





Power player

ABB's PCS100 RPC does more than just compensate reactive power

SOPHIE BENSON-WARNER – For some manufacturers, it can be a headache if their power supply fails or suffers quality degradation. For others, however, such power events can herald a major catastrophe, resulting in huge recovery costs and expensive production downtime. ABB's Reactive Power Conditioner is designed to mitigate most common supply voltage problems caused by reactive power, harmonics, fast changing loads, voltage drop, poor power factor and so on. In combination with an appropriate uninterruptible power supply, the Reactive Power Conditioner can provide a comprehensive power quality solution for industrial, commercial and renewable energy applications.

Title picture

Power supply degradation is best avoided when possible. ABB's PCS100 Reactive Power Conditioner helps maintain a supply of high-quality power to critical loads, like this water pumping station.

1 Most of society's industry and infrastructure is dependent on a constant supply of clean, high-quality power.



In the home, it can be annoying when far-off power grid events cause the lights to flicker, or even cause equipment to temporarily switch off. For industry, the effects can be much more dramatic: If a production line has to stop, it has to be restarted and, for some industries, this can be a complicated and very expensive exercise. Equally, utilities, such as gas, water and electricity providers, are very dependent on a stable power supply, as are a host of other entities, such as office complexes, transportation systems (trains, airports, etc.) and ports → 1. In the industrial setting, detrimental power events can be self-gener-

ated – by welding equipment, arc furnaces or fast transients from embedded generation sources such as photovoltaic, for instance. It is best, then, to invest

in appropriate equipment and ensure a constant supply of clean, high-quality power. ABB's PCS100 Reactive Power Conditioner (RPC) tackles most of the power quality problems found in industry.

Power protection

ABB has a variety of power protection products and the PCS100 Reactive Power Conditioner (RPC) is the latest addition to this portfolio → 2. Specifically designed for industrial and commercial applications, the PCS100 is able to respond instantly to power quality events, while providing continuous reactive power correction → 3.

Power problems can manifest themselves as power factor issues, inrush-generated sags, voltage imbalance or voltages outside regulatory requirements (a particular problem for direct online motors) and harmonics. These can result in financial penalties and costly electrical equipment malfunctions if left uncorrected.

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Although the PCS100 RPC's prime role is to condition current, by injecting reactive current into the circuit to stabilize the voltage, the PCS100 RPC can pro-

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vide a very cost-effective solution to these problems. Because the PCS100 RPC conditions the current drawn by the customer's load, it fits well with ABB's other products in the PCS100 family, such as the PCS100 UPS-I uninterruptible power supply (UPS) and the PCS100 Active Voltage Conditioner (AVC), which provide power supply to critical loads and condition voltage, respectively [1].

The PCS100 RPC is rated for applications from 100kVA to 2,000kVA and uses high-speed insulated-gate bipolar transistor (IGBT) inverter technology to control reactive power flow into the AC network. By injecting capacitive or reactive current at different frequencies and phase angles, the PCS100 RPC efficiently and reliably provides:

- Fast dynamic reactive power
- Unity power factor
- Correction of current imbalance
- Harmonic cancellation

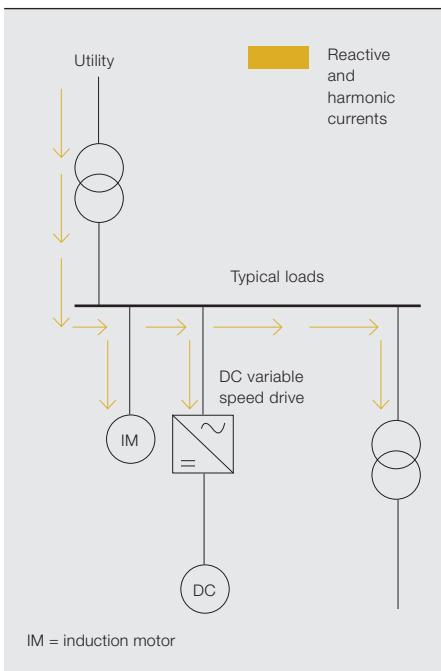
The inverter technology employed means the compensation is stepless, unlike many other solutions. This minimizes disturbances and ensures seamless power conditioning.

Modularity

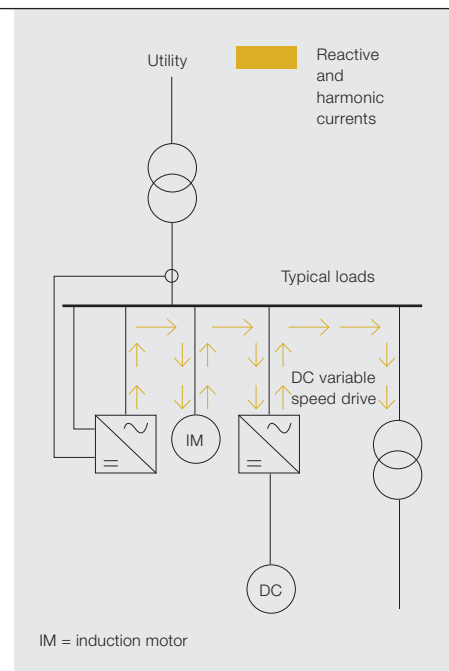
A complete range of cabinets for the PCS100 RPC is available. They are all suitable for direct connection to typical low-voltage supplies (380 to 480 V) → 4. The devices are rated from 100kVAr to several MVar. Combined with the PCS100 UPS-I and the PCS100 AVC, the PCS100 RPC can be applied to a wide range of situations, from computer

The highly reliable modular redundant designs mean the system is scalable and can be easily expanded as power needs grow.

3 ABB PCS100 RPC schematic



3a Without PCS100 RPC



3b With PCS100 RPC

room backup to large data centers and complete industrial plant protection. The highly reliable modular redundant design means the system is scalable and can be easily expanded as power needs grow. In addition, if one of the power modules fails, the system will not trip, but will continue to operate at reduced capacity. Because the granularity is small, the manufacturer can get full redundancy at very low cost. This level of reliability at such low cost is unique in the industry.

RPC plus UPS

A comprehensive power assurance package can be created by combining the ABB PCS100 RPC with an ABB PCS100 UPS-I. Precisely this has been done for one particular customer to help protect its critical polyimide film manufacturing line.

Polyimide materials are lightweight, flexible and resistant to heat and chemicals. They are typically used for flexible printed circuit boards in items such as telecommunication devices, wireless suspensions for hard disk drives and optical pickups. ABB's customer is a critical supplier to the electronics world and a power outage in the manufacturing process would result in significant recovery costs and production downtime as well damage to the company's reputation.

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The power protection package provided by the two PCS100 products enables outages, sags and swells to be eliminated (via a 1,050kVA PCS100 UPS-I), while at the same time increasing the power factor of the load above 0.90 (via a 323kVAr PCS100 RPC). In addition to dynamic power factor control, the PCS100 RPC also provides filtering of low-order harmonics, further improving power quality. This value-added concept was a key factor as protection of vital assets was essential to continuous output.



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This turnkey solution means that if a power outage occurred, the PCS100 UPS-I would disconnect the load from the utility and supply the manufacturing line with full power for 5 min. Simultaneously, the PCS100 RPC would provide power factor control above 0.90. The customer's expectations were that, should a power outage occur, the UPS-I would supply power to the load of 1,000 kVA. ABB's PCS100 UPS-I is able to go beyond that expectation and supply 1,050 kVA to protect the load in the event of a shutdown.

The PCS100 UPS-I includes a high-speed static switch, meaning that the transfer to power stabilization mode occurs very quickly. After further evaluations were undertaken, the company found that no competing products could provide this. The final deciding factor related to system efficiency as the manufacturer was able to save a large sum on air conditioning requirements due to low heat loss from the PCS100 UPS-I. The ABB PCS100 RPC itself has an efficiency of 99 percent. It also has a small footprint and is thus a good option when real estate is scarce or expensive.

The modular and scalable architecture of the ABB PCS100 RPC and its compatibility with the other members of the ABB power protection family, as well as its success in combating common industrial power problems, has already resulted in significant success in a range of power protection applications. For example, a 100 kVar RPC is helping to improve the electrical drive power quality of Wellington's iconic cable cars. This project on New Zealand's capital city's funicular railway includes some firsts for ABB: As well as being the first PCS100 installed in New Zealand, it is also the first in the public transportation industry globally. It is also the smallest footprint PCS100 product ever built.

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References

- [1] S. Benson-Warner, "Eliminating downtime: Keeping the power flowing during grid instabilities," *ABB Review* 1/2012, pp. 27–29.