

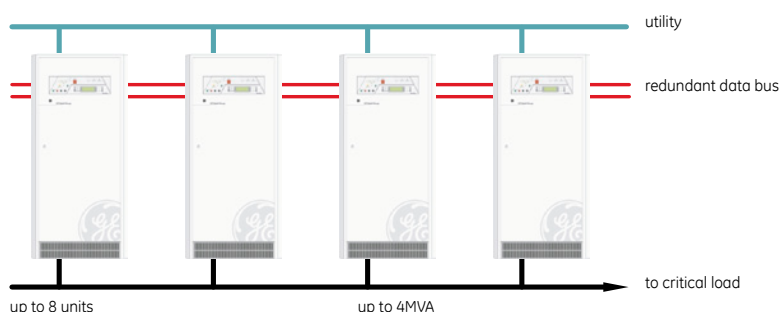
RPA™ - Redundant Parallel Architecture™

GE Digital Energy provides a unique technology called Redundant Parallel Architecture™ (RPA™) that can parallel Uninterruptible Power Supply (UPS) modules with true redundancy.

With RPA, there is no need for external electronics or switches to control the UPS modules in the parallel system. One of the UPS modules in the system arbitrarily takes a leadership role, while the other UPS modules have access to all control parameters. If one UPS fails to operate, the load is automatically redistributed among the others. If the lead UPS fails to operate then a different UPS automatically takes on the leadership role.

The RPA systems are designed to have no single points of failure, ensuring the highest level of power protection for critical loads.

RPA transforms parallel UPS into a true redundant system



features & benefits

- **RPA Configuration** provides complete redundancy of all critical components; allows paralleling of up to eight units for increased load capacity; and ensures excellent dynamic behavior based on output voltage load sharing. This provides the highest reliability and availability for mission-critical applications.
- **Modular** design allows for system upgrades to meet future power needs without any interruption to the critical load or transfer to by-pass.
- **Easy to install and maintain.**
- **Scaleable** design allows for **efficient use of capital.**
- **Redundant** high speed data bus & control electronics facilitates fast decision process with high reliability.
- **Peer-to-Peer architecture** where any UPS can be the “logic leader” ensuring **no single points of failure.**
- **Sequential soft start** (during mains recovery) avoids over-rating of the generator, over heating of cable and fuses, and avoids electrical disturbances to other loads connected at the input.
- **Intelligent Energy Management™ (IEM™)** capability for **optimal energy utilization** of UPS modules in a parallel configuration.

Digital Energy RPA

Redundant Parallel Architecture



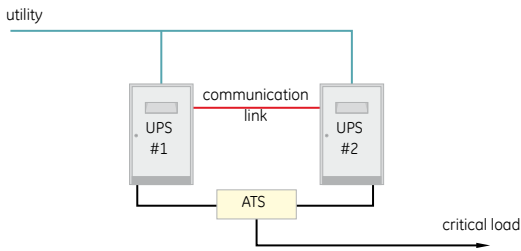
imagination at work

RPA™ Redundant Parallel Architecture™

a comparative overview

Multiple UPS are configured in a system to support an increase in load capacity and/or to improve reliability. There are several configurations that include multiple UPS.

parallel system with automatic transfer switch



The parallel system with an Automatic Transfer Switch (ATS) consists of one or more UPS modules with outputs connected by a switch that senses a loss in voltage and transfers the load to a different module or modules.

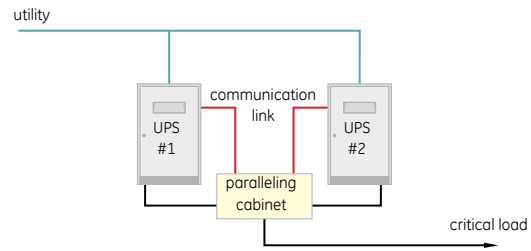
Pro:

- If one of the UPS modules fails, another unit is available to provide power to the load

Cons:

- No load sharing
- Additional cost of the ATS
- The ATS is a single point of failure: if it fails, the load will be interrupted even if utility power is available

parallel system with paralleling cabinet



The parallel cabinet configuration uses an external set of centralized electronics to distribute the load between the system's UPS modules.

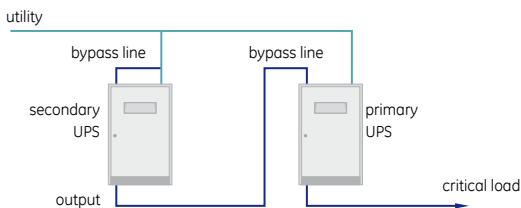
Pro:

- No ATS required

Cons:

- Motor-operated breakers replace the function of the ATS. While less expensive than an ATS, they operate much more slowly
- Failure or malfunction of the shared control electronics will result in a load interruption, which is possible even if the power is present. The shared electronics package is a single point of failure
- Non-redundant communications links
- System price is increased because of the additional cost of the shared control electronics and motor-operated breakers

isolated redundant system



The isolated redundant or hot standby system uses the bypass static switch of the primary UPS to tie the output of a secondary (stand-by) UPS to the load.

Pro:

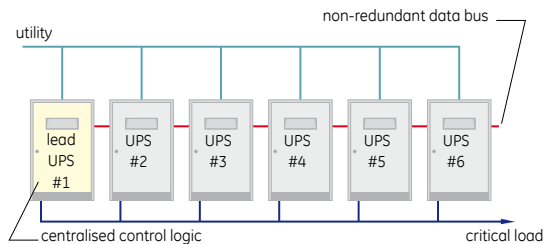
- Inexpensive, since no additional components are added to the system

Cons:

- There are many single points of failure
- No sharing of the load. If the primary unit fails, the secondary unit must be able to accept a 100% load increase in 10 milliseconds
- Overload capacity is limited to the rating of the static switch of the primary module
- System MTBF* is typically lower than the MTBF of a single module

* Mean Time Between Failures

parallel system with centralised logic



The parallel system with centralised logic is basically designed the same as the paralleling cabinet configuration. The difference is that they utilize the control electronics of one "lead" UPS module to control the distribution of the load between the system's other modules.

Pro:

- No ATS required

Cons:

- If the "lead" UPS module fails, the remaining units are uncontrolled. The system may go to bypass on all units, or may stop operation completely
- If the communication link between the lead and other units fails, the load may be interrupted even without a utility power failure

These configurations all share a common shortfall: they all have critical components that are not redundant. GE's RPA™ technology provides complete redundancy of all critical components and there are no single points of failure. RPA technology allows UPS system expansion not only to increase capacity but also to improve the reliability of the power provided to critical loads. For mission critical applications, RPA technology provides true redundancy for the highest reliability.

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