

Parallel Operation of Switchmode Power Supplies

In many applications it is desirable to connect multiple DC power supplies in parallel. This may be done to increase the total current available or for redundancy.

When increased current is the goal, the ideal situation is to have the total load current split evenly among the supplies in parallel. For example, if 4 supplies are used to deliver 20A it is best to have each supply loaded to 5A. Evenly splitting the load current means each supply will be operating properly. If a supply is required to go from no load to full load instantaneously (which is the case when a supply delivering almost all of the load current fails), it may go into current limiting. Proper load sharing also means the operating life will be maximized (the MTBF is longer at 80% of full load than at 100%).

Proper load sharing can only be accomplished when the output voltage of the supplies are at the same level at the point where they are commoned. This means that voltage drop in the wiring must also be taken into account. For example, if the terminals of one supply are used as the common point (i.e. two supplies are connected in parallel by daisy-chaining the output terminals and the load is connected directly to the terminals of one supply), then the voltage drop in the wires between the two supplies may affect the load sharing. An imbalance of as little as 50-75mV can lead to the supply with the highest output voltage delivering virtually all of the load current. If the output current rating is not sufficient for such a load current, the power supply will shutdown because of over-current or over-temperature. Maintaining a zero imbalance condition is very difficult - temperature fluctuation, component tolerances, and power supply location (i.e. wire lengths) are some of the factors that can influence the output voltage.

Redundancy presents similar conditions. In this situation the output voltage imbalance is not critical because the failure of one supply does not create an overcurrent condition for the remaining supply (or supplies). However, if there is an imbalance, the remaining supply may go from no (or minimal) load to full load instantaneously and as discussed above, the supply may be shutdown by the overcurrent protection circuitry.

Please note that parallel connection as a means of increasing the total load current capability is not recommended. In order for power supplies to be operated this way each supply must either be designed specifically for parallel operation or they must be adjusted for exactly the same output voltage. They should also be operating at the same ambient temperature. As these two conditions are very difficult to maintain this configuration is not recommended.