Medium-voltage, premium performance

ABB’s PCS100 medium-voltage UPS

PERRY FIELD – Launched in 2014, and inheriting many of its features from its low-voltage counterpart, the medium-voltage (MV) PCS100 MV uninterruptible power supply (UPS) is already becoming established in the market. Medium-voltage UPSs have been available for some time now, the incumbent in the sector being the dynamic rotary UPS (DRUPS). While a DRUPS system uses a rotating machine to generate the power to the load, the PCS100 MV UPS uses modular power electronic inverters. Such a design is referred to as a static solution as it has no moving parts. The UPS’s modular architecture allows the basic 2 MVA unit to be easily expanded as customer power needs increase.

1 ABB's PCS100 MV UPS

Energy efficiency is a topic that is rising to the top of the agenda for many facility managers. In the case of data centers, for example, energy consumption is one of the few operating costs the data center manager can influence. A static UPS is well placed in this regard to deliver real savings: With an efficiency of 99.5 percent, the PCS100 MV UPS leads its class.

Improving power quality is always a vital task for UPS systems. Many large, critical industrial processes – like semiconductor fabrication, chemical manufacture and food production – rely on a power quality level that often cannot be provided by the public grid. In these industries, major production losses caused by mains interruptions simply cannot be tolerated. The situation is further complicated by the fact that economies of scale mean single locations have grown larger and have generated a correspondingly higher demand for a safe power supply – often well into the tens of megawatts. In addition, production areas requiring large amounts of electrical power are often widely scattered over a particular site. Long distances in power distribution also have to be overcome in places like large airports, or in some of the vast electronics manufacturing facilities now operating around the globe.

These issues can all be solved by using MV-rated equipment such as MV UPSs and distributing electrical power at MV levels.

Medium is premium

Providing premium quality power at medium voltage does not have to be costly. The capital costs of a static MV system are often lower than those of a rotary or paralleled low-voltage (LV) system – at high power levels LV requires large conductors, sizable switchboards and multiple circuit breakers. Also, looking after all of these can add considerably to the maintenance budget, especially if a rotary system is employed. Of course, with MV, losses are lower and less space is required for equipment by virtue of the lower current required to transmit the same power.

The modular design of the PCS100 MV UPS allows a simple replacement of the LV grid-to-load interface with MV components. The core parts of the UPS, such as the highly reliable LV power electronics and battery storage, remain the same as for LV applications. In this way, the tried and tested functionality and maintainability of the LV UPS is kept but the advantages of MV can be exploited, ensuring high levels of availability and reliability.

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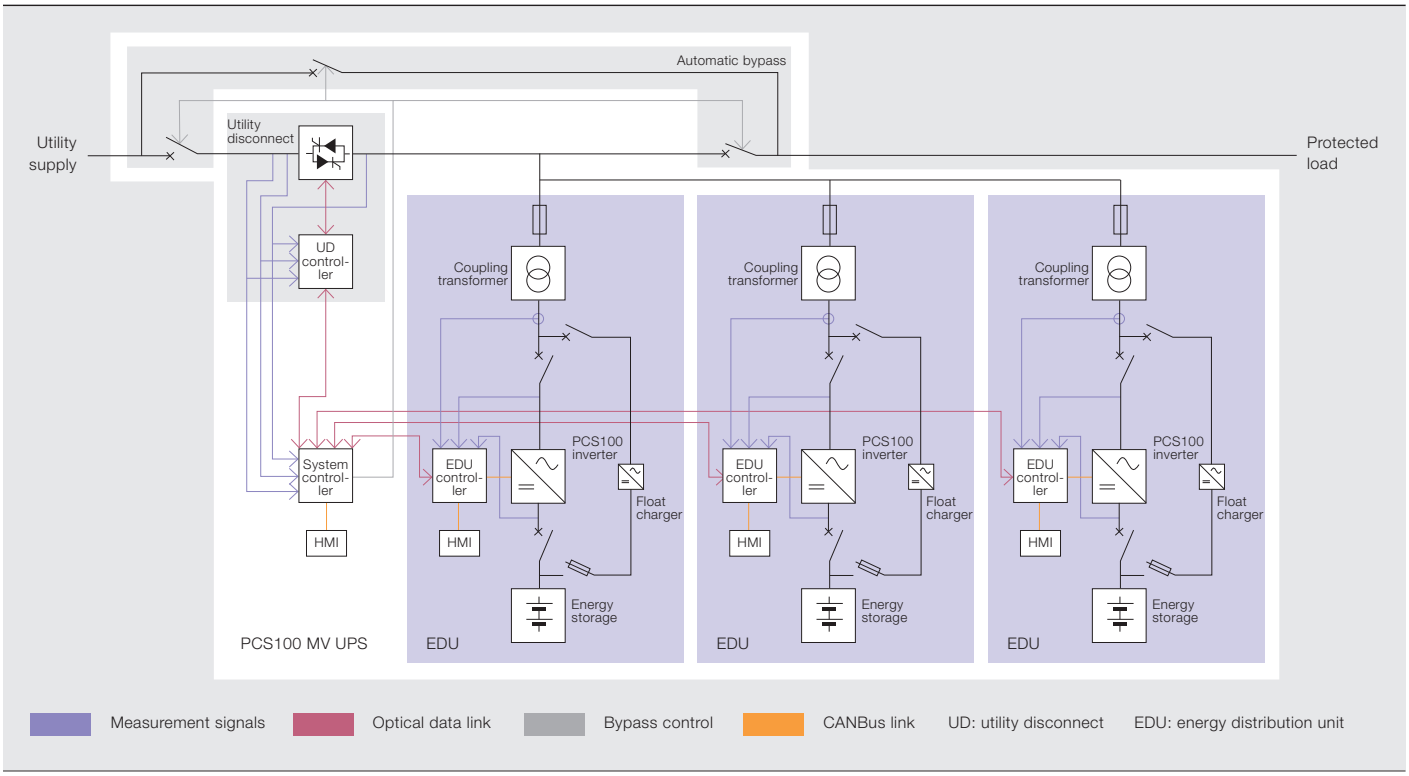
In large, high-technology manufacturing facilities, such as semiconductor fabs, the role of MV UPS systems is already well established. The MV UPS provides plant-wide security of power, protection from all grid disturbances and a buffer period before a switchover to local generation (in the case of a major outage).

Title picture
ABB's PCS100 MV is an all-electronic, high-power UPS suitable for protecting critical process or data center applications.
Pictured: ABB's PCS100 MV UPS.

2 Single-line diagram of ABB's PCS100 MV UPS



More frequently, the UPS is required to condition the incoming power – removing sags and short-duration phenomena caused by faults in the external power network. Here, ultracapacitor energy storage is used. For such high-power demands, the small footprint of ultracapacitor energy storage – with a power density of 1,000 kW/m^2 a reality – has a clear advantage.

In large data centers, the philosophy is similar. There are also many design options – one being, for example, to perform the UPS function at MV levels and distribute MV to the individual floors of the data center. Transformers complemented by static transfer switches close to the IT equipment can be used to create an isolated redundant back-up line with two alternative power supply paths to the loads [1].

Advantages of MV UPS technology

Using an MV UPS system to protect critical applications will reduce the required feeder ampere capacity. For example, 1 MW in a 400/230 V AC system involves 1,443 A current per phase. With 15 kV, this current is only 115 A for the same power transmitted. Another feature of the MV UPS is that the system can be centralized, which helps manage floor loading and allows freedom in the floor plan – lack of space being one of the major cost issues in a data center or a production facility. Reducing the space needed for infrastructure equipment like power supplies results in additional space for IT or manufacturing equipment.

Often, the area available for the UPS system is given and limited – particularly in existing buildings – but the power rating required increases remorselessly. High-power, compact MV static UPS products are well-suited to overcome this challenge.

As well as footprint, electrical losses are also an important consideration. Particularly at long distribution distances – in large industry facilities or in spread-out places like airports – losses can become significant. For longer distribution lengths, the influence of the cable will become more significant. Here again, operating at MV levels would give a better result.

Scalability and modularity

Scalability and modularity are key features of the PCS100 MV UPS. With a basic rating of 2 MVA, the PCS100 MV UPS system can grow in size as the factory develops → 1–3. The PCS100 MV UPS is the only static MV UPS on the market today that can provide this feature. As well as EDU (energy distribution unit) modu-

MV distribution reduces losses and needs less space for equipment by virtue of the lower current required to transmit the same power.

3 MV equipment takes up less space than LV. Modules are easy to add as power requirements grow.

As a key component in the infrastructure of a large data center, the UPS can also benefit from being operated at MV.

larity the PCS100 MV UPS has inverter modularity, giving extremely high levels of availability through inverter redundancy. This has the advantage that the customer has a lower initial capital investment and can flexibly grow the infrastructure as the business grows.

The PCS100 MV UPS is available in multi-megawatt ratings and provides tailored solutions to large IT, business and production facilities. The PCS100 MV UPS has been designed to provide clean, reliable and efficient power at a low cost for customers consuming high levels of power. The single-conversion topology used is a natural choice for MV as losses are extremely low, meaning efficiencies well in excess of 99 percent can be achieved. The PCS100 MV UPS can be installed to protect the complete supply or just selected sensitive loads.

Exclusively MV UPS for large-scale applications?

Increasing power density and total power demand at single sites, combined with a growing requirement for high-reliability power in IT, business and production facilities are growing trends in industry. Suppliers have to respond with suitable UPS and distribution designs, and the step up to MV is a logical one. MV systems reduce cable size and losses, which increases overall efficiency. Additionally, integrated, high-power MV UPS systems can reduce the number of components, such as switchgear and cabling, as well as shrink footprint – an invaluable aid where real estate is expensive or limited. An MV UPS enables a clearly laid out high-power system configuration and keeps its complexity within manageable limits.

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Further reading
To learn more about ABB's power protection solutions, please visit www.abb.com/ups

References
[1] Frank Herbener, (2013, March). *Isolated-Parallel UPS Configuration* [PDF]. Available: http://www.piller.com/documents/en/2129/isolated-parallel-ups-configuration-en.pdf