APPLICATION NOTE

# Continuous Power For Process Control Loads

## Food and beverage industry

The tremendous amount of food recalled annually around the world (including fruit, vegetables, cereals, bakery products, meat and many others) is mostly due to processing defects. ABB continuous power solutions protect process automation systems and equipment, thereby ensuring process continuity and reduced downtime.

**What is Continuous Power?**

Due to the increasing intensity of automation, food and beverage manufacturing plants are extremely vulnerable to downtime and power quality events. And the quality level of electrical power is business critical. This means that continuous uninterrupted clean power supply is required to protect process automation needs and equipment reliability from outage and power quality problems.

**Why you need Continuous Power For Process Control Loads**

Processing defects can be due to fluctuations or downtime in the power supply. For example, dairy producers must track the temperature of their milk accurately throughout the process since, if it causes the temperature sensors to fail, even a small power system disturbance can result in an entire batch of perfectly good product having to be dumped. Unexpected downtime can spoil valuable milk products, which then have to be disposed of. Industry analysts estimate the cost of downtime in an F&B facility to be between $100,000 and $1 million per hour. Thus, a continuous uninterrupted clean power supply is critical for this type of industry.

**Main benefits**

**Continuous Operation**

- Reliable double conversion UPS that protects process automation from disturbances.
- Decentralized Parallel Architecture (DPA).
- Modules can be replaced and added without downtime (on-line swappable).

**Self-optimizable projects**

- Pre-designed, pre-tested and easy to commission. Cuts down on project time.

**Energy Efficiency**

- 96% high efficiency in the double conversion mode reduces running costs without compromising reliability.

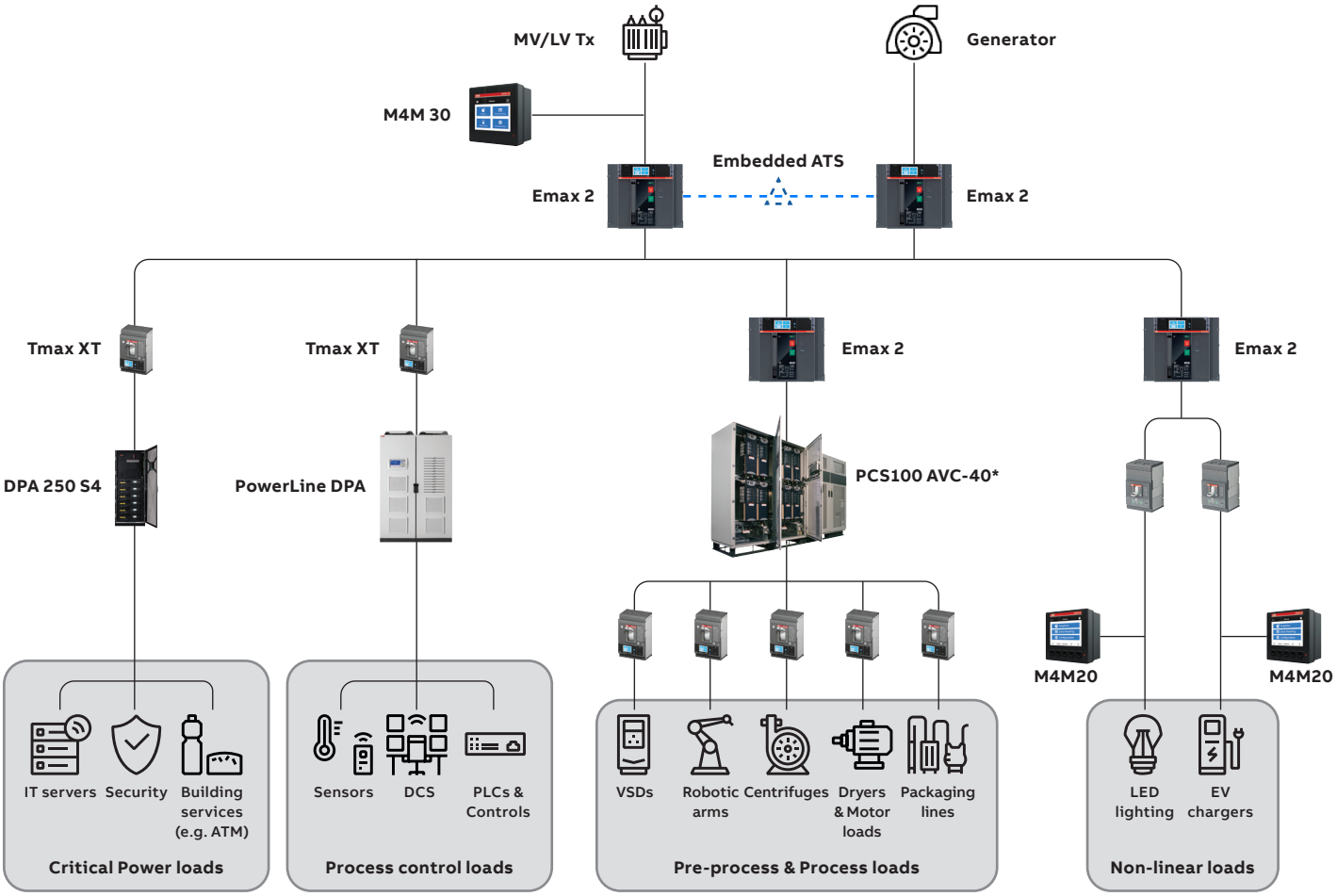
**Sturdy**

- Can easily cope with dust, water condensation, excessive humidity (up to 95%), corrosive air contamination and rough manhandling.

# Application overview

Depending on the nature of their business, F&B industrial buildings include a mix of different processes and equipment with greatly varying power protection requirements.

They have been categorized into the following classes of loads and are protected separately but in a centralized way:




**1. Critical power loads**
require continuous operation, protection against outages and abnormal supply conditions in order to ensure security, personnel safety and reliability.

**2. Process Control loads**
require continuous operation, protection against outages and Power Quality problems in order to support process automation and equipment reliability needs.

**3. Pre-process & Process loads**
require continuous operation, protection against outages and Power Quality problems.

**4. Non-linear loads**
can trip or fail but restart without impacting the performance of the system. For this reason they do not require protection against outages but can be separated.

# Processes

**Ingredients, F&B Processing**

**Picking**
Stable power is required to support increasing automation in picking processes. Installation of UPS in control equipment can eliminate waste and increase output.

**Mixing**
requires precise control to ensure consistent product quality. Mixing machines often have high starting torque and frequently operate at different mixing speeds. This can cause undesired voltage fluctuations within a facility, affecting sensitive equipment connected to the same power supply. Power factor control minimizes voltage fluctuations and penalty charges from the power utility.

**Sterilization**
is a key element of nearly all food and beverage processes. Pasteurization, cooking and Ultra High Temperature (UHT) treatment rely on continuous clean power. Temperatures must be accurately controlled and often recorded to keep track of the effectiveness of sterilization. Any power event or interruption that impacts the sterilization process or temperature recording can result in loss of product. Disposal of waste product and the extra time it takes to clean the system prior to resuming production can entail significant costs..

**Packaging**

**Conveying**
Increased automation means that faster and more complex conveyors must be used. Bottling is a typical example. Interruptions are usually due to voltage fluctuation causing sensors, drives or controls to malfunction. Besides physical damage to the product or tools, it also leads to timeouts for cleaning or repair work.

**Filling**
machines designed to fill dry mixes, liquid or thin food products can be subject to voltage sags. Eliminating these common power quality problems can help filling machines achieve continuous output and reduce product waste.

**Packing**
comprises a number of fully automated processes performed at high speed. Such processes may include product separating, weighing, vacuum packing and freezing. Disruptions to packing results in loss of product, poor quality and potential health risks if the packing is compromised.

**Palletizing**
Often a highly automated process and the final stage after packaging. Robots are widely used and require good quality power for continuous operation. Data records from the batches must be securely acquired and stored.

Every touchpoint across food and beverage production is held to high standards of safety, from personnel and practices to preparation and packaging. Not only can downtime in F&B cost thousands of dollars per line per hour, it can also result in significant food wastage. Overlaying the entire operations are production schedules that factor in added or extended shifts, maintenance, cleaning and sanitation, while assuring minimal downtime. ABB leverages expertise across the entire food and beverage processing spectrum to help support plan development and focus on matching the correct product to the correct application, maximizing uptime and ensuring safety.

# Continuous power for process control loads

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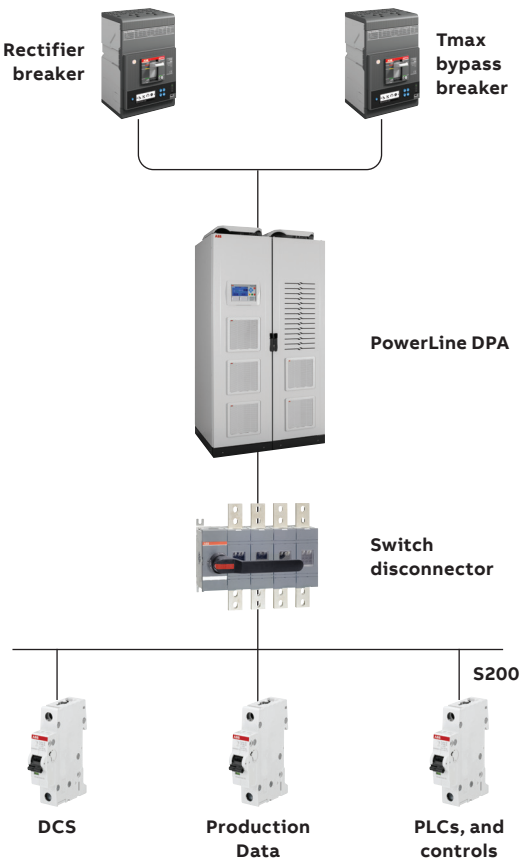
Process control loads require continuous operation, as well as protection against outage and power quality problems in order to support process automation needs and ensure the reliability of equipment such as PLCs & DCS.
Outage affects process automation to a considerable extent and restoring the original conditions often takes hours. A continuous supply of electrical power via UPS is therefore critical for the industry.
Automation interruptions may lead to downtime within manufacturing and industrial operations. In a food and beverage plant, this downtime can cost between $100,000 and $1 million per hour. A clean continuous power supply is therefore critical for the industry.
For example, accurate tracking and tracing of the product throughout the manufacturing process is critical in the dairy industry. This is because the system may not be able to record or process the data acquired from the batch of manufactured products if the plant loses power and the control system is interrupted.

If critical events such as transferring raw milk into containers for pasteurization or transferring powder milk from a spray dryer to a silo cannot be tracked, it could lead to the risk of non-compliance with the food safety regulations. This means that it is critical for manufacturers to protect their equipment from losing data as a result of unexpected outages caused by electrical shortages.
Selectivity is also an important parameter. Consider a fault between two circuit breakers (or any other protection device) connected in a series, where the breaker closer to the fault trips without tripping the upstream breaker. To isolate the fault and maintain continuous supply for other loads that are not directly connected to the fault, selectivity must be achieved between circuit breakers, otherwise there is no use in installing a UPS system.
As shown in the figure below, a UPS can be installed to protect all critical loads or to protect a specific critical load. (e.g. a DCS).

## Example of an SLD For Process Control Loads



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PowerLine DPA

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PowerLine DPA Catalog

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Tmax XT

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Tmax XT Catalog

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OT

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S200

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S800

**Main Components:**

- **UPS:** Modular PowerLine DPA
- **Upstream Breakers:** Tmax XT (MCCBs)
- **Downstream Breakers:** S200 /S800 (MCB)s
- **Switch Disconnector:** OT Switch Disconnector

**Why PowerLine DPA ?**

**PowerLine DPA** (3ph and 1ph) is an on-line double conversion UPS that renders the advantages of ABB's unique modular UPS architecture available for locations that are usually rough on electronic equipment. PowerLine DPA is based on ABB's Decentralized Parallel Architecture (DPA) and ensures the very best UPS design in terms of availability, service ability, safety and ease of use.

Sturdily built, it is suitable for industrial plant environments with a variety of temperatures, dust, moisture and corrosive contaminants.
PowerLine DPA is designed for a 15-year design life.
Tailored for industry and process control loads, its pre-configured options ensure agile implementations with short lead times.
Find your way around selectivity when adopting UPS and circuit breakers using ABB building blocks for selectivity. The table below contains useful information about selectivity.
It gives all the nominal characteristics of the selected UPS, together with all the relevant information about the required circuit breakers and switch disconnectors to make it easier for you to match them together and achieve selectivity.

**Application Table**
**PowerLine DPA**

| UPS Power rating (kVA) | CB Type (Bypass) | CB Type (Rectifier) | Switch Disconnector (optional) | CB Type (Downstream) | Selectivity with upstream bypass | Selectivity with upstream rectifier |
|---|---|---|---|---|---|---|
| 20 | XT5 N 630 Ekip Dip R 400 | XT5 N 630 Ekip Dip R 400 | OT160 | S203 B 10A | up to 0.7 kA | Up to 70kA |
| 40 | XT5 N 630 Ekip Dip R 400 | XT5 N 630 Ekip Dip R 400 | OT160 | S203 B 25A | up to 1,5kA | Up to 70kA |
| 80 | XT5 N 630 Ekip Dip R 630 | XT5 N 630 Ekip Dip R 630 | OT250 | S203 B 63A | up to 4kA | Up to 35kA |
| 120 | XT5 N 630 Ekip Dip R 400 | XT5 N 630 Ekip Dip R 400 | OT200 | S803 B 80A | up to 5kA | Up to 100kA |

Note: Ekip Touch/Hi-Touch can be used instead of Ekip Dip.

**Main benefits**

**Continuous Operation**

- Reliable double conversion UPS that protects critical loads from disturbances.
- UPS paralleled horizontally so as to enable redundancy.
- Selectivity between upstream and downstream protection devices.
- Decentralized Parallel Architecture (DPA).
- Replace or add modules with no downtime (online swappable).

**Self-optimizable projects**

- Pre-designed, pre-tested and easy to commission. Cuts down on project time.

**Energy Efficiency**

- High, 96 % efficiency in double conversion mode reduces running costs without compromising reliability.
- Highly flexible battery configuration allowing battery optimization and reducing the need to oversize.

**Sturdy**

- Can easily cope with dust, water condensation, excessive humidity (up to 95%), corrosive air contamination and rough manhandling.

**Please remember**

- The standalone UPS is monoblock with a single rectifier and bypass line. You lose backup power if one of the 2 lines fails.
- The modular UPS comprises several independent modules. If one module fails the other module(s) continues to work. If redundancy is needed, you can save space thanks to the easy N+1 or N+X redundancy configuration. It also allows for expansion as power requirements increase.
- The UPS rating can be sized to suit the critical loads connected downstream of the UPS and their power rating (Watt = VA x Power factor). Here are some simple steps to help you calculate your UPS rating:
  - Make a note of all loads (DCS, Server Cabinets, Workstations etc..) as a whole VA or Watt.
  - Specify your feeder location and redundancy requirement.
  - Add all the UPS loads in the same zone and the required battery back up (e.g. select all the loads in the main control room that need 30 minutes of UPS backup).
  - Check whether the loads can be distributed in 1 or more UPS systems.
  - Consider the future extension capacity.
  - Perform an adequacy check of the UPS for the single largest load with crest factor. Make sure that the UPS is able to withstand the biggest inrush current.
- For the circuit breaker settings:
  - Overload Zone: The upstream circuit breaker and overload protection inside the UPS, and the downstream circuit breaker must trip faster (taking into account the tolerances and the real currents circulating in the circuit breakers).
  - Short Circuit Zone:
    - If the upstream circuit breaker is thermomagnetic, the magnetic threshold must be set to maximum value if it is adjustable (TMA).
    - If the upstream circuit breaker is electronic, set instantaneous protection function I to OFF.

For further information please consult our training module “Selectivity in low voltage UPS distribution networks” on ABB MyLearning
(Code : 9CSC017718-GLB-EN).

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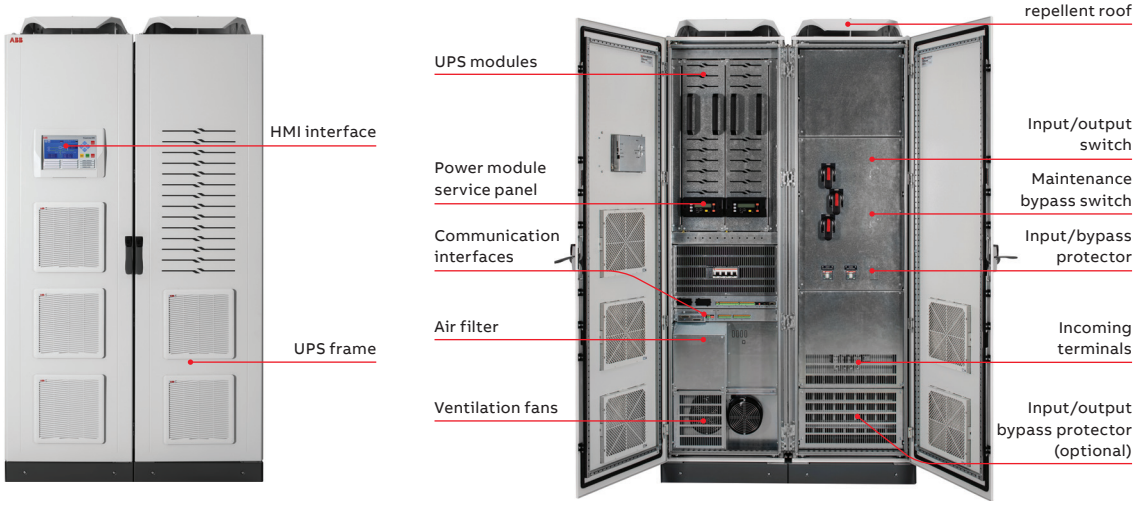
ABB MyLearning

# Annex

**PowerLine DPA**




**Features:**

**Safe**

- High overload and short circuit capability
- System-integrated galvanic isolation and step up-down voltage transformers available (optional)
- High capacity battery current charge for long battery banks
- High protection rating: IP31 (standard), IP42 (optional)
- Designed for deployment in demanding industrial situations
- Small foot print / high power density

**High Availability**

- Decentralized Parallel Architecture (DPA)
- Modules can be replaced and added without downtime (on-line swappable).

**Efficient**

- User-friendly operating interface
- Up to 96% overall efficiency
- Fast maintenance
- Full front access
- Reduced spare part inventory.

**Sturdy**

- Can easily cope with dust, water condensation, excessive humidity (up to 95%), corrosive air contamination and rough manhandling.
- -5 to +45 °C operating temperature range.

**Monitoring**

Can be supplied with relay boards and a network management card providing connection to a DCS or SCADA system via SNMP, ModBus TCP or ModBus RS-485. These interfaces allow:

- Environmental monitoring
- Extensive alarm handling and dispatching
- Redundant UPS monitoring
- Integration of PowerLine DPA into multivendor and multiplatform environments
- Supply of UPS data to Web applications.

**Battery Bank**

- Use VRLA / NiCad / Li-Ion batteries
- Support up to 10h autonomy times.
- Fast recharging.

**Standards**

- IEC/EN 62040-1 General & Safety
- IEC/EN 62040-2 Electromagnetic compatibility (EMC)
- IEC/EN 62040-3 Performance & Testing
- ISO 9001:2015, ISO 14001:2015, OHSAS18001.

# To discover more

**APPLICATION FINDER**

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