

Article PCS100 UPS - Single conversion UPS for large industrial power protection

The different types of UPS and their relative merits for various applications are not easily understood. There is a lot of literature from UPS manufacturers that is crafted carefully to push the benefits of their particular product. Within the ABB portfolio we have a wide range of UPS offerings and can position the products according to the technical needs of the customer. This article is about the PCS100 UPS-I product and how it is positioned in the market to meet the customers specific requirements.

Definitions

First we need to define some of the words used in the title. Figure one shows the basic topology for a single conversion and double conversion UPS. Single and double refer to the number of conversions between AC voltage and DC voltage.

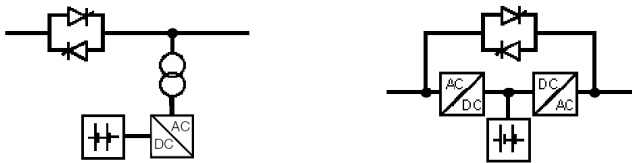
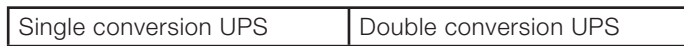


Figure one: Basic topology for a single conversion and double conversion UPS

The 2nd part of the title needing explanation is “industrial”. This word has many different meanings. In some cases an industrial product is one that has higher IP rating, suitable for harsh environments, or an isolation transformer, or even a specialized product for markets such as oil and gas. When we talk about industrial together with the PCS100 we are actually referring to the load’s electrical characteristics. This is the primary product positioning for the PCS100 UPS-I, industrial electrical loads. And finally large, in this context we talk about power requirements of typically half a megawatt and above.

Understanding the loads

Now that we have defined the load type we need to understand where these are and what they require. The type of industrial customer that would benefit from power protection are those with high value products that spend extended time in the manufacturing process. Some examples of these are:

- Semiconductor and LCD manufacturing
- Pharmaceutical and chemical manufacturing
- High value textile processes (i.e. carbon fiber)
- Automotive, presses, painting, robots, CNC

All of these processes are targets for power protection, as the cost of an interruption to production can be extremely high. While there are many electrical devices involved in these processes,

some common elements can be found. These are listed in the table below and the associated challenges they bring identified.

Load type	Issues
Motors (compressors, conveyors, pumps)	Starting and stopping, inrush, poor power factor, regeneration
Welders, plasma cutters	Inrush currents
Downstream transformers	Inrush currents, magnetizing currents
Rectifiers, variable speed drives, CNC machines	Harmonic currents, dynamic loads

The other challenge with these processes are often the power requirements are into the megawatt range. Combining these load types with ratings in megawatts is precisely the definition of large industrial when referring to PCS100.

Why single conversion for large Industrial electrical loads?

As outlined above, these loads and the amount of power required presents several challenges. One of the recurring themes is inrush current. Inrush current is experienced when a motor or transformer is switched on. In the case of a motor this inrush current can be six times the nominal current draw of the motor. Obviously for a power protection device to handle such high currents can be challenging. And it’s not only the magnitude, this current is reactive current which can cause voltage drops if not accounted for. This is where the single conversion topology of the PCS100 is strong. During the vast majority of the time, when the utility power is within tolerance, the utility disconnect switch of the PCS100 UPS-I is conducting.

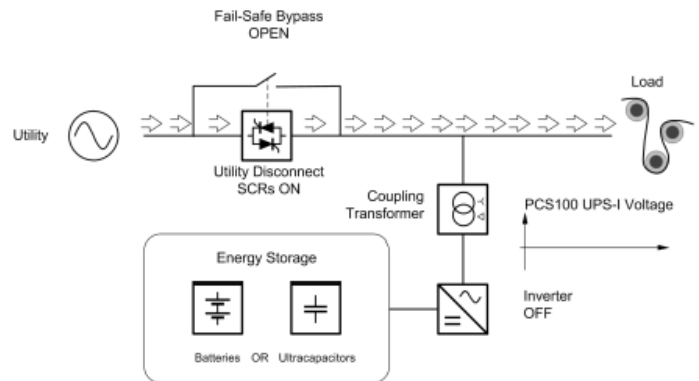


Figure two: Single line showing UD on and conducting power (Refer to PCS100 UPS-I technical catalogue page 7)

This utility disconnect switch is made using silicon controlled rectifiers, SCRs, which are one of the simplest and most robust semiconductors available.

The SCRs chosen for the utility disconnect switch in the PCS100 UPS-I are selected to provide not only the continuous current requirement, but also significant overload capability (up to 300 percent for 5 seconds). It is this overload capacity, together with the fact that the voltage drop across the SCR is very low (in the order of a few volts, even in the overload region) that makes powering these current inrushes possible.

High power needs high efficiency

When the requirement is to protect megawatt levels of loads the efficiency of the power protection equipment becomes very important. For 1 MW load levels, an efficiency of 99 percent (typical for the PCS100 UPS-I) results in 10 kW of power loss. If high efficiency power protection equipment is not used then the losses can jump to 30-40 kW of power.

The increase in air handling needed to manage this level of power loss in a switch room is significant, as is the wasted energy being dissipated 24/7.

Don't let load faults expose your power protection

Large industrial loads are also often a mix of many machines and processes. This presents a challenge for the power protection equipment in terms of circuit protection and discrimination. Should there be a fault in part of the load, which is not uncommon in manufacturing processes due to the complexity, the UPS must provide the fault current to allow the circuit breaker or fuse to clear.

If the fault cannot be cleared, then the power to the rest of the manufacturing plant will be effected, reducing the plant productivity.

Dollars and cents

While this article is focused on some of the technical aspects around power protection for large industrial loads, there are also commercial aspects that go hand-in-hand. These industrial customers are wanting products with lifetime in accordance with the plans for their plant. This can be anywhere from 10-20 years and managing operational expenses over this time is important. The single conversion PCS100 UPS-I has excellent lifetime primarily due to the fact the main power electronics is in standby for the majority of the time.

To find out more about ABB power conditioning, visit:

www.abb.com/pcs100-power-converters.

