Autotransformer 120/240 V - 32 A and 120/240 - 100 A

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Autotransformer
120/240 V 32 A

Autotransformer
120/240 V 100 A

The Autotransformer: for step up, step down and split phase balancing

An autotransformer can be used for step up, step down and split phase output balancing purposes.
While the step up and step down functions are fairly straightforward, split phase output balancing may require some more attention.

Consider for example a 30 A 120/240 V split phase supply.
The supply could be the grid, a generator or two stacked inverters.
Some of the loads connected are 240 V, others are 120 V. On each 120 V leg the load should not exceed 30 A. The problem is that as soon as 120 V loads are connected, the two legs will show a different current. This is because the 120 V loads on the two legs will never be balanced. A 120 V 1200 W hairdryer, for example, will draw 10 A from one leg. A 120 V washing machine could even draw in excess of 20 A from one leg. Between the two legs the difference in current, or current unbalance, will therefore often be 20 A or more. This means that the 30 A supply will not be used up to its full potential. By the time one leg draws 30 A, the other leg may be drawing no more than 10 A, and increasing the 240 V load, for example, will result in an overload of one leg while the other leg still has spare capacity.

Theoretically, the total power that can be drawn from a 30 A 120/240 V supply is 30 x 240 = 7,2 kVA.
In case of 20 A unbalance, the practical maximum will be 30 x 120 + 10 x120 = 4,8 kVA, or 67% of the theoretical maximum.

The solution is an Autotransformer.
By leaving the neutral of the split phase supply unused, and connecting an Autotransformer to create a new neutral, as shown in figure 1, any load unbalance is 'absorbed' by the Autotransformer.
In case of a 30 A supply, the load can be increased to 7,2 kVA, and a 20 A load unbalance will result in one leg supplying 40 A, and the other leg 20 A. The 20 A difference will flow through the neutral and the windings of the Autotransformer. The current through both 120 V wires of the split phase supply will be 30 A.

Ground relay for use with Multi or Quattro Inverter/Chargers included

When operating in inverter mode, the neutral output of the inverter/charger must be connected to ground to guarantee proper functioning of a GFCI. In case of a split phase supply the neutral must be grounded. For this purpose a grounding relay is built in the autotransformer's enclosure. The relay is controlled by the 230/240 V Multi or Quattro. (The internal grounding relay in the 230/240 V Multi or Quattro must be disabled)

Temperature protected

In case of overheating, the Autotransformer is disconnected from the supply. Reset is manual.

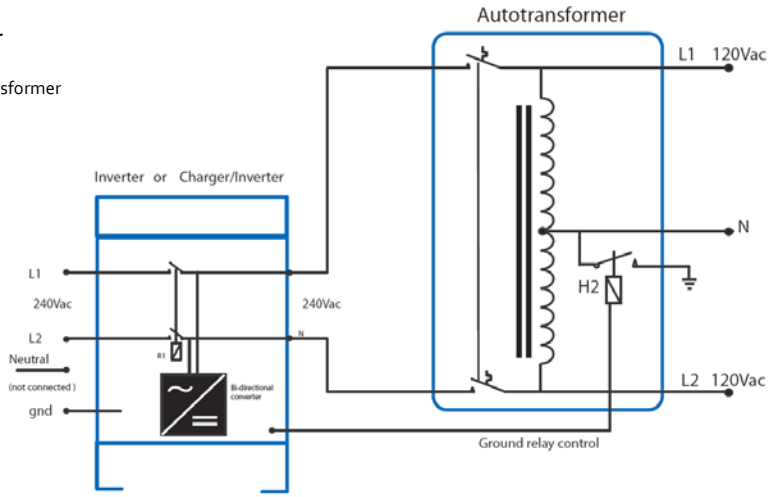
An alternative to stacked inverters

The alternative to stacking two 120 V inverters to provide a 120/240 V split phase supply is a 240 V inverter with an additional Autotransformer.

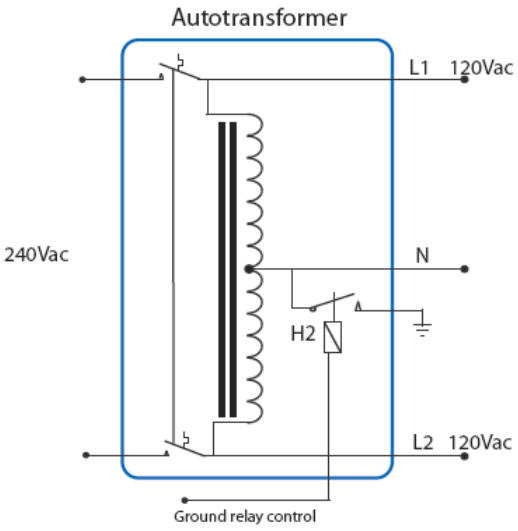
Two stacked 120 V 3 kVA inverters will supply up to 25 A to each 120 V leg. If the load on one leg is less than 25 A, the maximum load on the other leg is still limited to 25 A.

One 240 V 5 kVA inverter with a 32 A Autotransformer will supply up to 21 A of balanced load to each 120 V leg. Fewer loads on one leg will however result in more power being available on the other leg, with a maximum unbalance of 32 A.
Therefore the load can be up to 38,5 A on one leg if the load is not more than 3,5 A on the other leg (maximum unbalance: 38,5 – 3,5 = 35 A). If load unbalance is to be expected, a lower power 240 V inverter with autotransformer will therefore be preferable to the stacked inverter solution.

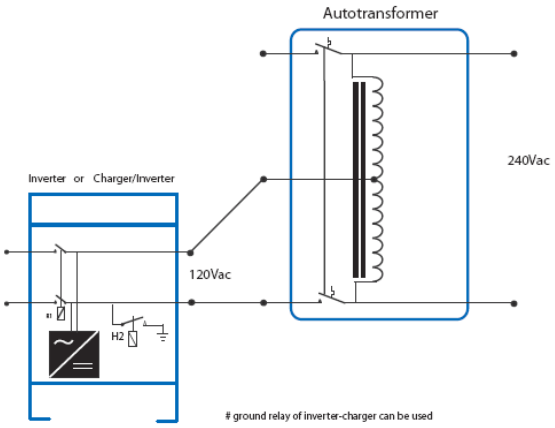
Figure 1:
Split phase supply for unbalanced load
(Ground relay of autotransformer should be used)



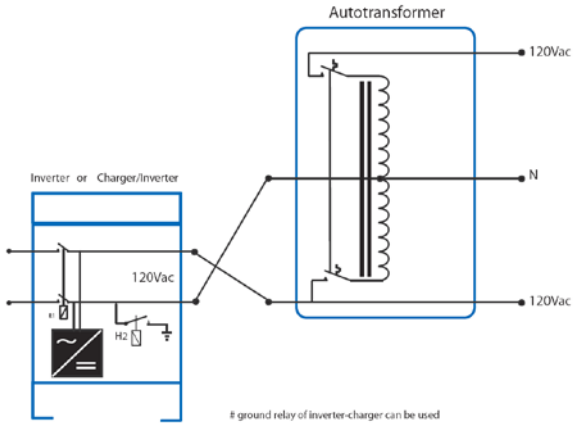
Autotransformer	32 A	100 A
Input/output voltage	120 / 240 V	
Input circuit breaker	32 A, two pole	100 A, two pole
Frequency	50/60 Hz	
Maximum 240 V feed through current	32 A	100 A
Neutral current, 30 min	32 A (3800 VA)	
Neutral current, continuous	28 A @ 40°C/100°F	
Transformer type	Toroidal	
Enclosure	Aluminium	
Input circuit breaker	yes	
Protection category	IP21	
Safety	EN 60076	
Weight	12,5 kg	13,5 kg
Dimensions (h x w x d)	375 x 214 x 110 mm	425 x 214 x 110 mm



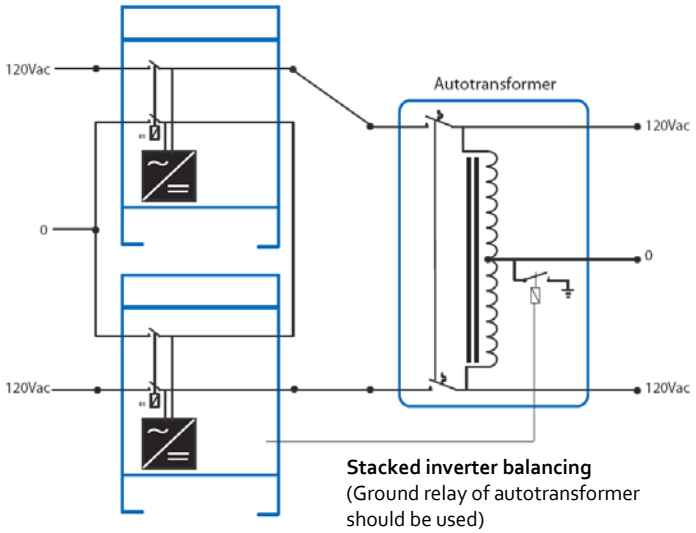
Autotransformer: schematic diagram



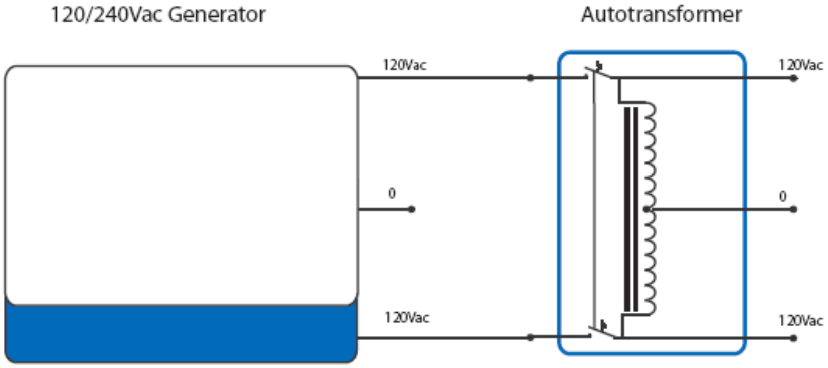
Step-Up: 120 VAC to 240 VAC
(Internal ground relay of inverter/charger may be used)



Split phase: 120 VAC to 120/240 VAC
(Internal ground relay of inverter/charger may be used)



Stacked inverter balancing
(Ground relay of autotransformer should be used)



Generator Balancing
(Neutral of generator should be connected to ground)

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