

**Manual**

EN

**Appendix**

Appendix

## **Autotransformer**

ATR-32A

ATR-100A





## 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 30A 120/240V split phase supply.

The supply could be the grid, a generator or two stacked inverters.

Some of the loads connected are 240V, others are 120V. On each 120V leg the load should not exceed 30A. The problem is that as soon as 120V loads are connected, the two legs will show a different current. This is because the 120V loads on the two legs will never be balanced. A 120V 1200W hairdryer, for example, will draw 10A from one leg. A 120V clothes washer could even draw in excess of 20A from one leg. Between the two legs the difference in current, or current unbalance, will therefore often be 20A or more. This means that the 30A supply will not be used up to its full potential. By the time one leg draws 30A, the other leg may be drawing no more than 10A, and increasing the 240V 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 30A 120/240V supply is  $30 \times 240 = 7,2\text{kVA}$ .

In case of 20A unbalance, the practical maximum will be  $30 \times 120 + 10 \times 120 = 4,8\text{kVA}$ , 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 30A supply, the load can be increased to 7,2kVA, and a 20A load unbalance will result in one leg supplying 40A, and the other leg 20A. The 20A difference will flow through the neutral and the windings of the autotransformer. The current through both 120V wires of the split phase supply will be 30A.

## **Ground relay for use with Multi or Quattro inverterchargers 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 enclosure. The relay is controlled by the 230/240V Multi or Quattro. (The internal grounding relay in the 230/240V 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 120V inverters to provide a 120/240V split phase supply is a 240V inverter with an additional autotransformer.

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

One 240V 5kVA inverter with a 32A autotransformer will supply up to 21A of balanced load to each 120V leg. Less load on one leg will however result in more power being available on the other leg, with a maximum unbalance of 32A.

Therefore the load can be up to 38,5A on one leg if the load is not more than 3,5A on the other leg. (maximum unbalance:  $38,5 - 3,5 = 35A$ ). If load unbalance is to be expected, a lower power 240V inverter with autotransformer will therefore be preferable to the stacked inverter solution.

## 4. Specifications

<b>Autotransformer</b>	<b>32A</b>	<b>100A</b>
Input/output voltage	120 / 240V	
Input circuit breaker	32A, two pole	100A, two pole
Frequency	50/60Hz	
240V to L1,L2 current	32A	100A
Neutral current, 30 min	32A (3800VA)	
Neutral current, continuous	28A @ 40°C/100°F	
Transformer type	Toroidal	
Enclosure	Aluminium	
Input circuit breaker	yes	
Protection category	IP21	
Safety	EN 60076	
Weight	12,5 Kg	13,5Kg
Dimensions (h x w x d)	375 x 214 x 110 mm	425 x 214 x 110 mm

## 5. Operation

### 1.1 On/Off switch



The MCB for over current and temperature protection and ON/OFF switch

The Autotransformer is ON



Push little blue switch



Switch the MCB ON



The green LED is on

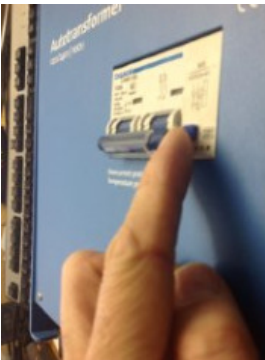
## 1.2 Temperature protection

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

When the transformer is warm the fan will blow and the RED led is on.

Disconnect some of the 120V load.

When the transformer is overheated the MCB will switch off. The little blue switch will be out of the MCB.



Push little blue switch



Switch the MCB to "ON"



The Autotransformer is on.  
The green LED is on.



### 1.3. Over current protection

In case of over current the MCB will switch off. The little blue switch remains inside the MCB Disconnect some of the load.

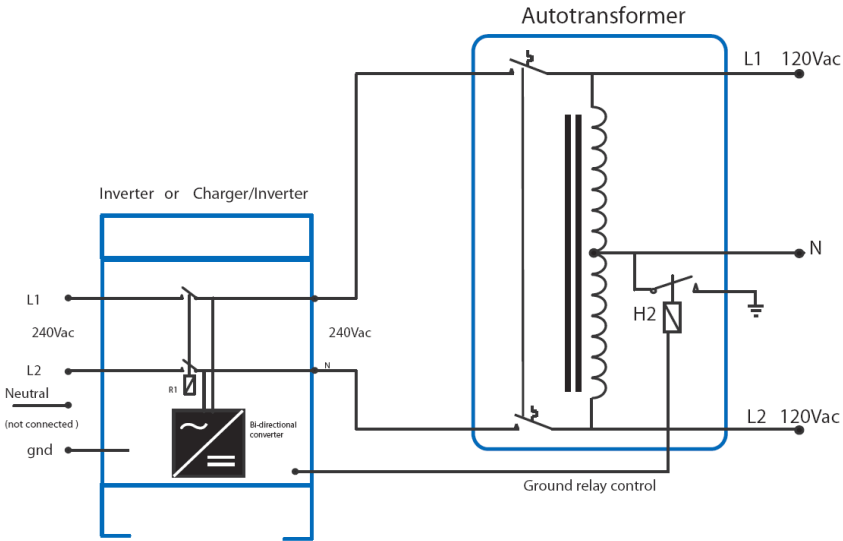


Switch the MCB to "ON"

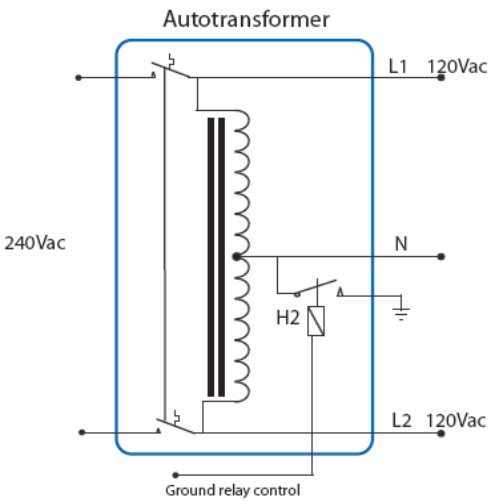


The Autotransformer is on. The green LED is on.

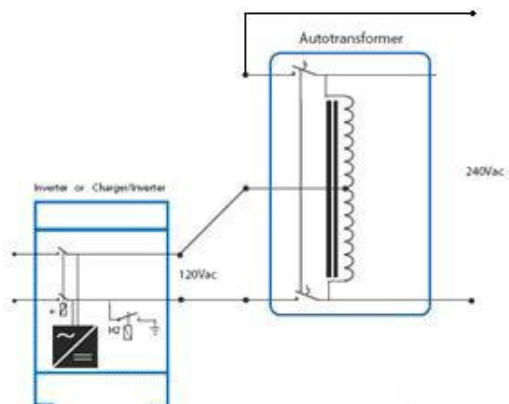
## APPENDIX A:



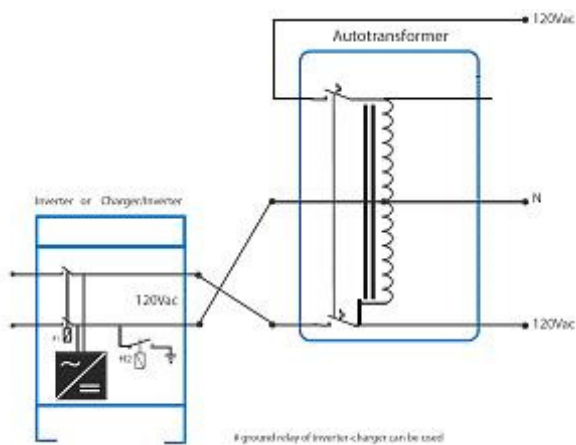
**Figure 1 - Split phase supply for unbalanced load**  
(Ground relay of autotransformer should be used)



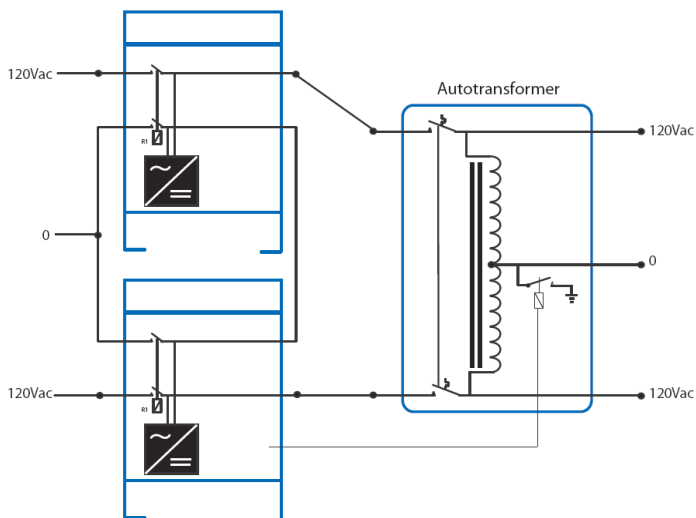
**Figure 2 - Autotransformer: schematic**



**Figure 3 - Step-Up: 120VAC to 240VAC**  
(Internal ground relay of inverter/charger may be used)

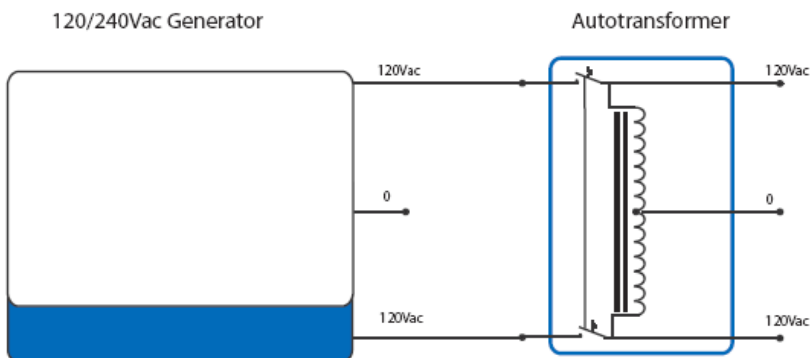


**Figure 4 - Split phase: 120VAC to 120/240VAC**  
(Internal ground relay of inverter/charger may be used)



**Figure 5 - Stacked inverter balancing**

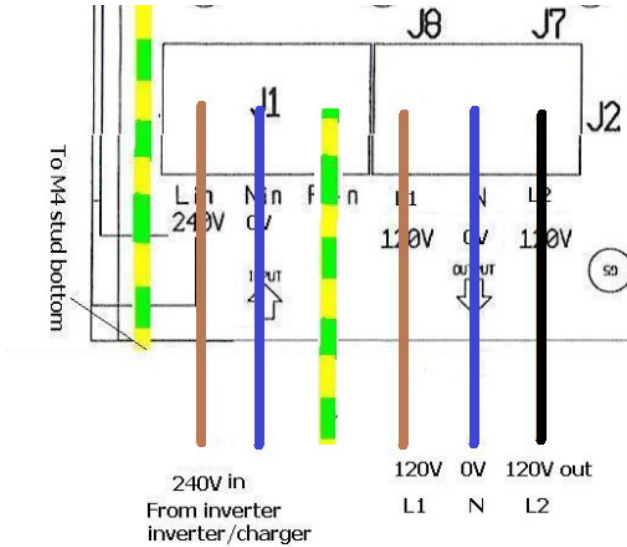
(Ground relay of autotransformer should be used)



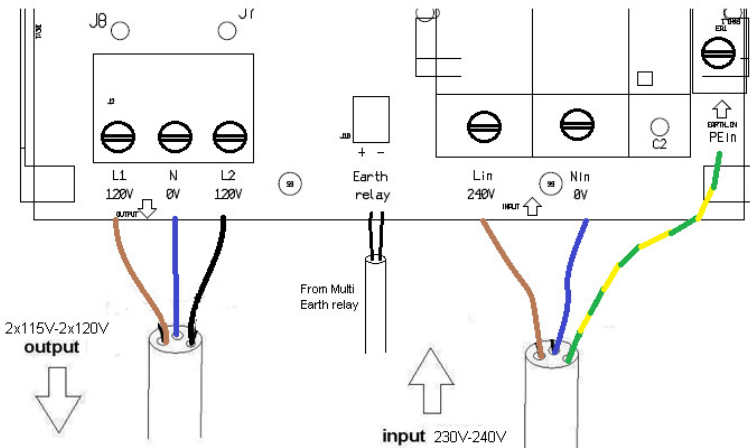
**Figure 6 - Generator Balancing**

(neutral of generator should be connected to ground)

## APPENDIX B: wiring diagram



Wiring diagram: MTR-32



Wiring diagram: MTR-100

# Victron Energy Blue Power

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Serial number:

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