

insider



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Data centers require a continuous clean electrical supply for reliable operation. ABB's UPS and power protection solutions are designed to eliminate voltage disruptions in industrial and commercial applications, such as those seen in data centers.



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Insider

**John Penny**

General Manager

LV Power Converter Products (DMPC)

Welcome to the final release of the insider magazine for 2013. This issue has a major focus on data centers, a business area experiencing significant growth globally with the increasing digital lives we all lead at home and in business. With global IP traffic forecast to grow at 25% compound annual growth rate (CAGR) not only is more data being transferred globally but more needs to be processed and stored. With the availability of broadband access to an increasing number of the world's population, data centers will remain a growth sector for many years to come.

Data centers are now large energy users and electricity is a major cost for data center operators. This makes energy efficiency a major concern and an area where ABB can contribute to reducing the carbon footprint caused by the digital revolution. ABB's design engineers are focused on providing the la-

test power protection technologies with features and benefits that really make a difference. Data center operators focus on reliability, availability, efficiency and maintainability small footprint. This has been listened to by ABB's product managers and R&D engineers.

One of the major product releases in 2013 was the DPA 500 UPS that extends the modular UPS range to even greater power ratings of up to 3 MW. This product offers the highest levels of availability in a compact and efficient modular design.

ABB is now well positioned as a supplier of a wide range of power protection products from the ubiquitous UPS solutions through to voltage conditioners, frequency converters and reactive power conditioners. This huge range of products, from small power to huge multi megawatt capacities, means ABB has product available for the simplest, to the most demanding of applications. This is combined with the application knowledge and experience to ensure the products are correctly applied, and the global service support makes ABB an ideal power protection partner.

In 2013 the global ABB team and our partners have undertaken some fascinating projects. Apart from the many small, large and challenging data center applications, some of the world's leading semiconductor companies have been protected from voltage events. Cable cars have had their problematic power draw conditions by the new PCS100 Reactive Power Conditioner (RPC) and ships yards have been supplied with PCS100 Static Frequency Converters (SFCs), to

allow ships to be connected to the shore supply, reducing noise and pollution. An interesting article in this issue summarizes ABB's shore-to-ship technology and identifies key projects undertaken.

The year has seen many sales and service training courses run and our expanding product portfolio and channels to market will mean 2014 is also a busy year for training. We hope many of you can attend training which is not only a great way of learning more about the products, but also a good way of meeting others who sell and service the ABB's power protection products.

Looking forward into 2014, the power protection team, based in New Zealand, is developing a range of medium voltage UPS products initially rated up to 6 MVA, based around the needs of customers with large sensitive and critical loads. The first release, scheduled for 2014, will be product rated up to 6.6 kV with even larger 15 kV class products to follow (including 11 kV and 13.2 kV options) with even higher MVA ratings.

I am sure you will enjoy reading this issue of Insider – All the best for the New Year.



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Five reasons to invest in power protection

With ABB power protection solutions in place....it's business as usual

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The Power converters and inverters playlist can now be found on the ABB YouTube channel.

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[It's business as usual - ABB's power protection solutions](#)



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PCS100 Power protection
PCS100 Grid interconnection
PCS100 Energy storage and grid stabilization

www.abb.com/UPS

FOR

UPS and Power Conditioning



Data center dynamics

Power protection –
for those who need
zero downtime.

Data centers are major power users, with larger installations consuming tens of megawatts of power. As customers are often highly reliant on the operation of a data center, it is critical that data is available at all times, and that it is stored in a reliable and energy-efficient way. ABB's PCS100 Active Voltage Conditioner, Industrial UPS and Reactive Power Conditioner systems ensure this, by providing a continuous flow of reliable power.

The data center industry is driven by the digital revolution and cloud computing, one of the most dynamic and fastest growing market sectors. Data centers require a continuous clean electrical supply for reliable operation and electric power is a major cost for data center operation.

ABB now has an extremely comprehensive range of power protection products available to data center designers and operators. Protecting the server load from outages and other voltage events is a major consideration in any data center. Uninterruptible Power Supplies (UPS) are the solution of choice and ABB has this requirement well covered with a very comprehensive range of both stand-alone and modular UPS. For server protection the flagship products are Conceptpower DPA and PowerWave 33 which utilize a highly modular Distributed Parallel Architecture (DPA) that provides best in class reliability, system availability and the ability to scale with your business.

ABB also have a highly innovative range of industrially rated UPSs and Voltage Conditioners that have been widely applied to protect the world's most sophisticated industrial processes including silicon chip and liquid crystal display manufacturing. The PCS100 UPS-I and AVC (Active Voltage Conditioner) are suited for the protection of demanding direct connected motor and motor drive loads along with very sensitive electronics. These products also have application in data centers and are an ideal choice for the protection of balance of data center loads such as, air-conditioning data center that may just require voltage conditioning or short outage protection.

In very large and specialized applications the UPS-I can also be used for server protection. For example where space is at a premium the extremely small product footprint along with compatibility with new generation storage technologies such as super capacitors and lithium ion batteries can mean the UPS-I is an ideal fit.

The UPS-I is a single conversion modular redundant design with a centralized static bypass which provides typical system efficiency of greater than 99 percent. Available in a range of low voltages modules from 208, 400 through to 480 VAC and now at medium voltages (MV) with ratings up to 6 MVA the MV UPS-I range is well suited to protection of Mega scale data centers.

Identifying the need

In a typical UPS-I application a Swiss government data center had been protected by rotary UPS systems only and static UPSs were to be added to enhance system reliability. ABB's PCS100 UPS-I was identified as an ideal solution for the retrofit into the data center due to their very high electrical efficiency of the UPS and small footprint. Efficiency and space are always important considerations but restricted space and cooling in this application meant they were essential features. Four UPS-I systems with a capacity of 2000 kVA were selected and ordered.

Voltage Conditioning Applications

Although UPSs are the technology of choice for data centers they do come at a relatively high operational cost particularly as a result of battery maintenance and replacement. In a typical power system 90 to 95 percent of problematic voltage events are voltages sags which can be corrected with a voltage conditioner. ABB's PCS100 AVC range of active voltage conditioners correct voltage sags and surges within a few milliseconds while maintaining exceptional efficiency performance. For application where outage ride through is not required they can offer an ideal solution. This can include by-



ABB's PCS100 UPS-I

pass (or reserve) supply conditioners for UPSs, conditioning of balance of data center loads to prevent nuisance trips through to conditioning the alternative feed on a dual reticulated server protection application where running two independent UPSs is not justified.

Current Conditioning Applications

Voltage disturbances are not the only power quality problem present in data centers. Power electronic loads on both the balance of data center and servers can create harmonic and power factor problems. Most servers utilize wave shaping rectifiers on their switch mode power supplies but these will often draw leading reactive current (capacitive) under light loading conditions. As most of these supplies are redundantly configured they do run very lightly loaded.

Harmonics and power factor problems cause increased apparent power (kVA) loading on the electrical supply often resulting in higher electricity charges from the utility. Most data centers also run standby diesel generators and they can require considerable de-rating for poor power factor, harmonics and supply imbalance. Leading power factor is a particularly bad problem for generators and even quite low levels of leading reactive current can cause the alternator to enter an unsafe operating area and potentially lose control of voltage.

The PCS100 RPC Reactive Power Conditioner is an active solution to power factor and low order harmonic problems. Its fast operation and flexible control mean even the most difficult power factor problems including leading power factor are resolved. In addition to power factor and harmonics the RPC can also correct the component of supply imbalance, negative sequence current that is most problematic for diesel generators.

ABB have a comprehensive range of power protection products that can be applied to ensure data centers can operate with highest levels of reliability, availability and energy efficiency.

View ABB's data center solutions [brochure](#)

Visit www.abb.com/powerquality for more information, or see links below for articles on ABB's PCS100 power protection range for protecting data centers: [Weta Digital](#) and [NIWA](#)



ABB's PCS100 power protection portfolio

PCS100 AVC (Active Voltage Conditioner)

- Protects sensitive loads from the most common disturbances in utility supplies
- Sags, surges, unbalance, flicker and poor regulation are corrected within a few milliseconds
- High power and performance inverter-based system
- Operating efficiency 97 to 99 percent (model dependent)
- Very small footprint due to no storage to operate
- Rated 150 kVA - 30 MVA. Download PCS100 AVC brochure [here](#)

PCS100 UPS-I (Industrial UPS)

- The PCS100 UPS-I is the ideal solution where very deep sags or short term power outages are a problem
- The PCS100 UPS-I uses energy storage coupled through an inverter to allow the downstream load to ride through very deep sags and short term outages
- The PCS100 UPS-I is an offline system. It is inactive unless the voltage increases by 10 percent or falls by 10 to 13 percent. This enables it to be very efficient, up to 99 percent
- Ratings from 150 kVA to 3000 kVA and voltages 208 Vac to 480 Vac. Download PCS100 UPS-I brochure [here](#)



PCS100 RPC (Reactive Power Conditioner)

- ABB's PCS100 RPC is specifically designed to condition the current drawn by industrial and commercial loads. The PCS100 RPC uses leading-edge power electronic conversion to inject current into supply, correcting for common problems such as:
 - Unbalanced load current
 - Low order harmonic currents
 - Power factor problems including leading power factor
 - Load current induced voltage drop
- As a purely static device, the PCS100 RPC provides extremely fast correction. Its modular redundant design makes it a very reliable, scalable and serviceable product, backed by ABB's global support network. Packed with new features to suit industrial and commercial applications. Ratings from 100 kVA to 2000 kVA and voltages 380 Vac to 480 Vac. Download PCS100 RPC brochure [here](#)

For more information, please visit www.abb.com/pcs100-power-converters or contact powerquality.nz@nz.abb.com
Click [here](#) to view ABB's power protection brochure.

It's business as usual with PCS100 power protection

Five reasons to invest in power protection – watch our new 50 second video [here](#).

1 Eliminate unwanted downtime

Power protection is important for 24/7 processes in industrial manufacturing plants. A slight disruption in power caused by external environmental factors can result in the whole or parts of a production line stopping. This can lead to production targets not being met, hence downstream customers may have to look elsewhere to meet their requirements. ABB's power protection portfolio can eliminate unwanted downtime by protecting sensitive industrial and commercial loads from voltage disturbances.

2 Maintain quality production output

When production lines are restarted or operate at less than optimal voltage, the product quality of the items being manufactured can suffer. This can result in loss of quality and can damage a supplier's reputation, which will eventually cause a loss in profitability for the manufacturer. When a sag, surge or outage occurs, ABB's power protection products provide continuous voltage regulation by drawing additional current required to make up the correction voltage from the utility supply. This enables production output to be maintained and supply forecasts to be achieved.

3 Minimize waste of resources and materials

Usually when a production line stops, raw and partially completed materials can be damaged due the production cycle not being completed. This creates waste as many materials cannot be re-used for commercial sale. ABB offers complete power protection and provides enhanced energy efficiency by reducing system losses, thereby improving power quality and providing equipment immunity from power quality events on the AC network supply.

4 Prevent damage to customers machinery

Uncontrolled stoppage on a production line can also damage the production line tools. This increases maintenance costs and time required for repair purposes. This therefore has an impact on the quantity or amount of product being manufactured. Voltage sags and surges and unbalance also stress the power supplies in the production tools, leading to premature failure of electronic components, which adds to the maintenance costs.

5 Increased profits

The highly reliable PCS100 products are designed for harsh electrical environments whilst also providing high efficiency (greater than 98 percent). This will ensure your equipment is protected at all times. Small confinements are made easy thanks to the unique modular design of the PCS100 portfolio, saving storage space. Lowest total cost of ownership means very low maintenance, providing continuous output, allowing power quality to be improved and profits increased.

PCS100 top five projects for 2013

Around the world with PCS100 – providing power protection on a global scale.

1



In May, ABB commissioned and installed eight PCS100 Industrial UPSs (UPS-I) for Samsung's new \$3 billion liquid crystal display production facility in Suzhou – the biggest single investment ever made by a South Korean company in China. The overall power protection solution had a combined capacity of 16.5 MVA of electric power and was one of many that ABB has supplied to semiconductor companies in Asia. [Read more here](#)

2



In July, ABB supplied a PCS100 Reactive Power Conditioner (RPC) with a power rating of 100 kVAR, to improve the power quality for the electrical drive system that powers the cable cars in New Zealand's capital city, Wellington. This project achieved many unique milestones. It was the first PCS100 RPC installed in New Zealand, the first for the public transport industry globally and the smallest footprint PCS100 product ever built. [Read more here](#)

3



Following the acquisition of Thomas & Betts, an effort was undertaken to have one complete ABB solution for Thomas & Betts data center in Memphis, USA. Included in this complete solution was a 600 kVA PCS100 UPS-I which will back up the data center and additional critical areas including the Customer Service department. The order was received in 2013 and will be commissioned in December. For more information, please visit www.abb.com/powerquality

4



In May, ABB supplied 20 x 900 kVA and 2 x 1500 kVA PCS100 Active Voltage Conditioners (AVCs) to SK Hynix, a major player in the memory chip industry. Based in Korea, SK Hynix successfully produces semiconductors that have fuelled growth of the IT industry, not only in Korea but the world over. With a total of 22 PCS100 AVCs protecting the M12 12 inch wafer fabrication line, SK Hynix's facility can run smoothly without any voltage fluctuations, reducing production loss and increasing turnover. [Read more here](#)

5



ABB provided a leading-edge solution consisting of four 250 kVA PCS100 Static Frequency Converters (SFCs) to the first and only "green shipyard" in India at Pipavav Shipyard Limited (PSL). Together with providing a green solution (by reducing emissions, pollution and noise level), cost saving is also being achieved by using grid power instead of diesel generator (DG) power. [Read more here](#)

Visit www.abb.com/pcs100-power-converters or contact powerquality.nz@nz.abb.com

Looking forward in 2014 – what's in store

An insight into future developments of power conditioning products.

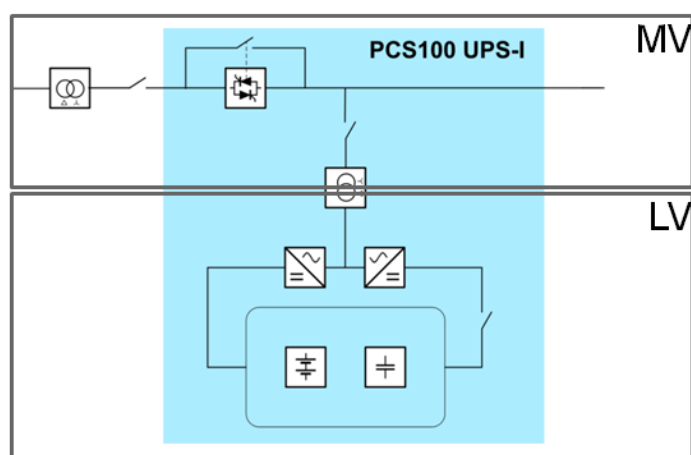


Figure one: Single conversion topology is a natural choice for MV. Power electronics and energy storage can remain at LV, with transformer coupling to MV

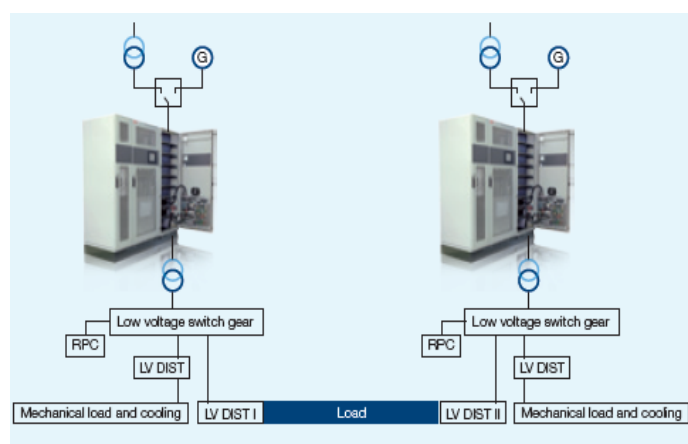


Figure two: Centralized bus mega data center – medium voltage UPS solution

The New Zealand-based power protection team are developing a range of medium voltage UPS products initially rated up to 6 MVA, based around the needs of customers with large sensitive and critical loads. These PCS100 MV UPS products will complement the existing range of the PCS100 LV UPS-I product and the LV double conversion products. The PCS100 MV UPS will be suitable for use in protecting critical industrial processes and large data centers. The first release, scheduled for 2014, will be product rated up to 6.6 kV with even larger 15 kV class products to follow (including 11 kV and 13.2 kV options), with even higher MVA ratings.

Why MV UPS?

The common question of “why build upon the PCS100 UPS-I?” can be simply answered by the growing need of high power usage customers to protect their critical loads from voltage events (sags and surges) and outages. Low voltage UPSs and power conditioners are widely applied, but often space constraints means fitting product in is problematic. When installed at MV voltage levels, the very compact MV UPS design can be installed in MV electrical rooms or even plant substations.

A PCS100 MV UPS can be installed into the electrical supply to protect the complete supply or alternatively just selected sensitive loads. In a data center this could include the mechanical loads. Installing the UPS protection at medium voltage provides the most energy efficient configuration as the low current at the MV level means that serious semiconductor losses are very small.

The single conversion topology used in the PCS100 UPS-I product is a natural choice for MV as losses are extremely small, meaning efficiencies well in excess of 99 percent can be achieved. Power electronics and energy storage can remain at LV, with transformer coupling to MV. Finally, the PCS100 MV UPS has many retrofit possibilities allowing custom designs to suit many applications for the higher powered industries.

Because the energy storage is kept at low voltage levels, a wide range of energy storage options will be available (flywheels, ultra-capacitor, lithium Ion and high discharge sealed pb acid batteries). It is expected that ultracapacitors will be widely applied in industrial applications due to their long life and compact size. For longer autonomy applications Lithium Ion or lead acid batteries can be applied.

The PCS100 MV UPS will offer advantages such as:

- Small footprint (compact design)
- Retrofit possibilities
- Highest energy efficient configuration

For further information please visit:

www.abb.com/pcs100-power-converters or contact powerquality.nz@nz.abb.com for further product information.



Critical protection

Standardization and modularity as the foundation of data center UPS infrastructure.

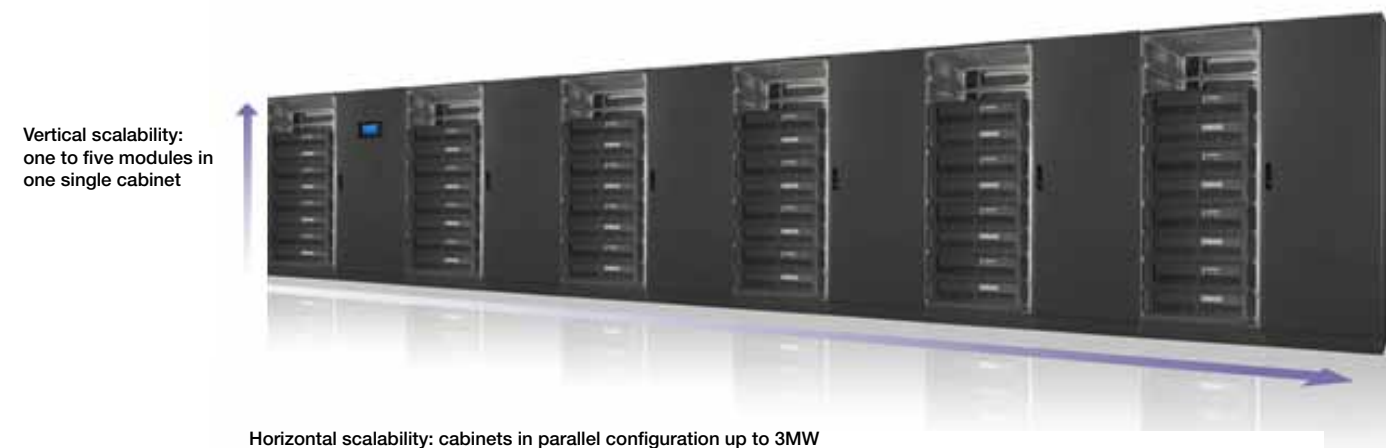


Figure 1: Scalability up to 3 MW

Data centers are growing ever larger, more numerous and more complex. The way to keep control of costs, availability and reliability, while maintaining flexibility, is to fully exploit standardization and modularity. All ABB's data center products are designed with standardization and modularity as cornerstones of their architecture. In this article, we look at how these concepts are embodied in ABB uninterruptible power supplies UPS and the advantages they bring.

UPS

Power disturbances come in many guises: On top of total power outages and blackouts, the voltage may sag or swell over short periods. It may also do so over longer periods – so-called brownouts or overvoltages. And there can be electrical noise on the line, or frequency variation, or harmonics may appear in the voltage. A UPS remediates all of these.

A UPS will condition incoming power. Spikes, swells, sags, noise and harmonics will all be eliminated. In the case of total power failure, power will be supplied from batteries or other energy storage systems. A backup generator will kick in for longer power outages. This ensures that data center operation is available 24/7 and that no data corruption or loss will occur. No modern data center can operate without a capable UPS.

Modularity

ABB Newave were pioneers in UPS technology. In fact, two of most important current architectural trends in the UPS market today – transformerless and modular UPS – were concepts developed in ABB Newave's early years. The latter concept is now embodied in ABB Newave's decentralized parallel architecture (DPATM) – the essence of modularity. With DPA, each 100 kW UPS module contains all the hardware and software required for full system operation. Each module is fully independent and modules can simply be combined like Lego™ bricks as desired. This powerful scalability approach means the UPS can be sized exactly to fit prevailing needs and modules can simply be added as requirements grow (five 100 kW modules can be mounted in one rack and six racks can be configured in parallel to provide a top rating of 3 MW in the Conceptpower DPA 500 model). This means that you only power, cable and cool what you need. Power consumption is the topic of greatest concern for data center operators and the energy savings made by this modular approach over the service life of the UPS are substantial.

Human error is reduced too: Because things are so simple, wiring errors are eliminated and configuration and reconfiguration are child's play.

Hot-swapping

Modules can be hot-swapped too, i.e., removed or inserted, without risk to the critical load and without the need to power down or transfer to raw mains supply. This unique aspect of modularity directly addresses continuous uptime requirements, significantly reduces mean time to repair (MTTR), reduces inventory levels of specialist spare parts and simplifies system upgrades. This approach pays off too when it comes to serviceability and availability – online swapping of modules means you do not have to switch off during replacements, so there is no downtime and the service personnel do not need special skills.

Cost of ownership

The modularity and scalability described help minimize the cost of ownership, but costs are held down too by implementing designs that have best-in-class energy efficiency. ABB's Conceptpower DPA 500, for example, operates with an efficiency of up to 96 percent. Its efficiency curve is very flat so there are significant savings in every working regime.

The advantages of standardization and modularity go further as installation and servicing costs are also kept low: A straightforward, standardized modular concept simplifies and speeds every step of the deployment process – from planning, through installation and commissioning to full use. High-quality standardized products significantly reduce intervention time during maintenance or in the event of failure – components can be changed quickly and easily, service is simplified and modules can even be hot-swapped. Agility is maximized.

Standardization also enables the use of ready-made interfaces and management modules, and simplifies integration with data center systems, such as ABB's Decathlon data center monitoring software. Such standardized equipment monitoring systems provide simple management tools that promote predictive maintenance so that problems can be identified before they become significant. This reduces reliance on scheduled preventative.

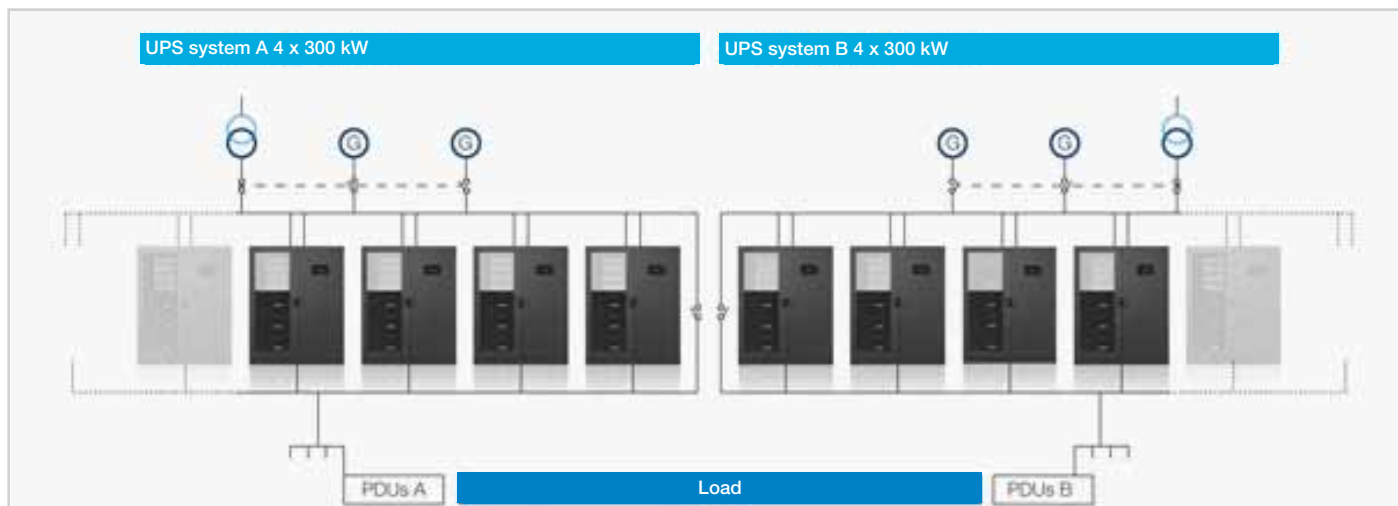


Figure 2: Centralized UPS solution (large and small data centers can now be built by using the same pre-designed, pre-manufactured and pretested sub-systems as building blocks)

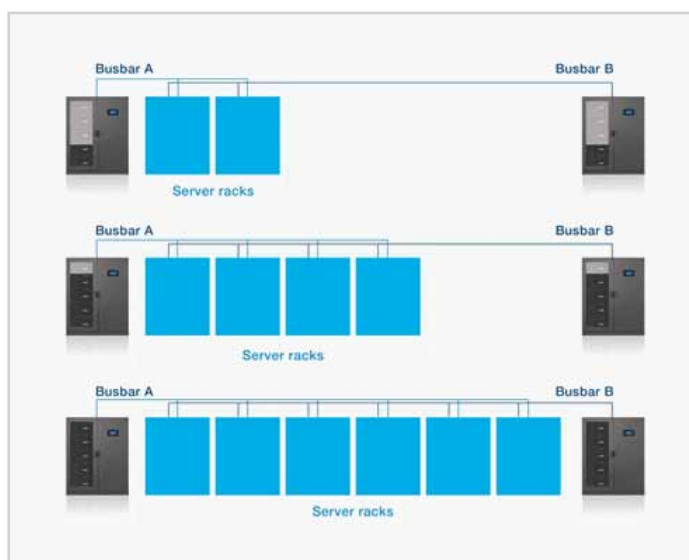


Diagram 3: End of raw application with distributed power protection concept (applicable in small or large data centers with decentralized power protection demands)

Reliability and availability

UPSs play a vital role in ensuring IT reliability and, thus, data availability. As a result, the reliability of the UPS itself is a major consideration. Any time a UPS fails and becomes unavailable, mission-critical electrical loads are put at risk. The surest way to increase availability of power is to optimize the redundancy of the UPS system and to minimize its maintenance and repair time.

Mean time between failures (MTBF) and MTTR are common parameters in the UPS industry and both impact system availability. Availability, a measure of how good the system is, is formally defined as:

$$\text{MTBF} / (\text{MTBF} + \text{MTTR}) \times 100\%$$

Modular UPS designs minimize the system's MTTR. The modular DPA concept allows the modules to work as one system but without interdependence. Quick and simple repair by swapping modules, which can be held as spares on-site or at a nearby service center, minimizes the system's MTTR. Not only does

this improve availability but it also reduces cost as service engineers need less training and spend less time on-site, and any risks of data or production loss are minimized. Inventory levels of specialist spare parts are reduced.

Modularization can increase the number of components in a UPS and the number of interconnections. At first sight, this may risk reliability degradation, but, in fact, the overriding advantages of modularization more than compensate: The better quality that results from the mass production and testing made possible by standardization has a direct positive impact on reliability; modular systems with standardized connections can be pre-wired and field-configured at the factory allowing for more thorough testing; and standardized connections reduce the risk from bad connections in the field – one of the biggest bugbears in any technical setting. In addition, modular components can be returned to the manufacturer for service, which greatly improves repair quality - factory-repaired UPS power modules are many times less likely to cause outages, introduce new defects or inhibit return to fully operational status compared with field-repaired modules.

View ABB's data center solutions [brochure](#)

To see further technology information please visit: www.abb.com/UPS





Shore-to-ship solutions

An economic and efficient solution to interconnect ships (60 Hz) with the public grid (50 Hz).



Two 1250 kVA PCS100 SFCs installed at Viktor Lenac shipyard

Many of the world's harbors are located in city environments where noise and emission pollution from docked ships is a growing concern. This is compounded with the move by many urban authorities to encourage inner city living. With this in mind, maritime cities, port authorities, ship-owners, industry suppliers and regulators are now focusing on the decade old technology known as shore-to-ship power, for which universal electrical standards are on the verge of being ratified by IEEE, ISO and the IEC. Often the shore supply is not at the same frequency as the ship. ABB's power converter technology supply allows commercial ships calling at ports and shipyards to turn off their diesel engines and tap into cleaner energy sources. Having successfully delivered the world's first shore-to-ship power connection to the port of Gothenburg, Sweden in 2000, ABB has not only the core technologies but also the experience required to make the complete connection, onboard and onshore.

ABB has a comprehensive range of Static Frequency Converter (SFC) solutions from the very high power and efficiency PCS 6000 medium voltage converters, to the highly flexible and reliable PCS100 SFC products which are based on a low voltage modular topology. Both designs allow ships operating at one electrical frequency to connect to the shore at another frequency. Growing environmental and legislation compliance pressure is seeing many port authorities, shipping companies and shipyards embracing shore to ship power. ABB is a market leader in this new but fast growing business and has many global installations, recently supplying an 8 MVA PCS100 SFC to Jurong Shipyard in Singapore, the largest application for ABB's low voltage technology.

Other PCS100 SFC applications have been; Viktor Lenac shipyard in Rijeka Croatia, to help improve quality of power and reduce maintenance costs, the Swedish port of Gothenburg, supplying electrical power to a large number of Stena Line vessels using the port, and the port of Ras Laffan in Qatar. ABB's medium voltage SFC products are also shaping the environmental future for ports, with a project consisting of a 6.25 MVA PCS 6000 that is helping to ensure environmental compliance at the Swedish port of Ystad. "It is important to us that our services are environmentally friendly. Besides, we calculate that the effects on the environment will turn out so positively for Ystad's inhabitants that the total socioeconomic



8 MVA PCS100 SFC to Jurong Shipyard in Singapore

balance will be on the plus side", said Björn Boström, Managing Director of the Port of Ystad.

With ABB's shore-to-ship power connection, a large cruise ship can cut fuel consumption by up to 20 metric tons and reduce CO₂ emissions by 60 metric tons during a 10-hour stay in port – equivalent to the total annual emissions of 25 European cars. It is no surprise then that interest in shore-to-ship power is growing, not only for environmental but also for economic reasons. Shore-to-ship electric power supply, also known as "cold ironing," is a sensible choice for greener ports and fleet. The solution enables ships to shut down their diesel generators and plug into an onshore power source while berthed. Most of the world's ships generate power at 60 Hz, which creates a special challenge for many parts of the world where the shore frequency is 50 Hz.

Converting voltage is relatively easy with an electrical transformer but converting frequency is very challenging which is where ABB's SFC technology comes into its own. Hans Nyberg, Project Manager at Stena Line commented on the PCS100 SFC they have installed, "most ships run at 60 Hz as by increasing the frequency, you can get more power from the engines. ABB's PCS100 SFC technology allows continued operation while the ship is docked without pollution or noise. That is the greatest advantage."

With an ABB shore-based power connection, a ship is able to turn off its engines without interrupting its port services, such as loading and unloading, hoteling or any other activities that consume power at berth. The connection and disconnection of the ship takes as little as 15 minutes, and administration of power supply and consumption is handled by the port operator. Establishing a shore-to-ship power connection necessitates investment by both ship owners and port authorities or terminal operators in the form of either a retrofit of existing assets or construction of new ones.

The ship needs an additional electrical switchboard, cables connecting it to the ship's main switchboard, and, in many cases, a step-down transformer. The port requires a substation with breakers and disconnectors, an automated earthing switch, a transformer, protection equipment such as transformer and feeder protection relays, communications equipment to link ship and shore, and in most cases a frequency converter to adapt the frequency of

electricity from the local grid to match that of each vessel. Further, a cable-management system is needed for either the port or the ship.

Such technology is now readily available, and given the environmental pressures port companies face and it is no surprise that shore to ship power is gaining considerable attention. It is increasingly appearing in regulations and discussions in the European Union, the United States and within the United Nations' organization for maritime policy, the IMO. EU directive 2005/33/EG, which went into effect January 1, 2010, exempted ships using shore-based electricity from a rule requiring use of reduced sulfur-containing marine fuels while in port. In the United States, legislation proceeds state by state; California, a regulatory forerunner, has begun to require shore side electricity connection for some ship types.

At the IMO level, new restrictions on the allowable sulfur content in fuels improves the economical case for onshore power, without explicitly mandating or supporting it. Onshore power supply is a well-established technology, which is already available at several ports, including those in the United States, Belgium, China, Canada, Germany, Sweden, Finland and the Netherlands. With a new set of global shore side electricity standards on the verge of ratification, the practice is expected to rapidly expand for all major types of ships and ports worldwide.

ABB's solutions

Static Frequency Converters (SFCs), which are a safe, economic and highly efficient solution converting the grid electricity to the appropriate load frequency. Historically rotating machinery has been used but this is inefficient and has high operational and maintenance costs. ABB's leading-edge frequency conversion technology guarantees a seamless automated power transfer of the ship load from the onboard power plant to the onshore source and back.

This solution contributes to a significant reduction of fuel and lubrication oil consumption, which means less pollution and improved financial benefits. Shore-to-ship power is especially applicable to ships operating on dedicated routes, and vessels that consume large amounts of power while in port. This could bring real benefits for terminal operators whose ferries berth each day for a fixed number of hours.

Versatility, integrity and unrivalled flexibility

The PCS100 SFC systems are configured as an arrangement of modular redundant rectifiers and inverters controlled by a power electronic controller. This unique line-up produces sine wave voltage to supply the output load. Should any module fail the system will continue to operate normally with slightly reduced capacity. The converters also allow for the control of reactive power on the ship as well as on the shore side and bi-directional power flow. This feature permits maximum flexibility in adjusting the system to suit the customer's needs. The PCS100 SFC is suited for low-power applications, with a power rating of 125 KVA to multi MVA.

The modularity and scalability of these systems enable multiple units to be paralleled, which makes the solution adaptable to the different power requirements of ships and to a variety of port infrastructures. The PCS100 SFC has a small footprint design and can be placed indoors or outdoors. This gives the customer flexibility with the physical and spatial layout to harmoniously fit to the surrounding architecture.



ABB's static frequency converter

The PCS 6000 systems are based on the highly reliable and efficient medium voltage IGCT (Integrated Gate commutated Thyristor) and are suited for applications up to 120 MVA. This suits a centralized port electrical reticulation system where one large converter supplies 60 Hz to docking stations remotely located.

For further information please visit:

www.abb.com/converters-inverters
(Converters for grid interconnection)

Additional articles

[ABB innovation reduces pollution and saves costs at Viktor Lenac shipyard in Rijeka, Croatia](#)

[ABB's shore-to-ship solution helps to ensure environmental compliance at the Swedish port of Ystad](#)



PCS100 Product training 2014

Register your interest now for 11-13 March 2014



Enhance your technical ability and knowledge in the PCS100 product range. Receive the benefit of interactive practical training with real devices for demonstration purposes and functional exercises.

Product training

Products, applications, markets and technical basics

- Power protection
- Frequency conversion
- Grid connect interfaces

Marketing

- PCS100 tools and support

Hardware

- Power modules, aux.module, interfaces

Control modes, interfaces, options

- Power protection
- Frequency conversion
- Grid connect interfaces

Order handling process

- PCS100 sizing and pricing

PCS100 outlook

- Ongoing and future developments

Who should attend?

ABB channel partner sales and service engineers.

Training locations

ABB's low voltage power converter product training is conducted in our well-equipped manufacturing and R&D facility in Napier, New Zealand, by highly qualified engineers and instructors.

Enrolments

Register your interest for any one of our courses via email to: pq.supportline.nz@nz.abb.com

Confirmation

Confirmation of acceptance and course information will be sent approximately two weeks before the start of the course. We will inform you by email or phone if there are no vacant places.

Course program

The course program and all related information about the course times and venue are sent to the participants with the confirmation. The course normally runs from 9.00 a.m. - 4.00 p.m. over a three day period.

Reservations

We reserve the right to change any course schedules, programs and their contents. A course could be cancelled due to minimal enrolment. The maximum number of students varies between 10 - 12 persons.

Cancellation

In the case of cancellation, inform us as soon as possible. This will allow another applicant to attend the course. Your place on a course can be transferred to another person in your company or department.

Training schedule 2014

Course	Day one	Day two	Day three
One	11 March	12 March	13 March
Two	13 May	14 May	15 May
Three	16 September	17 September	18 September
Four	18 November	19 November	20 November
Agenda a.m.	PCS100 product platform overview	PCS100 frequency conversion	PCS100 sizing and pricing tools
Agenda p.m.	PCS100 power protection	PCS100 grid connection	Outlook /future developments

Service and commissioning training 2014

Register your interest now for 18-20 March 2014

Your knowledge. Your power.

ABB is a leading supplier of power electronic systems. This extensive experience and history of innovation helps customers around the world to improve plant performance and production.

Our customer awareness means that we are committed to supporting customers globally in their plans for growth. ABB offers a wide range of professional training courses adapted to meet the needs of customers and partner channels.

Benefits of the training

Service and commissioning training courses give valuable support to increase return on investment, reduce costs in down time and improve skills and motivation of personnel.

Training participants profit from our extensive experience and modern training infrastructures which enable them to:

- Efficiently operate and maintain ABB’s PCS100 low voltage power converter systems
- Extend the lifetime of the product

Training locations

ABB’s low voltage power converter product training is conducted in our well-equipped manufacturing and R&D facility in Napier, New Zealand, by highly qualified engineers and instructors.

Course profile

Our service and commissioning training courses are aimed at qualifying existing maintenance engineers to undergo unsupervised first level support of ABB’s PCS100 applications. The main goal of the course is to learn how to operate, troubleshoot and maintain the system.

Upon completion of the course, maintenance engineers will be able to locate and identify hardware components, download fault loggers and important information for first analyses by support personnel, replace parts and perform preventative maintenance. Trainees will gain practical experience using available tools and techniques through organized practical exercises.

Who should attend?

- In order to ensure that the people we train in the servicing of the PCS100 product attain the level of understanding required for field work, it is vital that those attending this training have the following background;
- Work hands on as a Service Technician
 - Have a good understanding of three-phase electrical system theory



- Are familiar with the operation and use of relevant test equipment (scope/multi-meter etc)
- Understand the basics of fault finding and can follow direction in terms of testing required by the factory

Enrolments

Register your interest for upcoming courses via email to: pq.supportline.nz@nz.abb.com

Training schedule 2014

Course	Day one	Day two	Day three
One	18 March	19 March	20 March
Two	20 May	21 May	22 May
Three	23 September	24 September	25 September
Four	25 November	26 November	27 November
Agenda a.m.	PCS100 platform service introduction	PCS100 service power protection	PCS100 service grid interconnection
Agenda p.m.	PCS100 platform service detailed	PCS100 service frequency conversion	Outlook / future developments

Power conditioning



Power protection

6. Public transport reliability

Providing power conditioning for the public transport industry

10. Data center designed

ABB extend range of modular UPS to 3 MW

12. Advanced semiconductor engineering

A success for ABB's PCS100 Active Voltage Conditioner

Project completion

14. Energy storage

Microgrid technology turns heritage building into a green pioneer

Power control

16. Gearless milling

ABB will help to ensure power stability for Aktogay sulphide plant

Automotive excellence



Power protection

6. PCS100 Active Voltage Conditioner

New 400 V PCS100 AVC has 20 percent more kVA rating

09. Accelerating to new levels

PCS100 making head waves in the automotive industry

11. Producing a good yarn

Allowing grid interconnection for Sinterama's new production facility

Power protection events

13. ABB event in Malaysia

Ineltec 2013 exhibition and ABB's Power Quality seminar

Grid interconnection

17. A shore connection

ABB providing shore power supply to Viktor Lenac shipyard



Prevent unwanted downtime?

Absolutely.



By choosing from ABB's UPS-I solutions, you are selecting from a unique line up of advanced technologies and expertise. This power protection product range provides energy efficiency, high reliability and increased productivity with zero unplanned downtime. These unique systems have a small footprint in design and give superior value to operations in the industrial, utility and commercial sectors. www.abb.com/pcs100-power-converters

ABB Limited

Tel. +64 6 843 1400

E-mail: powerqualitynz@nz.abb.com

Power and productivity
for a better world™

