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**Datasheet for the decision  
of 10 January 2014**

**Case Number:** T 1212/13 - 3.5.02

**Application Number:** 07728730.8

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**IPC:** H02H7/30

**Language of the proceedings:** EN

**Title of invention:**

Power Supply System and Method

**Applicant:**

Broadband Power Solutions, en Abrégé B.P.S. S.A.

**Headword:**

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

Inventive step

- main and first to third auxiliary requests - (no)

Remittal to the department of first instance - (yes)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern  
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Case Number: T 1212/13 - 3.5.02

**D E C I S I O N  
of Technical Board of Appeal 3.5.02  
of 10 January 2014**

**Appellant:** Broadband Power Solutions, en Abrégé B.P.S. S.A.  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 17 October 2012  
refusing European patent application No.  
07728730.8 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman:** M. Ruggiu  
**Members:** M. Léouffre  
W. Ungler

## **Summary of Facts and Submissions**

- I. The applicant appealed against the decision of the examining division, posted on 17 October 2012, to refuse the European application No. 07728730.8.
- II. The examining division held in particular that the subject-matter of the original independent claims 1 and 13 did not involve an inventive step in the light of documents:
  - D1 = WO 2004/102785 A, and
  - D2 = US 5 561 579 A.
- III. With the statement setting out the grounds of appeal, received on 18 February 2013, the appellant filed a new main request and two auxiliary requests.
- IV. In an annex to the summons to oral proceedings, dated 26 September 2013, the board communicated its preliminary opinion that the claims of the main and auxiliary requests did not appear to involve an inventive step having regard to document D2 in combination with common general knowledge.
- V. With a letter dated 6 December 2013, the appellant filed a third auxiliary request.
- VI. Oral proceedings before the board took place on 10 January 2014.
- VII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request or of the first and second auxiliary requests as filed with the statement of grounds of appeal dated 15 February 2013, or on the basis of the claims of a third auxiliary request as

filed with letter dated 6 December 2013, or on the basis of the claims of a fourth auxiliary request as filed during the oral proceedings of 10 January 2014.

VIII. Claim 1 of the main request reads as follows:

"A power supply system (S) comprising:

- a power processor (1) having a power input (2) with a nominal input voltage  $V_{Nin}$  and an AC power output (3) with a nominal output voltage  $V_{Nout}$  and a nominal output current  $I_{Nout}$ , said power processor (1) being connected downstream to at least one downstream circuit breaker (4) intended to be itself connected to a critical load (5) and upstream to an upstream circuit breaker (8), said upstream circuit breaker (8) being higher-rated than the downstream circuit breaker (4), and
- a power supply safety or backup circuit (6) connected in parallel to said power processor (1) between said power input (2) and said AC power output (3) and comprising:
  - a bidirectional switch (7), and
  - control means (12) for closing said bidirectional switch (7) after detecting a short circuit condition downstream of the AC power output (3);characterised in that said backup circuit (6) also comprises a current limiter (9) connected in series to said bidirectional switch (7) to limit the current that can flow through the backup circuit (6) to a maximum current of  $\alpha I_{Nout}$  wherein  $\alpha$  has a value comprised between 5 and 20, said maximum current corresponding to a tripping current with a predetermined tripping time for the downstream circuit breaker (4) without tripping the higher-rated upstream circuit breaker (8)."

Claims 2 to 10 are dependent on claim 1.

Claim 11 of the main request reads as follows:

"A method of supplying an additional current for opening an individual circuit breaker (4) connecting downstream an AC power output (3) of a power processor (1) to a critical load (5), when said critical load (5) suffers a short circuit condition, said power processor (1) being connected upstream to an upstream circuit breaker (8), said power processor having a nominal output voltage  $V_{Nout}$  and a nominal output current  $I_{Nout}$ , said upstream circuit breaker (8) being higher-rated than the downstream circuit breaker (4), comprising the steps of:

- providing a power backup circuit (6) connected in parallel to the power processor (1) between a power input (2) of said power processor (1) having a nominal input voltage  $V_{Nin}$  and said AC power output (3) and comprising a bidirectional switch (7), preferably a triac, and a current limiter (9), preferably a resistor, connected in series to the bidirectional switch (7) to limit the current that can flow through the power backup circuit to a maximum current of  $\alpha I_{Nout}$ , wherein  $\alpha$  has a value between 5 and 20, preferably between 7 and 13, and most preferably about 10, said maximum current corresponding to a tripping current with a predetermined tripping time for the downstream circuit breaker (4) without tripping the higher-rated upstream circuit breaker (8);
- detecting said short circuit condition;
- closing said bidirectional switch (7)."

Claims 12 and 13 are dependent on claim 11.

IX. Claim 1 of the first auxiliary request reads as follows:

"A power supply system (S) comprising:

- a power processor (1) having a power input (2) with a nominal input voltage  $V_{Nin}$  and an AC power output (3) with a nominal output voltage  $V_{Nout}$  and a nominal output current  $I_{Nout}$ ; and

- a power supply safety or backup circuit (6) connected in parallel to said power processor (1) between said power input (2) and said AC power output (3) and comprising:

- a bidirectional switch (7), and

- control means (12) for closing said bidirectional switch (7) after detecting a short circuit condition downstream of the AC power output (3);

characterised in that said backup circuit (6) also comprises a current limiter (9) connected in series to said bidirectional switch (7) to limit the current that can flow through the power backup circuit (6) to a maximum current of  $\alpha I_{Nout}$  wherein  $\alpha$  has a value comprised between 5 and 20, preferably between 7 and 13, and most preferably about 10, said current limiter (9) being a resistor having an impedance value of  $V_{Nin}/\alpha I_{Nout}$ ."

Claims 2 to 7 are dependent on claim 1.

Claim 8 of the first auxiliary request reads as follows:

"A method of supplying an additional current for opening an individual circuit breaker (4) connecting an AC power output (3) of a power processor (1) having a nominal output voltage  $V_{Nout}$  and a nominal output current  $I_{Nout}$ , to a critical load (5) when said critical load (5) suffers a short circuit condition, comprising the steps of :

- providing a power backup circuit (6) connected in parallel to the power processor (1) between a power input (2) of said power processor (1) having a nominal input voltage  $V_{Nin}$  and said AC power output (3) and comprising a bidirectional switch (7), preferably a triac, and a current limiter (9) under the form of a resistor, connected in series to the bidirectional switch (7) to limit the current that can flow through the power backup circuit to a maximum current of  $\alpha I_{Nout}$ , wherein  $\alpha$  has a value between 5 and 20, preferably between 7 and 13, and most preferably about 10;
- detecting said short circuit condition;
- closing said bidirectional switch (7)

Claims 9 and 10 are dependent on claim 8.

- X. Claim 1, respectively claim 7, of the second auxiliary request specifies the bidirectional switch 7 of claim 1, respectively of claim 8, of the first auxiliary request, as being "under the form of a triac".

Claims 2 to 6, respectively claims 8 and 9, of the second auxiliary request are dependent on claim 1, respectively claim 7.

- XI. Claim 1 of the third auxiliary request adds the following features to claim 1 of the main request:

"and in that the control means (12) is successively set:

- for detecting the short circuit condition downstream of the AC power output (3) and for closing the bidirectional switch (7), when the voltage at the AC power output (3) falls below a threshold value of at most 80% of the nominal output voltage  $V_{Nout}$ , in particular below 20% of  $V_{Nout}$  and/or the current at the

AC power output (3) rises above a threshold value of at least 120% of the nominal output current  $I_{Nout}$ , in particular above 150% of  $I_{Nout}$ ; and

- for reopening said bidirectional switch (7) when the output voltage reaches again 80% of  $V_{Nout}$ , after the individual circuit breaker (4) has been tripped."

Claims 2 to 9 are dependent on claim 1.

Claim 10 of the third auxiliary request adds the following features to claim 11 of the main request:

- detecting said short circuit condition "downstream of the AC power output (3), when the voltage at the AC power output (3) falls below a threshold value of at most 80% of the nominal output voltage  $V_{Nout}$ , in particular below 20% of  $V_{Nout}$  and/or the current at the AC power output (3) rises above a threshold value of at least 120% of the nominal output current  $I_{Nout}$ , in particular above 150% of  $I_{Nout}$ ;" and

"- reopening said bidirectional switch (7) when the output voltage reaches again 80% of  $V_{Nout}$ , after the individual circuit breaker (4) has been tripped."

Claim 11 is dependent on claim 10.

XIII. Claim 1 of the fourth auxiliary request reads as follows:

"A power supply system (S) comprising:

- a power processor (1) having a power input (2) with a nominal input voltage  $V_{Nin}$  and an AC power output (3) with a nominal output voltage  $V_{Nout}$  and a nominal output current  $I_{Nout}$ , said power processor (1) being connected downstream to at least one downstream circuit breaker



(4) intended to be itself connected to a critical load (5) and upstream to an upstream circuit breaker (8), said upstream circuit breaker (8) being higher-rated than the downstream circuit breaker (4), and

- a power supply safety or backup circuit (6) connected in parallel to said power processor (1) between said power input (2) and said AC power output (3) and comprising:
  - a bidirectional switch (7), and
  - control means (12) for closing said bidirectional switch (7) after detecting a short circuit condition downstream of the AC power output (3);

characterised in that said backup circuit (6) also comprises a current limiter (9) connected in series to said bidirectional switch (7) to limit the current that can flow through the backup circuit (6) to a maximum current of  $\alpha I_{Nout}$  wherein  $\alpha$  has a value comprised between 5 and 20, preferably between 7 and 13, and most preferably about 10, said maximum current corresponding to a tripping current able to trip the downstream circuit breaker (4) that needs 10ms to open without tripping the higher-rated upstream circuit breaker (8), the bidirectional switch (7) being a triac and the current limiter (9) being a resistor having an impedance value of  $V_{Nin}/\alpha I_{Nout}$

and in that the control means (12) is successively set:

- for detecting the short circuit condition downstream of the AC power output (3) and for closing the bidirectional switch (7), when the voltage at the AC power output (3) falls below a threshold value of at most 80% of the nominal output voltage  $V_{Nout}$ , in particular below 20% of  $V_{Nout}$  and/or the current at the AC power output (3) rises above a threshold value of at least 120% of the nominal output current  $I_{Nout}$ , in particular above 150% of  $I_{Nout}$ ; and

- for reopening said bidirectional switch (7) when the output voltage reaches again 80% of  $V_{Nout}$ , after the downstream circuit breaker (4) has been tripped or for reopening said bidirectional switch (7) after it has been closed for a predetermined time period, preferably 20ms."

Claims 2 to 4 are dependent on claim 1.

Claim 5 of the fourth auxiliary request reads as follows:

"A method of supplying an additional current for opening an individual circuit breaker (4) connecting downstream an AC power output (3) of a power processor (1) to a critical load (5), when said critical load (5) suffers a short circuit condition, said power processor (1) being connected upstream to an upstream circuit breaker (8), said power processor having a nominal output voltage  $V_{Nout}$  and a nominal output current  $I_{Nout}$ , said upstream circuit breaker (8) being higher-rated than the downstream circuit breaker (4), comprising the successive steps of:

- providing a power backup circuit (6) connected in parallel to the power processor (1) between a power input (2) of said power processor (1) having a nominal input voltage  $V_{Nin}$  and said AC power output (3) and comprising a bidirectional switch (7), under the form of a triac, and a current limiter (9), under the form of a resistor, connected in series to the bidirectional switch (7) to limit the current that can flow through the power backup circuit to a maximum current of  $\alpha I_{Nout}$ , wherein  $\alpha$  has a value between 5 and 20, preferably between 7 and 13, and most preferably about 10, said maximum current corresponding to a tripping current able to trip the downstream circuit breaker (4) that

needs 10ms to open without tripping the higher-rated upstream circuit breaker (8);

- detecting said short circuit condition downstream of the AC power output (3), when the voltage at the AC power output (3) falls below a threshold value of at most 80% of the nominal output voltage  $V_{Nout}$ , in particular below 20% of  $V_{Nout}$  and/or the current at the AC power output (3) rises above a threshold value of at least 120% of the nominal output current  $I_{Nout}$ , in particular above 150% of  $I_{Nout}$ ;
- closing said bidirectional switch (7);
- reopening said bidirectional switch (7) when the output voltage reaches again 80% of  $V_{Nout}$ , after the downstream circuit breaker (4) has been tripped or reopening said bidirectional switch (7) after it has been closed for a predetermined time period, preferably 20ms."

XIII. The appellant essentially argued as follows:

The subject-matter of claim 1 of the main request differed from D1 in that the backup circuit comprised a current limiter limiting the current to a maximum of  $\alpha I_{Nout}$ ,  $\alpha$  having a value comprised between 5 and 20. A current limiter provided the advantages mentioned in the paragraph of the description bridging pages 2 and 3. The problem solved by the current limiter could be seen as how to modify the backup circuit of D1 in order to minimise disturbances and avoid a general breakout. In particular, the values of  $\alpha$  were chosen such that a downstream circuit breaker could be tripped and a fault cleared without tripping the upstream circuit breakers. Even when considering D1 in combination with D2 which disclosed a hierarchical structure of circuit breakers,

the inventive step could only be denied with an ex post facto analysis. D1 related to the control of motors having high capacitance and high inrush current. Applied to the power supply of D1, a current limiter according to D2 would not enable the starting of a motor. The present invention applied to UPS (uninterruptible power supplies) for IT power supply and the value of  $\alpha$  was particularly designed therefor. The technical problem solved by the invention was to clear the fault while minimising disturbances. It was admitted that D2 concerned the supply of critical loads (cf. column 1, lines 46 to 57). D2 aimed however at limiting the current rating of the thyristors (cf. column 3, lines 50 to 67). D2 did not specify the extent to which the overcurrent would be limited. The invention aimed at tripping the circuit breakers. The special values of  $\alpha$  were chosen for allowing an overcurrent just sufficient to trip the downstream circuit breaker in less than 20ms.

The first auxiliary request was limited to a resistor. The choice of a resistor was not obvious having regard to the inherent problems of energy dissipation. In D2 a reactor was used, which was not a proper current limiter. It did not limit the current but only its derivative  $di/dt$ . Furthermore a reactor as in D2 would have induced overvoltages when switching off the backup circuit.

The second auxiliary request was limited to a triac and a resistor. There was a synergetic effect between the resistor and the triac. Actually a reactor induced transient overvoltages  $dV/dt$  and was detrimental to the use of a cheaper triac. A resistor was a solution to the problem of transients. A resistor allowed further

to shorten the tripping time, which was in the range of 10ms.

The third auxiliary request was based on the main request. Therefore the same argument related to the value of  $\alpha$  applied. Claim 1 of the third auxiliary request comprised further features related to detecting the output voltage and reopening the backup circuit when the output voltage reached again 80% of  $V_{Nout}$ . While D2 disclosed a power sensor determining whether the voltage was present with normal amplitude (cf. column 3, lines 54 to 58), D2 did not disclose any specific value triggering the reopening of the backup circuit.

The control of the time before reopening the bidirectional switch of the backup circuit led to preserving the life time of the resistor, reducing the losses, and re-establishing quickly the voltage applied to the critical load.

The fourth auxiliary request included the feature that the downstream circuit breaker needed 10ms to open. A basis for this feature could be found in the original description at page 6, line 19. The resistor of the power supply system according to the invention rendered possible to clear a fault and to re-establish the nominal voltage for the critical loads in half a cycle of the AC power voltage while a power supply according to D2 needed 15 cycles (cf. column 5, lines 12 to 20). It was unlikely that the overcurrent limit values would be reached in less than 10ms with a reactor according to D2 that would not create excessive current rating and overvoltages.

## Reasons for the Decision

1. The appeal is admissible.
2. An appropriate starting point for assessing inventive step appears to the board as being represented by D2. D2 discloses a power supply system comprising:  
a power processor 22 (cf. figures 1 and 2 and column 2, lines 54 to 58) having a power input 60, 90 with a nominal input voltage and an AC power output 62, 92 with a nominal output voltage and a nominal output current. Said power processor 22 is connected downstream to at least one downstream circuit breaker 95A, 95B, 95C intended to be itself connected to a critical load 94A, 94B, 94C (cf. column 4, lines 19 to 25) and upstream to an upstream circuit breaker 76 (cf. figure 2: mechanical breaker 76 inserted between distribution bus 78 and circuit 20). A power supply safety or backup circuit (cf. figure 1: fault current conduction circuit 24) is connected in parallel to said power processor 22 between said power input 60 and said AC power output 62. It comprises
  - a bidirectional switch 42, 44A, 44B, and
  - control means 66 for closing said bidirectional switch after detecting a short circuit condition downstream of the AC power output (cf. column 3, lines 58 to 60).Said backup circuit 24 comprises a current limiter 50 connected in series to said bidirectional switch 42, 44A, 44B to limit the current that can flow through the backup circuit 24 (cf. column 3, lines 63 to 67).

The rated current of a circuit breaker is the maximum current that can permanently be sustained. The upstream circuit breaker 76 of D2 has to sustain a permanent current equal to the sum of the currents supplied to

the plurality of loads attached to the plurality of downstream circuit breakers 95A, 95B, 95C. The upstream circuit breaker 76 must therefore be higher rated than the downstream circuit breakers.

3. *Main request*

3.1 Claim 1 of the main request differs from D2 in that:  
- the current limiter is arranged to limit the current that can flow through the backup circuit to a maximum current of  $\alpha I_{Nout}$ , wherein  $\alpha$  has a value comprised between 5 and 20 and  $I_{Nout}$  is the nominal output current of the power processor, said maximum current corresponding to a tripping current with a predetermined tripping time for the downstream circuit breaker without tripping the higher-rated upstream circuit breaker.

The subject-matter of claim 1 is therefore new (Article 54 EPC).

3.2 This feature limits the disturbances in the system when a fault occurs in a critical load while allowing selective tripping of the downstream circuit breaker connected to the faulty critical load.

3.3 It is however a common practice to use downstream circuit breakers having shorter response times (for a given current value) than the response times of the higher rated circuit breakers to avoid interrupting the power supply of any load other than the load connected to the fault circuit.

3.4 In the configuration according to D2 the power supply safety or backup circuit 24 is inserted between an upstream circuit breaker 76 and the downstream circuit breakers. The desirable hierarchical circuit breaker

strategy (cf. D2 column 3, lines 11 to 15) is preserved when the power supply safety or backup circuit delivers a current higher than the minimum tripping current necessary for the downstream circuit breaker but lower than an upper limit (maximum tripping current) corresponding to the instantaneous tripping current for the upstream circuit breaker. The minimum and maximum tripping currents values depend on the circuit breakers characteristics. A maximum tripping current  $\alpha I_{Nout}$ , wherein  $\alpha$  has a value comprised between 5 and 20, is considered as a choice devoid of surprising effect allowing to selectively trip a lower rated downstream circuit breaker while avoiding instantaneous tripping a higher rated upstream circuit breaker, specially if breakers of the well-known classes C and D are used. According to D2, column 3, lines 63 to 66, "The reactor 50 ensures that the fault current in the system is kept as low as practical in order to limit the required surge current rating of the fault current conduction circuit 24". When thyristors 44 are switched to a close state, reactor 50 opposes the flow of the fault current which increases at a rate determined by the reactor value up to a value corresponding to a limit defined by the internal reactance of reactor 50.

3.5 To respect the desirable hierarchical circuit breaker strategy, a skilled person would design the reactor 50 such that it limits the current to a value higher than the minimum tripping current for the downstream circuit breaker and lower than the instantaneous tripping current for the upstream circuit breaker. Therefore the subject-matter of claim 1 does not involve an inventive step.

4. *First auxiliary request*



4.1 Claim 1 of the first auxiliary request recites the features of claim 1 of the main request and defines further the current limiter as a resistor.

4.2 Resistor and reactor are two alternatives to limit the current flowing through the power safety and backup circuit, as acknowledged in the description of the published application at page 3, lines 9 to 13 and page 5, lines 20 to 25.

While a resistor is a straightforward solution to limit a current, e.g. a fault current, the short circuit power to be dissipated might be high and a reactor more appropriate in high voltage power supply safety or backup circuits. Nevertheless, a person skilled in the art would immediately recognise the possibility to replace the reactor of D2 by a resistor in a low voltage power supply system, like a power distribution system supplying IT equipment (cf. grounds of appeal at page 6, paragraph 7), because a resistor would then be able to dissipate the short-circuit power. The replacement of the reactor of D2 by a resistor designed to limit the overcurrent to a value of  $\alpha I_{Nout}$  wherein  $\alpha$  has a value between 5 and 10, i.e. a resistor having an impedance value of  $V_{Nin}/\alpha I_{Nout}$ , does not therefore involve an inventive step.

5. *Second auxiliary request*

5.1 Claim 1 of the second auxiliary request is based on claim 1 of the first auxiliary request and defines the bidirectional switch as a triac.

5.2 In a low voltage power supply for an IT equipment, a person skilled in the art would have considered a resistor rather than a reactor as a current limiter serially connected to the bidirectional switch, because

the energy to be dissipated in case of a fault would remain in an acceptable range. The advantages of a resistor over a reactor serially connected to a semiconductor switch are also well known to the person skilled in the art. A resistor does not induce any current phase shifting which could lead to overvoltages applied to the serially connected switch when this latter switches off. Consequently, a person skilled in the art knows that a semi-conductor switch serially connected to a resistive load does not need to be as robust as when serially connected to an inductive load. The properties of thyristors and triacs are also well known to the person skilled in the art. Compared to thyristors, triacs are more sensitive to overvoltages when switching off currents having high derivative values. Nevertheless triacs are cheaper alternatives to antiparallel thyristors and particularly suited for switching resistive loads in low voltage power distribution systems.

The person skilled in the art would have therefore substituted the reactor 50 and the antiparallel thyristors 44A and 44B of D2 with a resistor and a cheaper triac when supplying IT equipment. The subject-matter of claim 1 of the second auxiliary request is therefore obvious.

6. *Third auxiliary request*

- 6.1 Claim 1 of the third auxiliary is based on claim 1 of the main request and adds that "the control means (12) is successively set:
- for detecting the short circuit condition downstream of the AC power output (3) and for closing the bidirectional switch (7), when the voltage at the AC power output (3) falls below a threshold value of at most 80% of the nominal output voltage in particular

below 20% of  $V_{Nout}$  and/or the current at the AC power output (3) rises above a threshold value of at least 120% of the nominal output current  $I_{Nout}$ , in particular above 150% of  $I_{Nout}$ ; and  
- for reopening said bidirectional switch (7) when the output voltage reaches again 80% of  $V_{Nout}$ , after the individual circuit breaker (4) has been tripped."

6.2 The circuit 20 of D2 comprises a power sensor 64 connected to a switch selection circuit 66. When the magnitude of the current reaches a predetermined threshold the switch selection circuit shuts-off the turn-off thyristors 30, isolating a line disturbance (cf. D2, column 3, lines 41 to 49). A downstream line disturbance can be identified by using power sensor 64 to determine whether the voltage is present with normal amplitude. If a downstream line disturbance does exist, the thyristors 44 of the fault current conduction circuit 24 are switched to a closed state (cf. D2, column 3, lines 55 to 60 and figure 1). Following the occurrence of a fault current, the turn-off thyristors 30 of document D2 are repeatedly opened in less than half a cycle and for a maximum of one-half cycle. The full fault current conduction to downstream protective devices (circuit breakers 95A, 95B, 95C) is provided by the thyristors 44 for a maximum of 15 cycles (cf. D2, column 5, lines 5 to 19). D2 is silent about the current and/or voltage threshold values indicating fault conditions. Claim 1 of the third auxiliary request differs indeed from D2 in that the voltage threshold value is 80% of  $V_{Nout}$  and the current threshold value is at least 120% of the nominal output current  $I_{Nout}$ . These values are however considered as choices devoid of any surprising effect. The subject-matter of claim 1 of the third auxiliary

request is therefore also considered as obvious in the light of document D2 and the common general knowledge of the skilled person (Article 56 EPC).

7. *Fourth auxiliary request*

- 7.1 The board admitted the fourth auxiliary request into the proceedings.
- 7.2 The independent apparatus claim 1 of the fourth auxiliary request is based on original claims 1 to 6 and adds features related to the circuit breakers. These features are disclosed in the original description at page 5, lines 3 to 12, page 6, lines 6 to 7 and lines 19 to 23. The independent method claim 5 has been adapted to the device claim 1. Hence, the amended claims 1 and 5 do not extend the application beyond its original content and comply with the requirements following from Article 123(2) EPC.
- 7.3 The subject-matter of claim 1 of the fourth auxiliary request combines the features of claims 1 of the second and third auxiliary requests. Claim 1 is therefore new (Article 54 EPC) since it differs from the available prior art represented by D2, by the features recited under items 3.1, 4.1, 5.1 and 6.1 and by the added feature of a "downstream circuit breaker (4) that needs 10ms to open", i.e. that needs half a cycle of the AC power input to open.
- 7.4 The use of the system according to claim 1 in a low voltage power supply for IT equipment renders the use of a resistor particularly suited as a current limiter, which itself renders the use of a triac as a bidirectional switch an obvious choice for the backup

circuit, because a resistor does not generate any overvoltages at switching off points.

The choice of a resistor provides however a second advantage in that it shortens the time for the current that can flow through the backup circuit to reach the maximum desired level of  $\alpha I_{Nout}$ . It follows that it may be particularly advantageous to use a combination of a current limiter in the form of a resistor with a downstream circuit breaker having a response time of less than half a cycle of the power supply at a fault current value of  $\alpha I_{Nout}$ . A backup circuit able to trip a downstream circuit breaker that needs 10ms to open may bring the advantages mentioned by the applicant, namely preserving the life time of the resistor, reducing the losses, and re-establishing quickly the voltage applied to the critical load after a fault detection.

8. The power supply system of D2 uses a reactor as a current limiter and needs up to 15 cycles to clear a fault (cf. D2, column 5, lines 5 to 19). Hence, starting from D2, the problem to be solved could be seen in designing a power supply having a shorter response time at current levels adapted to supply critical loads of IT equipment. A solution to this problem starting from a current limiter in the form of a reactor as shown in D2 might not be obvious, and it might not be obvious either, without hindsight, to think of first replacing the reactor of D2 by a resistor to reduce the response time to 10ms.

The response time of the downstream circuit breaker did not appear in the original application as an essential aspect. Actually a time value was solely claimed in original claims 5 and 15. However, the feature disclosed therein related to the reopening time of the bidirectional switch and was not claimed in combination

with a resistor and a triac, which were only optional. Thus it might be that the search report does not cite the prior art relevant for the fourth auxiliary request. Therefore, the board decided to make use of its power under Article 111(1) EPC to remit the case to the department of first instance for further prosecution on the basis of the fourth auxiliary request, in particular to further consider the question of inventive step.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance for further prosecution.

The Registrar:

The Chairman:



U. Bultmann

M. Ruggiu

Decision electronically authenticated