potential energy and kinetic energy.

Kinetic Energy can be found in any drive application as even the motor itself stores energy in its rotating mass. The most common application for regeneration rotating kinetic energy is a centrifuge. Designed to run up and down every few minutes or even seconds, every ramp down a significant amount of energy can be used by other equipment if the drive is equipped with a regen unit. Potential Energy is everywhere, but the most well-known application is the crane. Due to the horizontal movement and the rotating components, this application unifies all above mentioned energy storage.

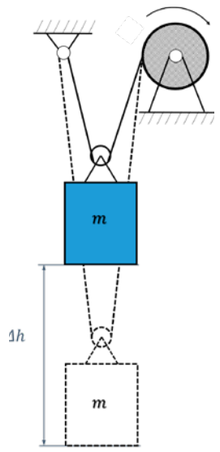
Imagine a harbour gantry crane with total weight of 50t moving with 7.5km/h, and lifting a container of 33t to 14m. The energy stored in this system is about 1.4kWh. That's the same amount of energy as stored in 466 alkaline batteries size AA. Now imagine the same crane running with an average of 720 movement a day, feeding 367MWh a year into a resistor in order to heat up the planet. That's the energy of 122.5 million batteries.



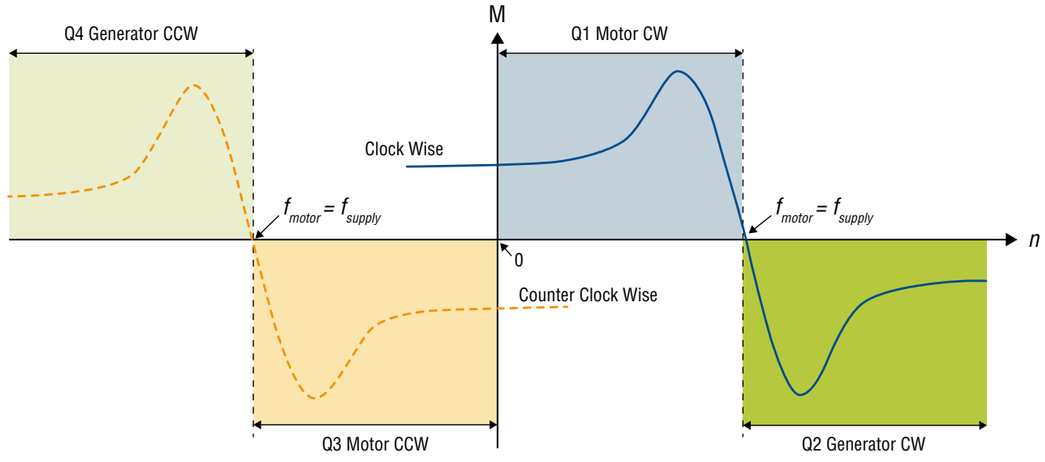
$$E_{Kin} = \frac{1}{2} \bullet I \bullet \omega^2$$



$$E_{Kin} = \frac{1}{2} \bullet m \bullet v^2$$



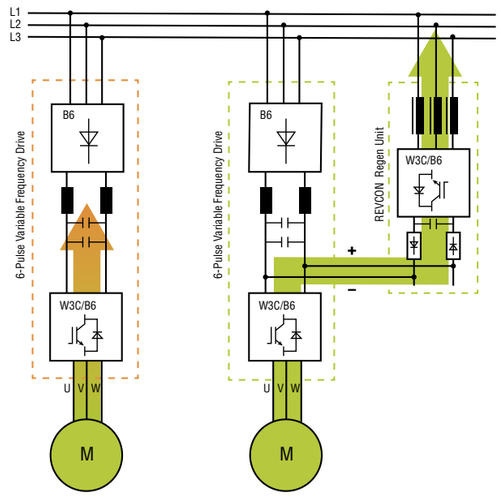
$$\Delta E_{pot} = m \bullet g \bullet \Delta h$$



Any standard Asynchronous motor can be regenerative!
The picture above show the four possible quadrants of operation of a motor direct on line.

If you do not like the thought of wasting this amount energy, combine your drive with a REVCON regen unit in order to allow 4Q operation.

The REVCON Regen solutions units are connected to the DC bus one or many drives, and enables the energy flow from the motor, all way back to the mains. This way the energy can be used by any other equipment.



Using a Variable Frequency Drive – VFD – enables to control the speed and use the optimum torque area at any speed. But unfortunately Q2 and Q4 is disabled as the energy is stuck in the DC Bus, and cause the drive to trip on overvoltage.

RLD – REVCON Low Duty Regen unit

< 50% duty / 2kW – 431kW



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The universal REVCON regen unit RLD enables the use of the braking energy caused by any standard variable frequency drive - VFD. Compared to the brake chopper, the REVCON RLD is using regenerative braking instead of converting the energy into heat. The energy is fed into the mains supply through a unique inverting procedure and creates only a small DC bus voltage raise.

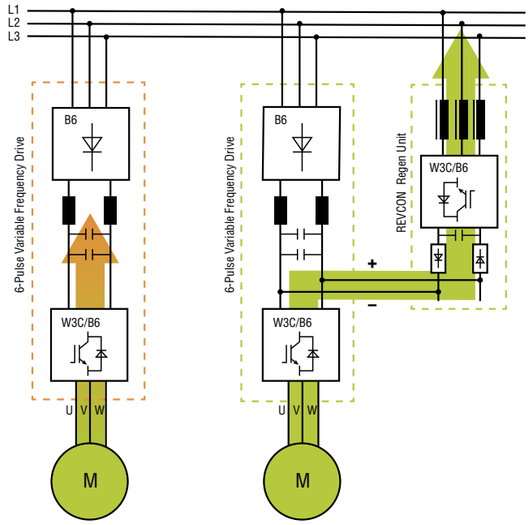
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The REVCON Low Duty - RLD - is designed for applications with non-continuous regen requirement such as elevators, centrifuges, cranes and many more.

The patented switching principle of the REVCON regen units is unique and guarantees an extremely high product lifetime and very low losses. Due to the high efficiency the design of the unit is extremely compact. Due to its unique control, no programming or parameter setting is required. Plug & Play!

All REVCON regen units are available for all low voltage 3-phase supplies and covers power from 2kW up to 431kW, with an open end in parallel setup!



The REVCON regen unit RLD allow 4Q operation of any standard 6-Pulse drive.



The Elevator / Lift release energy every second movement. The RLD is sized for only 50% of the nominal drive rating and feeds the appearing energy back to the mains supply.



Potential Energy Is stored in every elevated object. One single RLD can be used to regen the energy from the common DC bus of the drives.



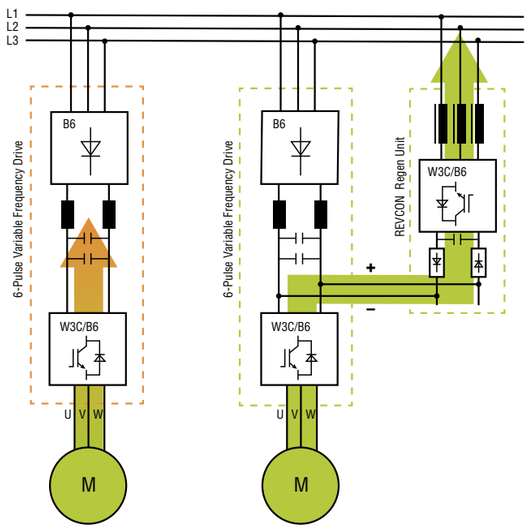
Kinetc energy stored in the rotating movement of the centrifuge drum. With the use of an RLD the released energy during decelerating can be used for other equipment.

RHD – REVCON High Duty Regen unit

100 % duty / 2kW – 250kW

The universal REVCON regen unit RHD enables the use of the braking energy caused by any standard variable frequency drive. Compared to the brake chopper, the REVCON® RHD is using regenerative braking instead of converting the energy into heat. The energy is fed into the mains supply through a unique inverting procedure and creates only a small DC bus voltage raise.

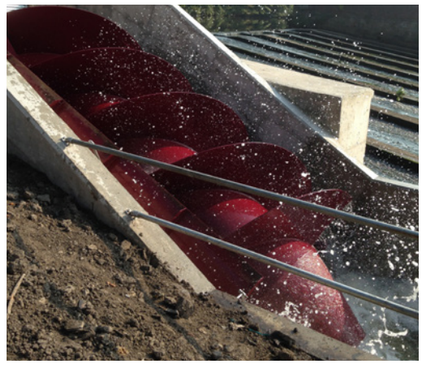
The REVCON High Duty – RHD – design is made for application with continuous braking such as e.g. engine test stands, escalators, hydroelectric power plants and many more.



The REVCON regen unit RHD allow 4Q operation of any standard 6-Pulse drive.



Any test rig requires a high dynamic load and negative torque on the motor shaft. The RHD allows for a very dynamic load in all four quadrants.



The Hydroelectric power plant transform the potential energy of the water into electricity. The RHD makes sure the VFD is able to regen the energy back to the mains in a highly efficient way.



Any downwards running escalator or conveyor is creating a negative toque as soon as loaded. The RHD is a very compact way to feed the energy back to the mains supply.

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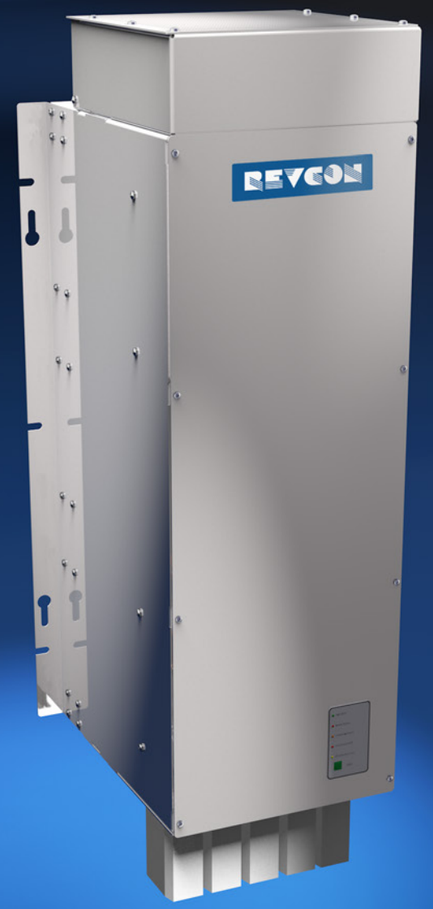


The patented switching principle of the REVCON regen units is unique and guarantees an extremely high product lifetime and very low losses. Due to the high efficiency the design of the unit is extremely compact. Due to its unique control, no programming or parameter setting is required. Plug & Play!

All our regen units are available for all low voltage 3-phase supplies and covers power from 2kW up to 250kW, with an open end in parallel setup!

Marine | Oil & Gas | Water Treatment | General Industry | Buildings

RFE – REVCON Front End
VFD supply and regen unit *2kW-250kW*



The universal REVCON Front End - RFE is used as a supply and regen unit for one or multiple variable frequency drives. Compared to the brake chopper, the RFE is using regenerative braking instead of converting the energy into heat. The energy is fed into the mains supply through a unique inverting procedure and creates only a small DC bus voltage raise.

Typical applications are engine test stands, escalators, hydroelectric power plants, cranes and many more.

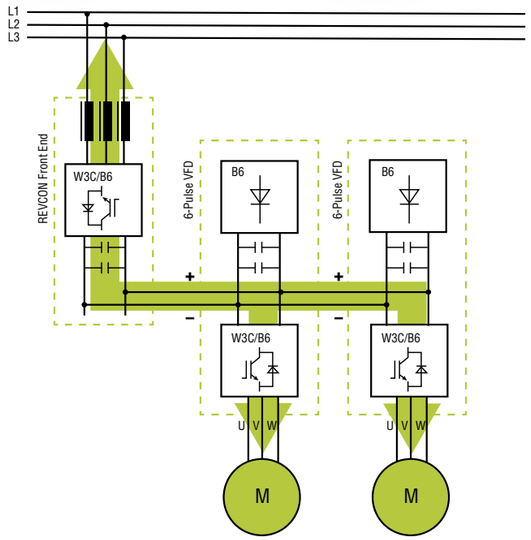
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The patented switching principle of the REVCON Front End is unique and guarantees an extremely high product lifetime and very low losses. This high efficiency enables a extremely compact design.

Due to its unique control, no programming or parameter setting is required. Plug & Play! This patented principle reach an efficiency of up to >99% and therefore the produced power losses are up to 75% less than those produced by comparable solutions, so called Active Front Ends, AFE.

All front ends are available for all low voltage 3-phase supplies and covers power from 7kW up to 250kW, with an open end in parallel setup!



The REVCON Front End unit RFE supply the VFD via the DC-Bus, and allows for 4Q operation.



Potential Energy Is stored in every elevated object. One single RLD can be used to regen the energy from the common DC bus of the drives.



Kinetic Energy is stored in the high dynamic movement of an automated storage and retrieval system and the high location of the goods mean significant potential energy. The REVCON Front end RFE ensures simple installation and 4Q operation of all connected drives.



Any test rig requires a high dynamic load and negative torque on the motor shaft. The RFE allows for a very dynamic load in all four quadrants.

RSD - DC-DC Transformer

The REVCON Step down RSD is a DC-DC converter, transforming high DC voltage into lower DC voltage output. The RSD is available as a current or voltage controlled system. An optional internal rectifier allows for AC feed from any low voltage source.

The DC output and input voltage is freely selectable within the limits of the low voltage directive. The units are available from 15A up to 500A, and the flexible concept allows for any thinkable customization even for single units.

Various applications can be realized by a REVCON Step down converter. Typical applications are power sources, Capacitor bank charging VFD feed and VFD UPS system.



RSU - DC-DC Transformer

The REVCON Step down RSU is a DC-DC converter, transforming low DC voltage into higher DC voltage output. The RSU is available as a current or voltage controlled system. An optional internal rectifier allows feeding AC from any low voltage source.

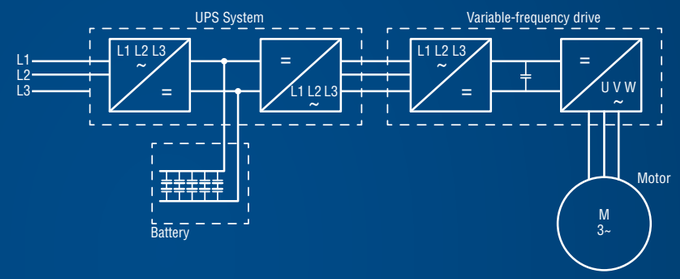
The DC output and input voltage is freely selectable within the limits of the low voltage directive. The units are available from 15A up to 500A, and the flexible concept allows for any thinkable customization even for single units.

Various applications can be realized by a REVCON Step down converter. Typical applications are power sources, capacitor bank charging, VFD Supply and VFD UPS systems.

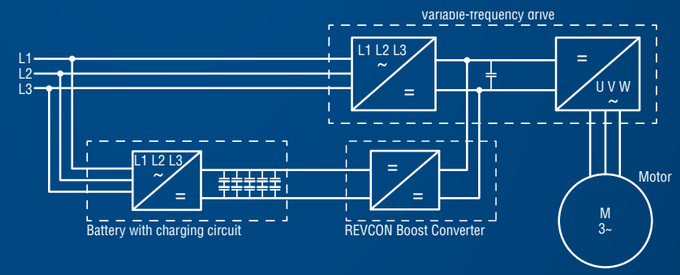




The Power of the VFD is led through the complete UPS application. This setup brings unnecessary performance losses due to rectification, followed by invertation, of the current.



During normal operation, the VFD is supplied directly by the mains, which means that there are no unnecessary performance and power losses. The REVCON UPS system sets the Voltage Value from the Batteries, or other emergency supply, to the required level of the VFD.



The REVCON Step Up or Step Down DC-DC- Converter is inactive until the power supply of the mains is cut off. In this case the boost converter maintain the power supply of the VFD immediately and without any delay!

Customized solutions!

This product catalog was provided by:

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