



## Behind the scenes

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Advancing efficiency with the PCS100 UPS-I

# From beginning to end

Good service is good business. Offering better service can mean introducing more value, return customers, and new customer recommendations.

Customers like choice, and here at ABB the PCS100 team offer custom-made solutions for power conversion, including installation and service maintenance.

You can be sure that we will be working behind the scenes to achieve the high standards that our customers expect, from beginning to end.



# 1|12 Insider



Perry Field  
Product Manager PCS100  
LV Power Converter Products

Welcome to the first issue of Insider for 2012. For those of you that take holidays at this time, hopefully you had some time to recharge and are ready for a busy 2012! The start of the year is always a good time to reflect on the past and look forward to the year ahead. As PCS100 Product Manager, my task is to make sure the PCS100 platform is aligned with the products and business needs, working closely with our sales teams, customers and R&D.

The PCS100 platform was introduced into production mid 2007, with the first system being a 400 kVA AVC for an airport crane system. Very soon after (in late 2007) the largest installation for PCS100 AVCs was delivered, consisting of 30 x 1.2 MVA and 16 x 1.5 MVA units for the semiconductor industry. Since then the total installed base of PCS100 AVC is now up to 400 MVA and constantly growing. Following the AVC release we have been busy introducing new products, and now within the PCS100 portfolio we have the Industrial UPS (UPS-I), Static Frequency Converter (SFC) Static VAR Compensator (STATCOM) and Energy Storage System (ESS) products. While innovation is constantly ongoing within our R&D department, we are at a stage now where consolidation is the primary focus for our product range.

One of the main areas of effort at present for the PCS100 products is certification. As we grow the business globally we are seeing more and more requests from our customers for product certifications. While the PCS100 is already designed to international standards, the process of obtaining certification often requires a large investment, both in financial and testing resources, and

typically these activities are deferred until the product is in a stable life cycle phase. Our verification and validation team within R&D has been very busy performing the necessary tests and documentation for our products to obtain CE marking and UL recognition. You can expect to see the results of these efforts roll out in 2012 which will considerably strengthen the global acceptance of PCS100 products.

Another area of activity with the PCS100 platform is service. Efforts are underway to improve the service features of the PCS100, providing better service for our customers and to grow our business. As these new features are released we'll run articles in insider and information will of course start to appear on the product web pages, which are regularly updated.

A reminder also that the PCS100 sales and service courses will run again this year. These courses were well received by the attendees last year, and we hope to see more of you again this year visiting the factory in New Zealand. In addition, myself and Andrew Hiscock (Product Manager for power protection) will be in Poland for the 3rd Annual PCS100 sales training for the European region during March.



**06** **Production success**  
ABB's AVC protects the industrial microwave generators during the production process at CHH

**08** **Going for gold**  
Dynamic voltage control for Canadian mines

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ABB provide power protection to Australasia's leading forest products company

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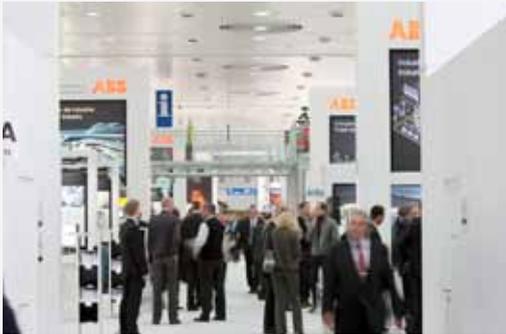
Power protection : [www.abb.com/powerquality](http://www.abb.com/powerquality)  
Grid interconnection : [www.abb.com/powerelectronics](http://www.abb.com/powerelectronics)  
Energy storage systems : [www.abb.com/powerelectronics](http://www.abb.com/powerelectronics)



12 PCS100 UPS-I  
Product feature

10 **New beginnings**  
 ABB is providing power and production protection that saves space, cost and energy for Toshiba Mobile Display Co. Ltd's new factory

PCS100 upcoming events for 2012



April 23-27  
 Hannover Messe, Germany

A showcase of industrial technology, with more 'world firsts' on display and more integrated solutions than elsewhere. Over 6,500 businesses from 65 countries came to Hannover to display their solutions. This year ABB's PCS100 focus will be on STATCOM and the Active Voltage Conditioner (AVC).



April 23-26  
 ABB Automation and Power World  
 Houston, Texas

A four day program consisting of educational workshops, technical training, customer case studies, application workshops, and panel discussions. This year's 130,000 sq. ft. Technology and Solution Center features the latest technology by ABB and our technology partners.

[Click here to watch the 2011 Automation and Power World highlights](#)



Carter Holt Harvey's Active Voltage Conditioner (AVC) protected production line

# Production success

ABB provide power protection to Australasia's leading forest products company.

# ABB's AVC protects the industrial microwave generators during the production process.



Carter Holt Harvey's LVL Mill in Marsden Point

ABB's technology has provided Carter Holt Harvey's Laminated Veneer Lumber (LVL) Mill in Marsden Point (two hours drive north of New Zealand's largest city, Auckland) a solution to the diode stack in the microwave generators from failing. This solution has provided greater productivity and decreased magnetron replacement.

LVL is a step-by-step process and if one production line fails, the whole process can be delayed causing production loss. This was evident for Carter Holt Harvey (CHH), and the need to install ABB's Active Voltage Conditioner (AVC) was necessary to prevent future voltage disturbances from occurring.

## Background

The CHH Wood products NZ business group manufactures and markets a full range of wood based building products, including timber, plywood, laminated veneer lumber (LVL), particleboard, and a range of interior decorative products, supplied from nine major manufacturing operations spread throughout New Zealand.

CHH's plant in Marsden Point manufactures LVL and uses industrial microwave generators during the production process. The microwave units heat the bonding agent (glue) used to hold the sheets of thin wood together (for plywood

manufacture) so the glue cures faster. This allows the factory to make more plywood than if they waited for the natural cure time of the glue. Voltage fluctuations were causing the microwave generators to trip which was halting the production line, causing production loss and requiring costly replacement of parts.

## Finding the right solution

CHH had specific requirements that were product reliability, increased yield, lower running costs, and increased machine centre uptime. To achieve this, they realised investment in a power protection system for the plant would be required.

Therefore, ABB's Active Voltage Conditioner (AVC) was installed to condition the incoming power to the microwave units.

## External elements

With Northland's power (including the CHH plant) being supplied through Auckland, the distance involved made the power feed vulnerable to external elements, such as, weather, tree branches, animals and other industrial sites powered by the same line. ABB's trusted global experience and proven applications in power protection helped mitigate such external elements by providing continuous online regulation and correction of voltage fluctuations.

## Applying the technology

Currently the AVC protects three microwave generators on one production line with a total rating of 300 kW. Since the PCS100 AVC has been installed, there

has been a reduction of loss of magnetrons which, has resulted in a considerable decrease in plant downtime.

## Customer satisfaction

Mark Stackpole, Carter Holt Harvey's Project Manager stated, "For the four months preceding the installation of the AVC, eight magnetrons were replaced for various reasons. In the four months following the installation, only one magnetron has been replaced and this was probably due to the magnetron reaching end of its life."

## In the four months following the installation, only one magnetron has been replaced

This is the first time in New Zealand that ABB's PCS100 AVC has protected industrial microwaves of this size, the largest system to date in the lumber industry, and a first worldwide for ABB AVC for an adhesive curing process.

See more on ABB's power quality technology at :

[www.abb.com/powerelectronics](http://www.abb.com/powerelectronics)  
(power quality products)



# Going for gold

## Dynamic voltage control for Canadian mines.

**ABB is using its vast technical know-how to bring innovative solutions designed for voltage regulation and power factor correction to two major mining companies. Mines have a huge reliance on electrical power and ABB is supporting the mining industry in lowering energy costs and improving the standard of power quality. ABB's PCS100 STATCOM solution is valuable to large continuous mining operations supports the use of high power electrical mining machines that must be fed over very long cable lengths.**

The PCS100 STATCOM solution gives fast acting dynamic voltage regulation (voltage support) for starting continuous borers, extensible conveyor belts and other related industrial equipment. If the mine is affected by low distribution voltage due to long cable lengths, this technology raises the overall voltage at the mining machine, which in turn increases mining machine production and leads to longer motor life.

### **Mining project one:**

One of the mining projects consists of a new mine with the first gold pour scheduled for early 2012, which will produce over 2.5

million ounces of gold in its first 15 years of production. Once at full production in 2012, the mine is forecasting a 15-year mine life with an average annual production of 180,000 ounces of gold. Following the initial two years of open-pit production, the mine will move into underground production with average annual production rising to 190,000 ounces of gold over the remaining mine-life.

### **Solution adopted**

ABB's power electronics team provided a solution which consisted of the design, manufacture and testing of six 4.5 MVar STATCOM



6 x 4.5 MVAR mining application for Canadian mine

units that were assembled in outdoor enclosures. Also included was a one 9.0 MVA ABB step-down oil-filled transformer for one STATCOM unit (115 kV – 13.8 kV). ABB carried out system studies to confirm the STATCOM performance and also provided on-site training of ABB's PCS100 STATCOM technology. The enclosure made by ABB was a 40' ISO container housing 4 x 2.25 MVA inverter rack and controls.

The STATCOM technology for the project is used to regulate the grid voltage by providing reactive power to the grid in either capacitive or inductive VAR sourcing. This reactive power sourcing is done through IGBT based inverters and the platform used by the ABB team from New Berlin WI, which is the power electronics low voltage inverter system PCS100.

#### Performance requirements

The STATCOM performance requirements were outlined as follows:

- Regulate the mine 115 kV bus voltage to a reference voltage continuously adjustable between 115 kV and 122 kV.
- Nominal slope adjustable in steps of not greater than 0.5% between 2% and 10%.
- Response time such that 0-90% rise time of the VAR output achieved in less than 100 ms.
- Maintain the system voltage during the duty cycle of a 6000 HP hoist motor. The motor will draw 6.0 MW during the lift cycle, and regenerate 3 MW during the lower cycle. This cycle is repeated six times per hour.
- Redundancy to maintain performance requirements during N-1 STATCOM configurations.

#### Opportunities

This is the first major project using PCS100 inverters and also using global power products as enclosure integrators. Therefore, close technical cooperation between ABB's New Zealand power electronics team and ABB's New Berlin team was necessary to assist in quality surveying equipment. The exceptional team work between the inverter factory and our own system integration group in New Berlin, which took care of system studies, system integration including outdoor enclosure design and installation/commissioning enabled ABB's global network to be utilised effectively.

#### Mining project two:

One of the fastest growing, lowest-cost gold producers, with operations and development projects throughout America is working in collaboration with ABB to expand an old mine that has produced over three million ounces of gold since achieving its first commercial production in 1997.

#### Background

The need identified was to modify an existing load supply point through a 3.2 km extension of 115 kV transmission line serving the current facility. The total combined load was expected to increase to 20 MVA (18 MW at 0.9 PF inductive), with eight MW located at the new substation. A system impact study was conducted to assess the expansion's impact on the IESO controlled grid reliability with several corrective actions being identified.

The impacts identified were excessive bus voltage fluctuations at the substation during operation of a large hoist motor, and voltage criteria violations at the mine point of connection following a contingency on the IESO controlled grid requiring load reduction.

#### Action taken

The solution adopted was a  $\pm 5$  MVAR ABB STATCOM and one 5 MVAR 13.8 kV capacitor bank, which allowed the mine expansion project to operate at full 18 MW load while meeting IESO post contingency voltage criteria. ABB's PCS100 STATCOM provides dynamic reactive power support to limit voltage sags caused by operation of the 4600 hp skip hoist motor to 1.5% at the 115 kV bus.

Increased network stability and transmission capacity, coupled with grid compliance and a highly reliable modular redundant power electronic configuration, ensures ABB's technology as a safe and reliable choice for mining applications.

See more on ABB's energy storage and grid stabilisation technology at :

[www.abb.com/powerelectronics](http://www.abb.com/powerelectronics)  
(energy storage and grid stabilisation)

#### A golden opportunity

While gold prices have surged 22% over the past year (2011), gold mining stocks have lagged curiously behind over that period.

The Amex Gold Bugs Index, a weighted benchmark made up of 16 of the world's largest gold and silver mining companies, began the year at 540, and after numerous troughs and peaks, we're back near those same levels. Normally, gold stocks will leverage gold on a 2-for-1 basis, but in this case, we've seen miners move sideways as gold has advanced. Yet with gold's price powering skyward, the gold miners have seen their margins expand, making them very profitable at current levels. That makes them absolute steals at these prices.

#### What else are experts noticing?

As gold prices have risen and stayed high, the price/earnings (P/E) ratios of gold miners have been cut in half. That means the sector as a whole is at as compelling a value as it's been in three years. With the price of gold set to rise still higher on the back of incessant money printing in the United States and Europe, these miners are only going to get more profitable. Gold stocks typically follow gold, which is driven in part by cultural influences. Such celebrations like the Chinese New Year impels new gold buying, and that has a positive secondary effect on the gold mining sector.

The bank's research team considered the production levels of 345 gold mines and concluded production will rise just 3.6% annually for the next five years, while demand expands much faster. Their price prediction: \$5,000 gold is likely in the near future.

Source: [moneymorning.com](http://moneymorning.com)



The rendering of the new factory of TMD, Hokuriku district in Japan

# New beginnings

ABB's power quality products support sustainable production for Toshiba.

ABB is providing power and production protection that saves space, cost and energy for Toshiba Mobile Display Co. Ltd's new manufacturing facility in Ishikawa, Japan. This is the first and successful installation for ABB's power protection products in Japan. The technology is being provided by ABB's power electronics team based in Napier, New Zealand with support from ABB in Japan.

## Background

Toshiba Mobile Display (TMD) is a fully owned subsidiary of Toshiba Co., Ltd, and is one of the leading manufacturers of middle to small sized thin-film transistor liquid crystal modules. It also deals with sales, R&D, and manufacturing of low-temperature polysilicon, thin-film transistor liquid crystal display and amorphous silicon. Its products are renowned for the affinity to touch screen function.

## Key challenges

One of TMD's key challenges in constructing the new factory was how to manage the voltage sags. A voltage sag can potentially cause a day of checking and recovering production lines and product quality, at the cost of millions of yen of lost production depending on the scale. TMD had found in other factories that voltage sags were mainly caused by extreme weather, such as thunderstorms. To prevent this, TMD had been predict-

# Power protection is an important factor to prevent expensive recovery costs.

ing thunderstorms and temporarily were stopping their production lines to avoid the effect of voltage sags. However, this practice meant there was a potential of increased electricity costs with the use of the co-generator system to back-up the power supply. The strategy then, was to mitigate voltage sags by implementing ABB's technology.

## ABB's solution

TMD analyzed all the data for lost time and the reason for the past voltage sags in its main power equipment, for connection units, and for other existing factories in Ishikawa. TMD chose ABB's PCS100 AVC (Active Voltage Conditioner) and PCS100 UPS-I due to the proven market and cost performance in power quality and protection.

The PCS100 AVC is a battery free solution leading to less maintenance costs, (no battery replacement), which poses as one of its advantages, along with sag and swell protection and continuous voltage regulation. The PCS100 UPS-I is tailored towards the demands of industrial applications such as motors, drives, transformers and tools. It also provides protection during deep sag and swell, plus outages during deep sag and swell, plus outages between seconds and minutes depending on storage (super capacitors or batteries) and system loading.

The solution chosen for this project was, two 480 V AVCs protecting down to 40% sags and one UPS-I battery system rated to supply 500 kVA at 208 V/3 phase for five minutes.

## Customer comments

Mr. Shinji Kubomae, TMD's Specialist Production Engineering Group 2, Process and Manufacturing Engineering Dept. states, "Since PCS100 AVC was introduced, we were able to be flexible in deciding whether or not to have full back up to the protected load. As a result, we achieved significant cost reduction, as well as space saving and energy efficiency."

## Benefits since installation

In addition, TMD experienced other benefits from working with ABB, including the achievement of a tight timescale for an intensive installation process that was required to be in place prior to the beginning of winter, in order to test the full extremities of environmental forces.

Mr. Yoshiyuki Iida, TMD's Group Manager, Manufacturing Group, New Clean room Promotion Dept. comments, "We appreciate ABB's efficient installation operation with professionalism and dedication of staff members demonstrated in the project."

Since the installation, both products have performed to a high standard and full operation is expected for the factory by spring 2012. In the future, TMD predicts ABB will provide them with power protection technology as highlighted by Mr. Yoshiyuki Iida, "We are also looking forward to communicating with your team to exchange technical information on your wide portfolio range."

Andrew Hiscock, ABB's Product Manager for power protection says, "We are very proud to have TMD install our UPS and voltage conditioner products for the protection of their critical load. This confirms ABB's leadership in the semiconductor sector for power quality and power protection products. We hope to build up on this reference and strengthen our partnership with TMD by executing more projects within Japan and internationally."

See more on ABB's power quality technology at :

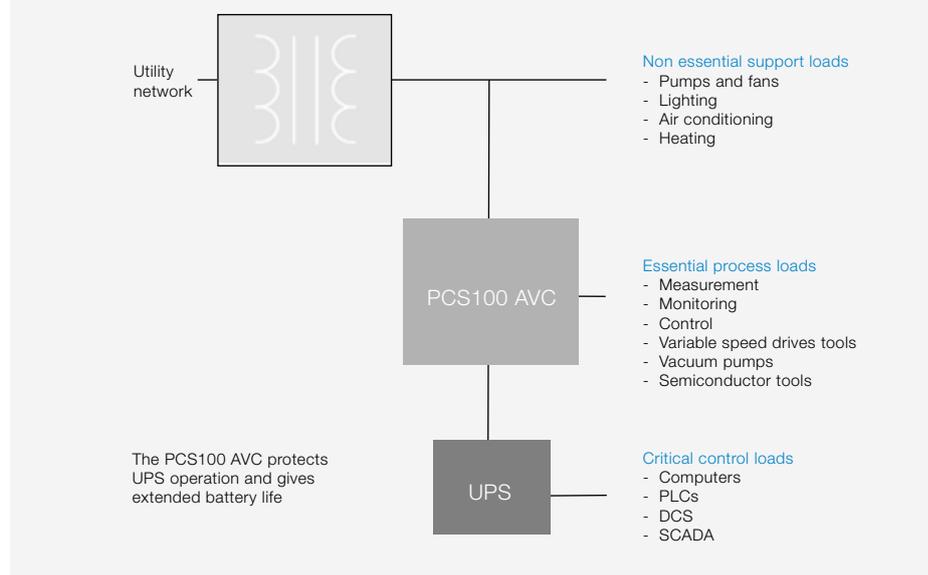
[www.abb.com/powerelectronics](http://www.abb.com/powerelectronics)  
(power quality products)



(Left) Mr. Yoshiyuki Iida / Group Manager, Manufacturing Group, New Clean room Promotion Dept. Toshiba Mobile Display Co. Ltd

(Right) Mr. Shinji Kubomae / Specialist Production Engineering Group 2, Process & Manufacturing Engineering Dept. Toshiba Mobile Display Co. Ltd

## Typical configuration



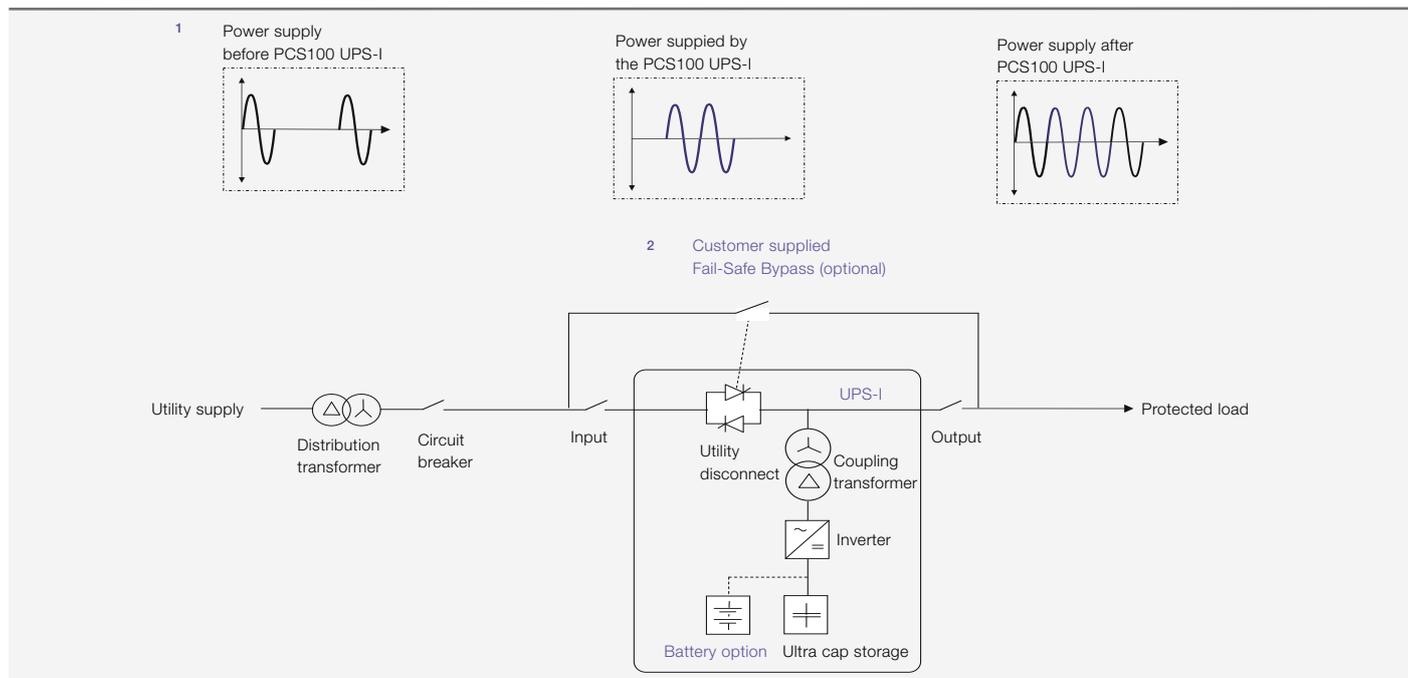


# New generation in protection

## Advancing efficiency with the PCS100 UPS-I

ABB's PCS100 UPS-I (industrial uninterruptible power supply) is gaining market strength as a high performance power protection solution that is capable of meeting CAPEX targets while beating other systems in the ongoing battle to increase product yield, productivity and reduce downtime. The strengths are its efficiency, reliability, lifespan, small foot print, and high power ratings in a single UPS system (up to 2.4 MW). Other user benefits are protection against short outages as well as deep sags. It also provides back-up during generator start-up following a utility supply failure, and allows process loads to ride through common power problems leading to increased yield, reduced product wastage and increased productivity.

## A short duration power outage event and configuration



The UPS-I is a new generation line interactive power protection solution. It protects customer's loads through outages and major voltage disturbances caused by faults in the electricity network and weather events such as lightning. It is a particularly good solution for recloser events, deep voltage sags (dips) or swells and protects the critical loads until the utility voltage returns to within specification or a standby generator starts. The back-up time is dependent on the power requirement of the load in kW and the capacity of the storage system which can be the latest ultra capacitors modules or lead acid batteries. The UPS-I range comprises models up to 2.4 MVA at low voltage, making it a total power quality solution for large industrial processes.

### PCS100 UPS-I advantages

#### High efficiency

The UPS-I has an efficiency of >99% for all 380 to 480 volt models and > 98% for 208 and 200 volt models. This is revolutionary in the industry as legacy solutions are typically 92 to 95% at full load and this efficiency decreases with reduced load. The UPS-I has minimal drop in efficiency down to 25% load.

#### Fast utility disconnect

People familiar with SCRs, the rugged semiconductors used in the utility disconnect, will know that removing the gate drive is not always sufficient to turn the device off as the device current must reduce to zero. The UPS-I actively turns the SCRs off by using the inverters to in-

ject current into the utility when a power quality (PQ) event is detected forcing the SCR current to zero.

#### Revolutionary storage

Batteries and ultra capacitors storage options are available for the UPS-I product. Although batteries have been around for a long time, the UPS-I is designed to operate with the latest low impedance spiral sealed lead acid batteries which provide very high energy density which means a small system footprint.

The batteries for a 30 second 2.4 MVA system take up only eight x 800mm square storage enclosures. This is ground breaking in terms of space.

The ultra capacitor storage option is ideal for high reliability applications

where short duration back up is required (typically three seconds). Ultra capacitors have exceptionally low impedance which means even higher energy density and reduced footprint. The life span is up to 15 years and a 2.4 MVA system will require only four x 800mm square storage enclosures.

#### Redundant operation

The UPS-I is built as an array of redundant inverter modules systems which is capable of operation at reduced power with up to 50% of modules unavailable. The inverter redundancy, and the very fast time to replace faulty modules pro-

vide an extremely high level of system availability.

#### CAPEX and OPEX comparison

The UPS-I requires, less typically, a quarter the footprint of a legacy UPS and about an eighth of the air-conditioning requirement. This equates to significant savings in upfront building cost which continues over the operating life of the system with associated greenhouse gas reduction.

#### Proven performance

The UPS-I has been well received and accepted for its performance in the semiconductor market. It has supported the world's largest memory chip and flat

## The UPS-I has minimal drop in efficiency down to 25% load.

panel display companies in delivering continuous power performance and reliability, whilst having minimal environmental impact. Its benefits outweigh other competitors' products in today's market and with continuous improvement to the UPS-I, it will meet an ever increasing appetite of customer demands. Over seventy 1500 kVA systems have been supplied to the semiconductor industry in Asia alone. In Europe, the UPS-I is generating significant new business in the data center market and in general industry.

See [www.abb.com/powerquality](http://www.abb.com/powerquality) for more information or the latest case studies.

# PCS100 Product training 2012

Register your interest now for 6-8 March



Enhance your technical ability and knowledge in the PCS100 product range. 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 partner channel sales and service engineers.

## Training locations

ABB's LV Power Converter product trainings are 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](mailto: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 is sent to the participants with the confirmation. The course normally runs from 9.00am - 4.00pm 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 applicants to attend the course. Your place on a course can be transferred to another person in your company or department.

## Training schedule 2012

Course	Day one	Day two	Day three
One	6 March	7 March	8 March
Two	8 May	9 May	10 May
Three	7 August	8 August	9 August
Four	6 November	7 November	8 November
<b>Agenda</b> Am	PCS100 product platform overview	PCS100 frequency conversion	PCS100 sizing and pricing tools
<b>Agenda</b> Pm	PCS100 power protection	PCS100 grid connection	Outlook /future developments

# Service and commissioning training 2012

Register your interest now for 2012 courses

## 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 support 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 PCS100 LV Power Converter systems
- troubleshoot problems faster
- extend the lifetime of the product

## Training locations

ABB's LV Power Converter product trainings are 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 to qualify maintenance engineers to undergo unsupervised first level support of ABB's PCS100 applications. The main course goal 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 good practical experience using available tools and techniques through organised practical exercise.

## Who should attend

ABB partner channel and customer service engineers.

## Confirmation

Confirmation, reservation details, and all related course information including schedule and venue details will be sent approximately four weeks before the start of the course.



## Enrolments

Register your interest for upcoming courses via email to : [pq.supportline.nz@nz.abb.com](mailto:pq.supportline.nz@nz.abb.com)

## Training schedule 2012

Course	Day one	Day two	Day three
One	20 March	21 March	22 March
Two	22 May	23 May	24 May
Three	21 August	22 August	23 August
Four	20 November	21 November	22 November
<b>Agenda</b> Am	PCS100 platform service introduction	PCS100 service power protection	PCS100 service grid interconnection
<b>Agenda</b> Pm	PCS100 platform service detailed	PCS100 service frequency conversion	Outlook /future developments

# In Control



## Project feature

### 4. Environmentally friendly force

ABB provides power supply to new frigates

## Industry watch

### 8. Powering up

High penetration solar photovoltaic and diesel power stations

### 12. The wind business

ABB's success and global presence

### 14. Electric drive

The business, product and strategy

# Safeguarding resources



## Project feature

### 6. Reliable protection

ABB's AVC provides a solution to ongoing sags and expensive costs in recovery

## Industry watch

### 8. Power of the storm

AVC in the Philippines

## Product feature

### 10. Energy storage innovation

Enhance the performance, quality and reliability of smart electricity grids

## Service and support update

### 12. Delivering service and support



Bridging the gap in environments where different frequencies coexist.



ABB plays a vital role in creating solutions that reduce greenhouse gas emissions to the worlds' ports, and supporting the sustainable care of the environment. Our products can be found worldwide, providing the solution to port environmental protection challenges. We supply docked ships with electricity from the shore so they can turn off diesel engines that provide electricity for onboard systems such as heating, lighting and refrigeration.

[www.abb.com/powerelectronics](http://www.abb.com/powerelectronics)

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for a better world™

