WHITEPAPER BY riello ups

POWER CONTINUITY FOR THE 4TH INDUSTRIAL REVOLUTION

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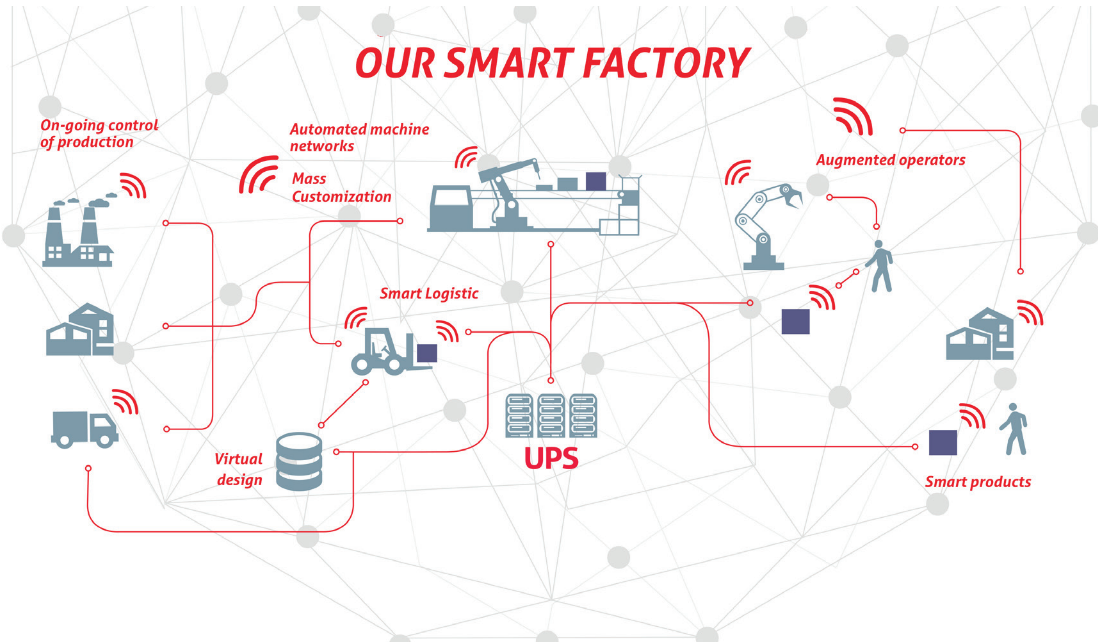


1 Introduction

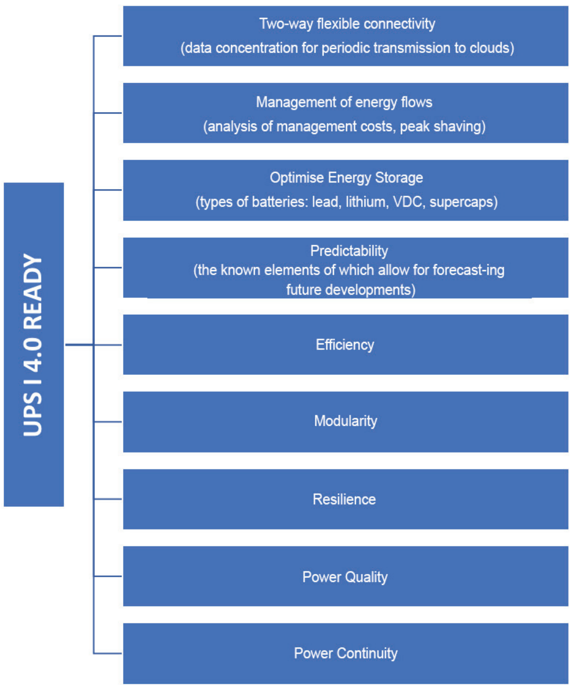
The term **Manufacturing 4.0** defines an industrial automation trend that integrates new production technologies geared towards improving work conditions, increasing productivity and enhancing the production quality of plants.
Manufacturing 4.0 incorporates the smart factory concept consisting of 3 parts:

- **Smart production:** new technologies that promote collaboration among all subjects of the production chain, namely operators, machines and instruments.
- **Smart services:** all the "information technology infrastructures" and techniques that allow for integrating systems; but also all structures that – in a collaborative context – enable companies to integrate (supplier – customer) with each other and with external facilities (roads, hubs, waste management, etc.).
- **Smart energy**: all the above aims are pursued with an eye to energy consumption, by creating more efficient systems and reducing energy waste.

2 UPS 4.0 READY

Starting from the fundamental concepts underlying the fourth industrial revolution, there are UPS (Uninterruptible Power Supplies) ready to play a decisive and strategic role to ensure power continuity and maximum digital interconnectivity. They are characterized by SMART platforms that allow for integrating, managing and analyzing the energy flows of production processes so that they can be optimally used by all value chain components; the result is an actual **smart grid of smart factory industrial processes.**

What UPS devices are able to offer and in what way they are 4.0 READY:



3 UPS for Smart Production

Two-way flexible connectivity (concentration of data and its periodic transmission to clouds): hardware will increasingly merge into software and vice-versa: HW, SW and data networks – all these components will become increasingly integrated. This evolution is reflected in the technologies surrounding us: the "Internet of things", telemetry systems and the series of smart technologies, generally speaking; isolated systems are history, as everything is interconnected.

A product such as a UPS, which is essentially designed to provide power continuity for sensitive and critical loads, must be able to interact with surrounding systems, provide information and receive commands remotely, manage its services in a flexible and intelligent manner based on timely requirements, and perform self-diagnosis.

The current revolution – which is changing products, work procedures and our way of life – can only stem from integrated development involving networks, which are used to exchange information, software, which provides intelligent services, and – above all – hardware, which is the backbone of all these services. Another essential feature is the compatibility with the main INTERCONNECTION systems:

Some UPS manufacturers guarantee data

- SNMP
- HTTP
- Profibus
- TCP/IP
- MODbus
- BACnet

concentration and its periodic transmission to clouds thanks to a remote cloud-based management solution that enables assistance centers to remotely monitor and control UPS systems, and enables users to interface with all company management and control systems to provide information.

This management solution guarantees data security by advanced server infrastructures characterized by extremely high levels of IT security, back-up systems, fire safety and personnel available 24 hours a day, 7 days a week. In fact, the solution can be a geographically redundant system, which increases its availability in the field both for users and for gateways, minimizing loss of data.

Modularity

Modularity is the practice of breaking down a system and/or its components into smaller elements, or modules, that when combined together function as a whole. Each individual power module of a UPS, therefore, has its own hardware and control parts enabling it to work together with other modules to form a larger and more powerful overall system. The power modules connected in parallel are controlled uniformly by the various UPS modules, and the absence of a master/slave architecture (once used to manage parallel UPS devices) eliminates the possibility of faults in a single point (single point of failure). Due to the highly flexible connotation of this architecture, the installed power can be increased or decreased depending on the load requirements: we therefore speak of "scalability". This concept goes hand-in-hand with financial savings as a lower initial cost is required for the investment – an idea summarized by the concise but equally effective expression: "Pay as you grow" (you only purchase the power modules when your load actually increases). "Automatic load management" will become equally straightforward, if the applied loads should decrease, for example when equipment is replaced with systems that consume less power, by activating only the number of power modules required for the load, plus the "Redundancy N+1".

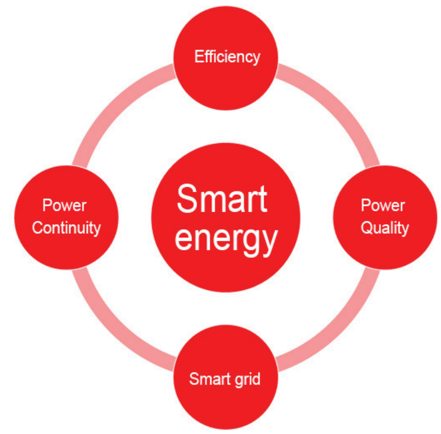
Resilience

This is an essential trait: energy systems or networks must be capable of reacting to any abnormal operating condition or critical event.
You should look for manufacturers that ensure that all the main components of UPS solutions are redundant and their temperature is constantly monitored. Also, make sure the power modules are controlled by separate and independent multi-microprocessors, as well as by multiple communication buses, guaranteeing top-class robustness.

4. UPS for Smart Services

Predictability

Thanks to information on the general operating conditions, ambient temperature/heat sinks and applied load, etc., it is possible to interface with a predictive system to forecast the future developments. By analyzing this data, for example, it is possible to predict the premature deterioration of the batteries and electrolytic capacitors due to excessively high operating temperatures.
This system also allows for verifying the presence of dust in heat sinks or abnormal operation of the ventilation system, besides detecting other alerts to perform maintenance in advance or to modify the operating conditions of devices before it is too late. Moreover, by exploiting the extensive information on the network's electrical and load parameters managed by the UPS system, it is possible to develop report tests with anomaly frequency analysis highlighting the electrical stress of the applied load (harmonic currents, resonance phenomena, micro-interruptions, frequency variations) that cause premature deterioration of all sensitive components or, even more dangerously, their immediate failure. Pervasive communication, exchange of experiences and best practices at all levels, adoption of predictive instruments and enhanced intervention speed, and waste control to improve efficiency.



5. UPS for Smart Energy

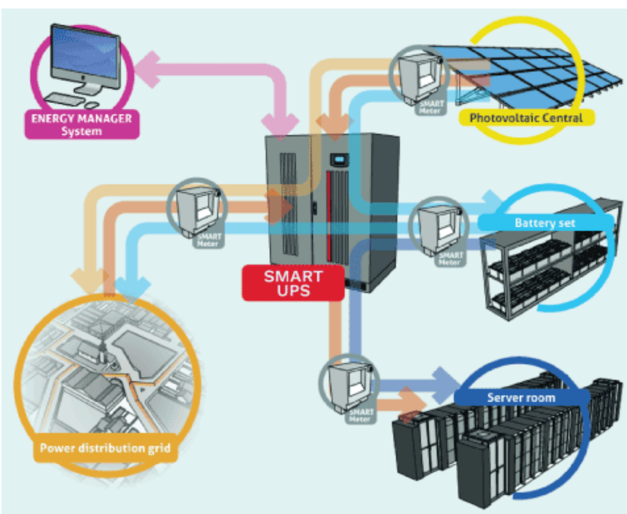
Efficiency

Reducing consumption is a challenge that all companies and industries must face daily. The adoption of technologically advanced solutions allows for pursuing this goal with a 15%–20% annual reduction of the energy bill, ensuring a ROI (Return on Investment) within a short time and considerable savings over the years.
Moreover, appropriate operating modes – such as Energy Saving – enable UPS devices to optimize efficiency. Through this specific function, it is the UPS that decides whether to adopt the ON-LINE or ECO modes, resulting in a 99% performance based on a statistic analysis of the quality of the power grid. In parallel systems, the "Efficiency Control System" (ECS) allows the UPS to switch from ON to OFF automatically, thus reducing the total energy dissipated by the system and guaranteeing the load supply and redundancy.

Smart Grids

Smart Grids (that is, the convergence between electricity and telecommunication grids) introduce a new concept of power transmission and

distribution grid that can be adapted for integration with new technologies, products and control systems. They efficiently manage the behavior and actions of all connected users (generators, utility points), including small- and medium-size systems for generating power from renewable sources, such as solar heating and wind power, and from traditional sources.
Energy storage for Smart Grids plays a different role: a tangible alternative to large centralized energy accumulators (e.g. large-scale hydroelectric systems): the one of distributed storage.
Batteries for UPS devices are costly but are often only used partially; why not use these distributed storage accumulators to generate business?
The additional energy produced is stored by battery banks of UPS devices (STORAGE), and can be managed and used as required.



For example, during peak offer periods (at night) and when the energy cost is lower, it is possible to create an energy reserve of the STORAGE device to be used during peak demand periods (during the day) when the energy cost is higher, or to ensure peak shaving and avoid costly increases in the contractual power or penalties for exceeding the maximum power thresholds.

Power Quality and Power Continuity
To guarantee the advantages expected from the fourth industrial revolution (flexibility, speed, productivity, quality, product competitiveness) and maximum efficiency of the production lines, high-level automatic systems are not sufficient but it is indispensable for the entire system – consisting of electromechanical, electronic and IT components – to be protected against external risks to ensure a power supply free of interruptions and disturbances.
The solution lies in adopting UPS devices capable of ensuring continuous, clean and perfectly sinusoidal power supply. The perfect UPS for this type of applications is designed to guarantee a reliable, continuous and high-quality power supply to systems that control and manage industrial production processes, as well as to all critical loads, by functioning as an interface between the grid and the load in case of power grid anomalies, overvoltage, undervoltage, spikes, harmonic frequencies, frequency variations, micro-interruptions and even annoying blackouts.

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