

Advel Application Note – AAN2011.2

Power supplies with serial or dual output

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1. Introduction

Sometimes it may happen that is necessary a dual voltage or a very high or special voltage value.

If you need a small quantity of this type of power supplies, it's more advantageous to use some standard power supplies, to be configured appropriately to get the output you need.

Of course this is possible if the power supplies used have particular features..

2. Special voltage values

We can define "standard" voltages those values easily available in the market and manufactured by many companies, ie: 12Vdc, 24Vdc, 48Vdc, 110Vdc.

If the voltage value you need is very close to a standard value ($\pm 10\%$) it's possible to use a standard power supply and then finely vary its output voltage through trimmer. Infact 80% of industrial power supplies provide an adjusting trimmer for V_{out} .

But if the voltage required by the load is very special, for example: $V_{out} = 16V$ or $V_{out} = 140V$ or $V_{out} = 220Vdc$, you must ask the manufacturer to make a non standard power supply, and for the new design you will have an extra cost of course.

3. Power supplies with serial output voltages

The alternative to an expensive "custom" power supply would be to use power supplies with standard output voltages, wired in series to obtain the desired voltage.

For example, it's not uncommon in an industrial system the necessity of a stabilized 220Vdc voltage.

Well it's possible to use two power supplies with standard output voltage 110Vdc, and wiring the outputs of the two power supplies in series, so as to obtain the voltage 220Vdc, as in Figure1.

Note that this is possible only if the power supplies have a "floating" output voltage, ie without any connection to GND or Input voltage. If the power supplies used doesn't meet this basic requirement, there is a risk of damaging the power supplies or the load, so be carefull.

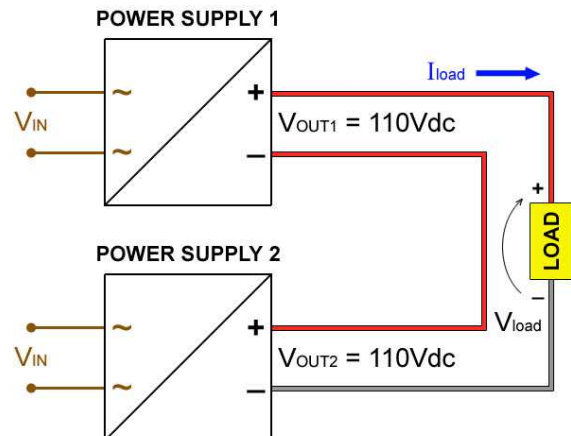


Figure1 – Two power supplies wired with output in series: the LOAD is subjected to voltage $V_{load} = V_{out1} + V_{out2} = 220Vdc$. The outputs of the power supplies must be "floating".

Note that the two power supplies in Figure 1 give out exactly the same current, thus the same output power.

Similarly, for example to obtain a 36V voltage, it's possible to wire in series a 12V V_{out} power supply with a 24V V_{out} one, as in Figure 2.

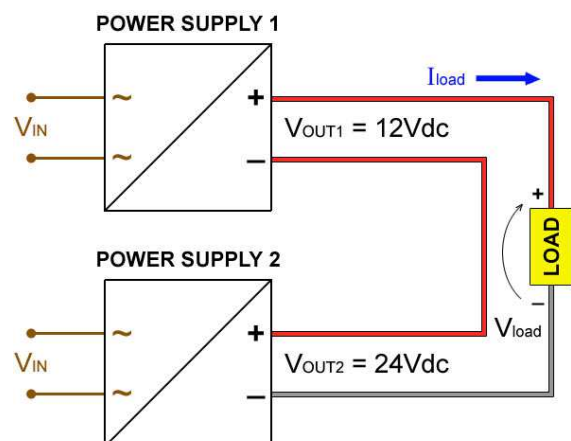


Figure2 – Two power supplies wired with outputs in series: the load is subjected to $V_{load} = V_{out1} + V_{out2} = 36V$.

Note that the two power supplies of Figure2 give the same current, but different output voltages, and so giving out a different output power. Infact we have:

$$P_{out1} = I_{load} \times V_{out1} = I_{load} \times 12V$$

$$P_{out2} = I_{load} \times V_{out2} = I_{load} \times 24V$$

then in this example the power supply 2 should be sized for a double power with respect to power supply 1.

For this reason it's recommended to use the serial wiring only with power supplies having the same output voltage.

Typically it's also possible to wire more than two power supplies with output in series. For example, in Figure3 it's obtained a voltage for the load equal to:

$$V_{load} = (3 \times 48V) \pm 10\% = 144V \pm 10\%, \text{ with three power supplies.}$$

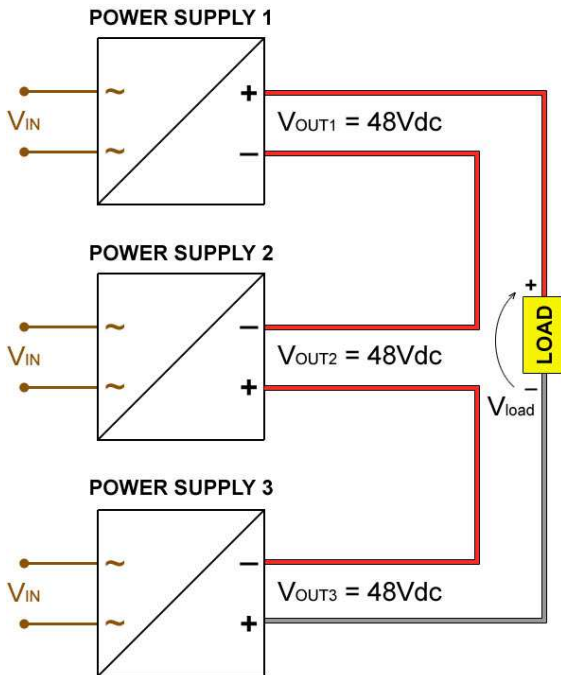


Figure3 – Three 48V V_{out} power supplies wired in series, the load is subjected to: $V_{load} = 3 \times 48Vdc = 144VdcV$. By trimmer, if present, you can get $V_{load} = 144Vdc \pm 10\%$.

Advel power supplies can be wired with outputs in series to obtain up to 500Vdc.

4. Power supplies with dual voltage

Often in industrial system is required a dual voltage, or negative voltage.

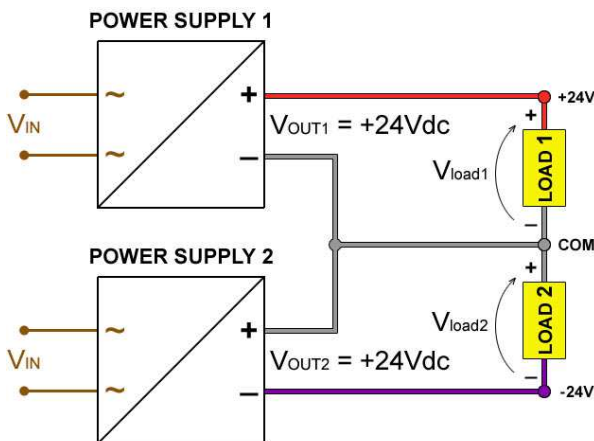


Figure4 – Two power supply in dual configuration.

Even in this case using power supplies with floating output, is possible to realize negative or dual voltages, through standard power supplies.

In Figure4 were used two power supplies with identical output 24Vdc, with outputs wired in order to obtain a dual $\pm 24Vdc$ voltage and a common central point (corresponding to the reference, or "0" Volt).

5. Advel power supply systems

As already mentioned all Advel power supplies have floating output, making them suitable for wiring the outputs in serial or dual configuration.

For this type of connection Advel offers two product lines: power supplies **SPS-D serie**, for DIN-rail mounting (the customer will have to wire the power supplies as described in the preceding paragraphs), or power supplies **SPS / SPF serie**, the 19" rack version, as showed in Figure 5.

Inside the racks there are the hot-swap power supplies, that are internally wired as requested by the customer (in series or dual or parallel configuration): to the terminal blocks are present the right voltages.



Figura5 – Two power supplies module in a 19" rack manufactured by Advel: the two power supplies are internally wired as requested by customer.

6. Conclusions

It was made a short description of how you can obtain high voltages or dual voltages, using appropriate wiring techniques, completely trivial. This type of wiring is always possible, as long as the power supplies have a floating output, such as Advel power supplies.



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