

Redundant & Parallel operation of Switch Mode Power Supplies

A) Redundant Operation

A typical example is shown in figure 1. Two Switch Mode Power Supplies are connected to operate in hot standby redundant mode. If one supply fails, the other takes over the load instantly. Relay connected across respective input drops off. The contacts may be used for alarm or tripping. The output voltage is less by about 0.7V & regulation is affected to that extent.

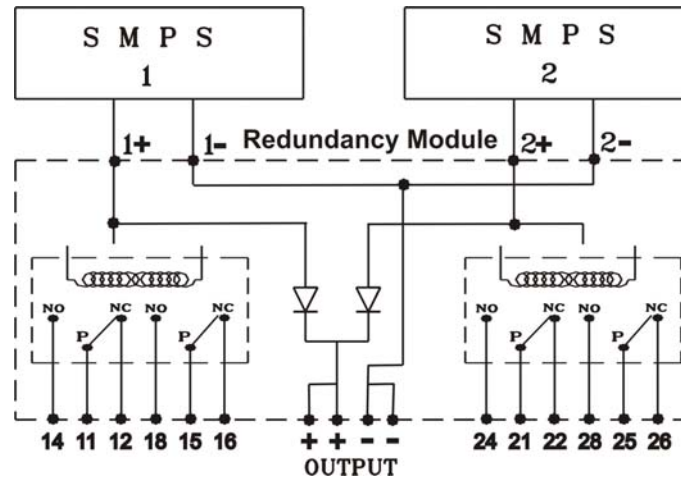


Figure 1

Recommended items for 24VDC Redundant Power Supply

Load Current	SMPS & Quantity	Redundancy Module
1.0 A	G31-24-24 : 2 Nos.	AS452-102 : 1 No
2.5 A	G31-60-24 : 2 Nos.	AS452-102 : 1 No
5.0 A	G31-120-24 : 2 Nos.	AS452-102 : 1 No
10.0 A	G31-250-24 : 2 Nos.	AS452-102 : 1 No
15.0 A	G31-360-24 : 2 Nos.	AS451-102 : 1 No
20.0 A	G31-500-24 : 2 Nos.	AS451-102 : 1 No
Note: SMPS Order codes shown are for 230VAC input supply. Replace G31 with G32 for 110VAC Input		

Recommended items for 48VDC Redundant Power Supply

Load Current	SMPS & Quantity	Redundancy Module
1.25 A	G31-60-48 : 2 Nos.	AS452-103 : 1 No
2.5 A	G31-120-48 : 2 Nos.	AS452-103 : 1 No
5.0 A	G31-250-48 : 2 Nos.	AS452-103 : 1 No
10.0 A	G31-500-48 : 2 Nos.	AS452-103 : 1 No
Note: SMPS Order codes shown are for 230VAC input supply. Replace G31 with G32 for 110VAC Input		

B) Parallel Operation

For parallel operation, refer figure 2 below. Output current = no of units in parallel x capacity of single unit.

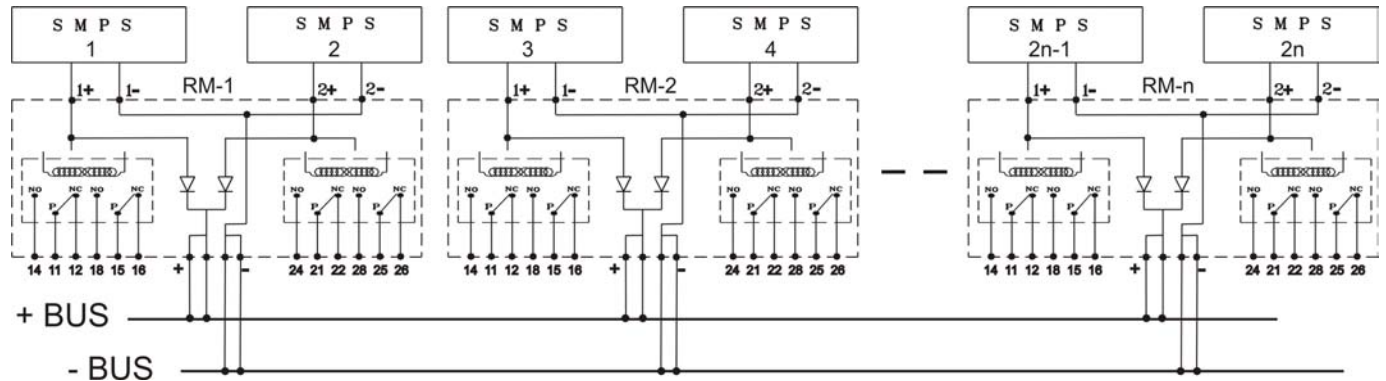


Figure 2

Recommended items for 24VDC Parallel Power Supply

Load Current	SMPS & Quantity	Redundancy Module
30 A	G31-360-24 : 2 Nos.	AS451-102 : 1 No (20+20A, 24V)
40 A	G31-500-24 : 2 Nos.	AS451-102 : 1 No (20+20A, 24V)
60 A	G31-360-24 : 4 Nos.	AS451-102 : 2 Nos. (20+20A, 24V)
80 A	G31-500-24 : 4 Nos.	AS451-102 : 2 Nos. (20+20A, 24V)
90 A	G31-360-24 : 6 Nos.	AS451-102 : 3 Nos. (20+20A, 24V)
120 A	G31-500-24 : 6 Nos.	AS451-102 : 3 Nos. (20+20A, 24V)
160 A	G31-500-24 : 8 Nos.	AS451-102 : 4 Nos. (20+20A, 24V)
200 A	G31-500-24 : 10 Nos.	AS451-102 : 5 Nos. (20+20A, 24V)

Note: SMPS Order codes shown are for 230VAC input supply. Replace G31 with G32 for 110VAC Input

Recommended items for 48VDC Parallel Power Supply

Load Current	SMPS & Quantity	Redundancy Module
20 A	G31-500-48 : 2 Nos.	AS452-103 : 1 No (10+10A, 48V)
40 A	G31-500-48 : 4 Nos.	AS452-103 : 2 Nos. (10+10A, 48V)
60 A	G31-500-48 : 6 Nos.	AS452-103 : 3 Nos. (10+10A, 48V)
80 A	G31-360-48 : 8 Nos.	AS452-103 : 4 Nos. (10+10A, 48V)
100 A	G31-500-48 : 10 Nos.	AS452-103 : 5 Nos. (10+10A, 48V)
120 A	G31-500-48 : 12 Nos.	AS452-103 : 6 Nos. (10+10A, 48V)
140 A	G31-500-48 : 14 Nos.	AS452-103 : 7 Nos. (10+10A, 48V)

Note: SMPS Order codes shown are for 230VAC input supply. Replace G31 with G32 for 110VAC Input

Setting Procedure for parallel operation

1. Use Both the Power Supplies of same make & rating.
2. Terminals are rated for 10A. Use maximum possible terminals for wiring.
3. Use wires of same length & cross section from SMPS terminals to Redundancy Module terminals.
4. Use wires of same length & cross section from Redundancy Module to +Bus & - Bus.
5. Connect at least 50% of Load.
6. Voltages are to be measured at Redundancy Module terminals & not at SMPS terminals for following settings.
7. Set output of SMPS 1 to required value (e.g. 24.10V at Redundancy Module terminals)
8. Set output of SMPS 2 to within +/- 50mV difference (e.g. between 24.05V and 24.15V).
9. Set other SMPS outputs as above.

All the above is necessary for equal current sharing by each SMPS. The sharing achieved is within +/- 10%. It is also recommended to periodically check the voltages as above & correct if necessary.

C) Parallel & Redundant Operation

When multiple numbers of SMPS are paralleled & redundancy is also required, it is recommended to have 20 to 40% additional capacity. i.e. When the load requirement is 120 A, for redundant operation, 160A capacity is recommended.

Following are the benefits of the above scheme.

- 2) Initial set up cost is lower than having a single SMPS of the required rating.
- 3) Standard, Ex-Stock available SMPS & Redundancy Modules.
- 4) Low inventory cost for spare units.
- 5) Failed unit can be replaced online.

Note :

This is an open loop control & the current sharing is dependant on following parameters

- 1) Output voltage of the power supplies.
- 2) Cable length (resistance) of input & output cables.
- 3) Forward Voltage drop across diode : Piece to piece variation & temperature coefficient.

However, this is a low cost & full proof method widely used in the industry. The internal current limit of each SMPS starts acting above its limit & even if unequal sharing happens then SMPS's are protected by their internal current limiting circuitry. The effect of this on output voltage is very minor.