



SIEMENS



Totally Integrated Power

Technical Series, Edition 6

Special Application:
Short-circuit Protection for the "Isolated Parallel" UPS System

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1. Basis

In view of the tremendous consequences involved in a failure of ICT components (components of information and communication technology) in a data centre, availability is an extremely critical parameter of data centre operation to electrical designers and data centre operators. Almost every infrastructure facility, such as air conditioning, smoke detection, fire fighting, video surveillance and security depend on reliable power supply.

Safety in the power supply of data centres

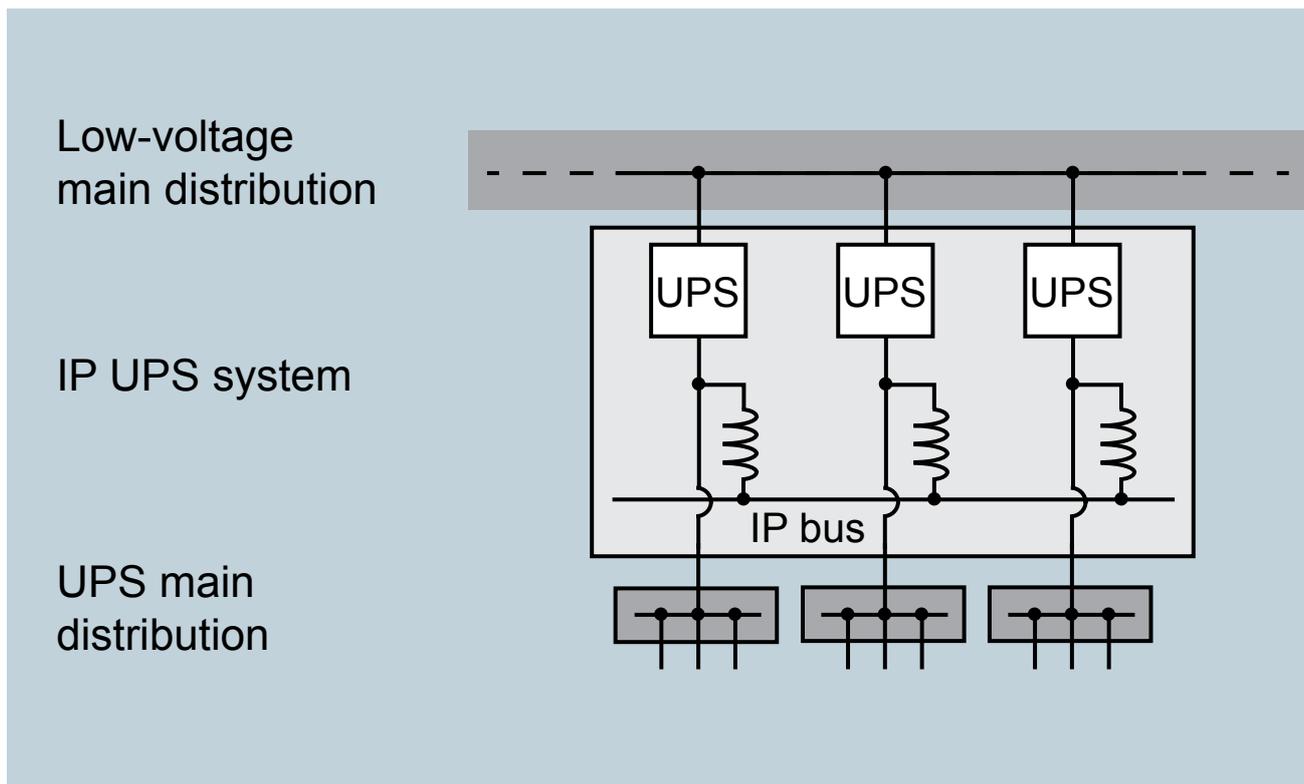
The core elements of reliable power supply are generator and UPS systems. However, they can only meet their tasks if the entire distribution chain maintains an adequate quality level and is tailored to requirements. Another important aspect of data centre availability is a redundancy concept and the avoidance of a so-called "single-point-of-failure" (SPOF). Here, the power distribution concept must also be looked into in a holistic manner.

Piller and Siemens have tackled this task and jointly developed a protection concept for reliable power supply which can be adapted to different data centre designs.

UPS system for a high-availability data centre

The starting point is the rotary UPS installation by Piller which, due to the inherently high fault clearing capacity, is capable of comfortably utilizing the advantages of redundant UPS use in the Isolated-Parallelsystem (IP system). This redundancy concept which was originally developed by Piller, in conjunction with CCG Facilities Integration Inc, provides load balancing between UPS installations, and simultaneously minimizes the number of fault-prone electronic components (such as additional UPS installations or static transfer switches). It is described in more detail in a White Paper by Piller (No. 051: Isolated-parallel UPS Configuration). Figure 1 shows the principal design of an IP system. This concept can be used in low-voltage as well as in medium-voltage installations.

Figure 1: IP system concept

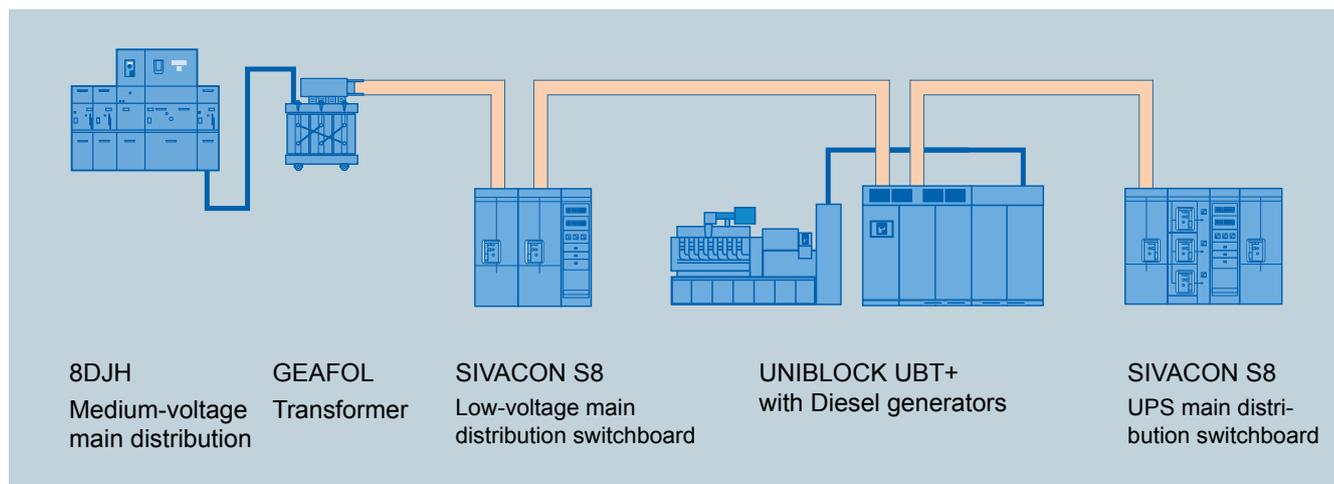


2. Electric power distribution for a high-availability data centre

Based on power distribution components and systems by Siemens in combination with Piller Rotary UPS, it is possible

to create a holistic solution for safe power supply to the data centre which is built on the IP system (see Figure 2).

Figure 2: Schematic view of the main components of electric power supply in data centres without a parallel UPS system



To prevent faults, it is indispensable to use high-quality components. This includes type-tested medium- and low-voltage systems with appropriately tested connection pieces and insulated busbars. With regard to the components shown in Figure 2, Piller and Siemens can offer the following products, for example:

- 8DJH gas-insulated medium-voltage switchgear
- SIPROTEC numerical protection devices
- SIVACON S8 low-voltage switchboards
- Rotary UPS systems of type UBT+ with Diesel generator (or UBTD+ Diesel UPS)
- Kinetic buffer with Powerbridge Flywheel
- Parallel UPS system with IP bus
- SIVACON 8PS busbar trunking systems
- 3WL and 3VL circuit-breakers

3. Short-circuit response of the load supply voltage

The creation of an IP system with suitably configured reactors can reduce the effects of a short circuit on all of the other connected loads.

In case of a short-circuit downstream of the IP system, its effects on the overall system will be relatively small, since there are always two reactors between the short circuit and the other loads or UPS installations, which are rated in such

a way that the effects of the short-circuit will be limited to a tolerable level. In addition, thanks to the selective protection of the UPS main distribution system and their sub-distribution circuits downstream of the IP system, the short-circuit will be isolated within milliseconds.

Figure 3: Piller Diesel Rotary UPS UNIBLOCK UBTD+

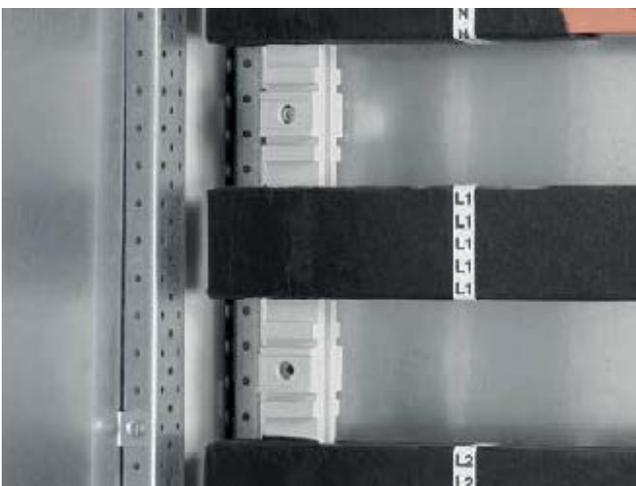


Figure 4: Preventing a short circuit by fully insulated busbars

Special provisions will have to be made if a short-circuit must be managed in the IP system. In this case, a short-circuit in the IP bus is the most critical event, since all of the UPS installations and all of the connected loads are connected through this bus.

An optimal situation would be if a short-circuit in the IP bus can be ruled out. To this end, fully insulated busbars are used for the IP bus (see Figure 4).

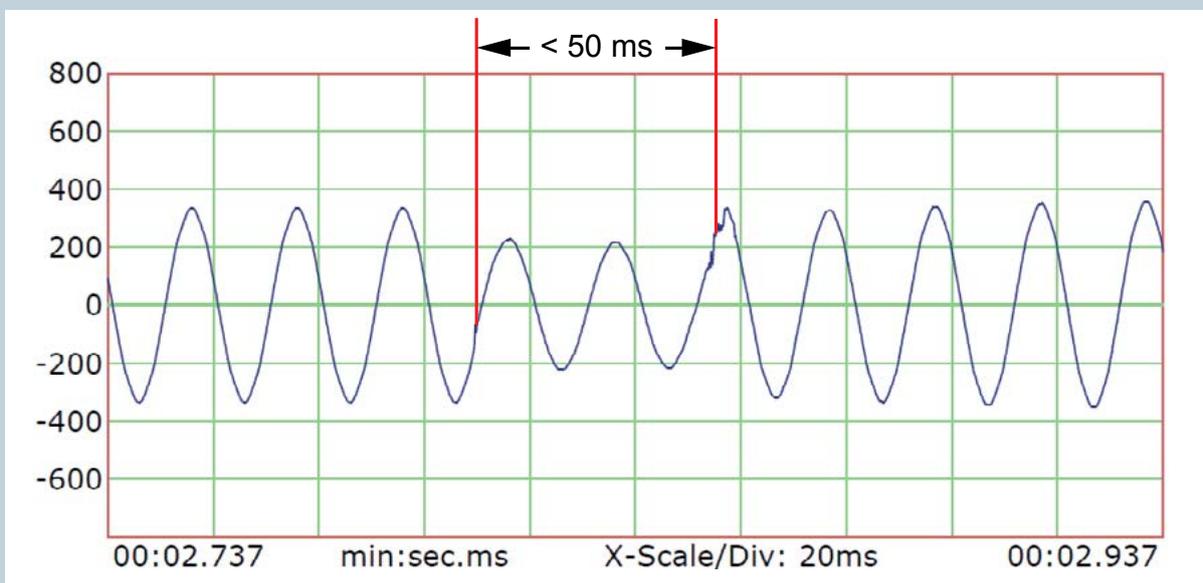
As a complement to this kind of passive protection in the IP system, a suitable solution for selective protection will be drafted. The combination of both is unique in the field of UPS. Normally, we only encounter simple protection which is not synchronized to the selective protection of the connected loads. A short-circuit in an ordinary UPS system often results in shedding all of the connected loads.

The selective protection system shall actively limit the effects of a short circuit (which is actually ruled out) in case of fault. The starting point is a suitable rating of the IP reactors, so that even in the event of a short-circuit in the IP bus, the initial voltage dip will be limited to 30%.

According to the ITI (CBEMA) curve (see Information Technology Industry Council: ITI [CBEMA] Curve Application Note 2005), such a voltage dip for sensitive computer power supply units is permissible for a period of 500 ms. Thanks to the selective protection system, the short-circuit effects on all connected loads are limited to a period of less than 50 to 70 milliseconds.

To attain this goal, reactor rating, protection system, control circuits and switching devices must be optimally selected and a project-specific device parameterisation must be made on the basis of short-circuit calculations. Figure 5 shows a typical test log for such an isolating operation.

Figure 5: Voltage curve when isolating a short-circuit in the IP bus



Conclusion

The above described safety devices for active and passive protection in accordance with the principles of redundancy and diversity make the IP UPS system the solution for all-round protection of the power supply for critical infrastructure system components in the data centre.



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