As for the PBA series (PBA300F ~ 1500F and 1500T), parallel redundancy operation is available to improve a system reliability (Back-up operation). Also N+1 redundancy operation is available to build a reliable system with minimum required units.

Feature of each method

In PBA300F ~ 1500F and 1500T series, three different kinds of way are available as following.

Method ①: Redundancy operation with external diode
Method ②: Redundancy operation with current sharing (N+1 redundancy)
Method ③: Redundancy operation with optional harness (H-PA-3) (N+1 redundancy)

* N+1 redundancy
If you add one extra power supply in parallel operation, even if one of the power supplies in your system fails, the remaining non-failed power supplies continue to sustain the system.

* Hot-swap or Hot-plug is not available.

<table>
<thead>
<tr>
<th>A way of redundancy</th>
<th>Failure happened at:</th>
<th>Primary side</th>
<th>Secondary power block</th>
<th>Secondary Control part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method ①</td>
<td></td>
<td>available</td>
<td>available</td>
<td>available</td>
</tr>
<tr>
<td>Method ② (N+1)</td>
<td></td>
<td>available</td>
<td>available</td>
<td>N/A</td>
</tr>
<tr>
<td>Method ③ (N+1)</td>
<td></td>
<td>available</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Redundancy operation with external diode

**Circuit**
PBA300F ~ 1500F and 1500T, example circuit for redundancy operation is shown below.

![Redundancy operation circuit with external diode](image)

**Explanation of Operation**
In this method, output power is provided by one back-up unit if the failure happened at one of power supply. And this method is effective to be recovered from all failure modes, such as failure at primary / secondary circuit.

The external diode is required to prevent influence from failure unit.

This method is the most reliable connection in redundancy connection.

**Note**
The power that load requires must be rated power or less of one unit.

Load < Rated power of one unit

Since there is no current sharing, output current is not balanced between PS1 and PS2. Therefore, this method can not be used for increasing power.

A Reference value for D1 and D2.
*D1 and D2 are same value.
Rated current :
Double of power supply's rated current
Rated voltage :
Double of power supply's rated voltage

D1 and D2 dissipate heat by output current. Therefore, heat-sink would be required for cooling.

Output voltage will be dropped by D1, D2. Adjust each output voltage higher by internal potentiometer if required, and also adjust them to be the same value.
Redundancy operation with current sharing

**Circuit**

PBA300F ~ 1500F and 1500T, example circuit for redundancy (N+1) operation is shown below.

![Circuit Diagram]

**Explanation of Operation**

In this method, output power is provided by one back-up unit if the failure happened at one of power supply. And this method will recover from all failure modes except CB circuit failure. CB terminal is used for current sharing.

The external diode is required to prevent influence from failure unit.

The advantage of this method is that output current of each power supplies can be balanced in this method.

**Note**

Differences in the output current values among the power supplies in parallel connection are 10% at most. Please make sure that the sum of the output current values does not exceed a value obtained from the right side of the following equation.

\[
\text{Output current in parallel operation} = (\text{Rated current per unit}) \times (\text{Number of units}) \times 0.9
\]

A Reference value for D1 and D2.

*D1 and D2 are same value.

**Rated current**

Double of power supply's rated current

**Rated voltage**

Double of power supply's rated voltage

D1 and D2 dissipate heat by output current. Therefore, heat-sink would be required for cooling.

Output voltage will be dropped by D1, D2. Adjust each output voltage higher by internal potentiometer if required, and also adjust them to be the same value.

If one of the power supplies stops operating, the output voltage may change about 5% appx.
Redundancy operation with optional harness (H-PA-3)

**Circuit**
PBA300F ~ 1500F and 1500T, example circuit for redundancy (N+1) operation with H-PA-3 is shown below.

![Circuit Diagram](image)

**Explanation of Operation**
Option harness H-PA-3 is available for redundancy operation. In this method, the external diode should not be used for stable operation. Therefore, this method will recover from primary circuit failure only. If the failure happened at one of power supply, output power is provided by the rest of unit with current sharing.

**Note**
If one of the power supplies stops operation, the output voltage may change about 5% appx. When unit replacement is required due to unit failure, input voltage for all units must be cut off. After replacement, input-line, output-line and H-PA-3 must be connected correctly, before re-applying input voltage.