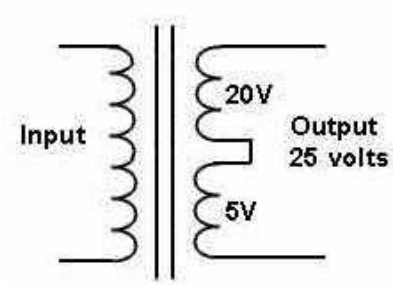
SHAK NOWTZ BY "MAD" FRANK - G3ZMF

SHAK NOWTZ No 3 – TRIX WITH TRANSFORMERS

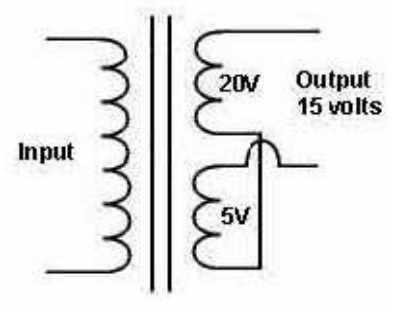
1 TRANSFORMER TRIX (LAMINATED METAL ONES)

If your transformer does not have the required voltage output, but does have a number of separate secondary windings, it may be possible to connect the windings, in **sum** or **difference mode**, to obtain the desired voltage. Remember however that the **maximum** current output is only the maximum current on the winding with the **lowest** rating. In other words, a 20 volt/ 5 amp winding plus a 5 volt/ 2 amp winding can only be used to a full load of 2 amps, the rating of the 5 volt winding.

On the other hand, you can now use this as a 25 volt/ 2 amp transformer, if the windings are joined additively (Sketch A) or, if you connect the winding in antiphase (see Sketch B) then you can end up with a subtractive arrangement and a 15 volt/ 2 amp transformer.



Sketch A - Additive connection (In Phase)

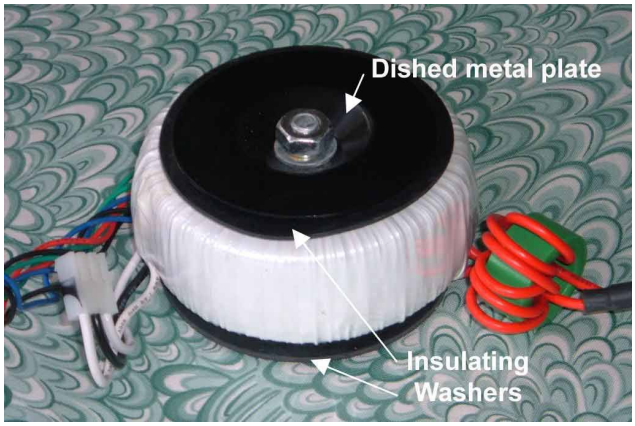


Sketch B - Subtractive Connection (Antiphase)

2 TRANSFORMER TRIX (TOROIDAL = BIG DOUGHNUTS)

Before I go into voltage changes, it is **very important** to remember that any metal passing through the centre of the toroid constitutes one turn of winding and must therefore **not** be allowed to form a completed turn around the outside of the core as this would then constitute a shorted turn. **Bang**!!!

However, a suitable clamp plate, securing nut and bolt, not forgetting insulating pads above and below the toroid, is fine. Actually this is a useful thing, as you can use an AC voltmeter to measure what you may think is a short circuit from clamp plate to chassis, but is actually one turn of a transformer.



With this in mind, look out for low voltage lighting transformers at the rallies, as most people are changing out heavy toroidal (linear) transformers for lightweight switched mode units. All very well to power a snazzy light in the galley – but often a source of QRM on the LF and HF bands.

Problem: 12 volt ceiling lights are usually fed with 11.75 volts, so when put through a bridge rectifier only give 11.75 x √2 = 16.6 volts peak and about 13 volts on full load.

16.6 volts is dangerously high for most "12 volt" rigs, but 13.0 volts is too low to regulate, even down to 12.0 volts, so more volts are required.

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First: Check the rating of the transformer ie 12V/ 50W or 11.75V 50 VA. 50VA is 50 voltamps ie 5 V x 10 A, 10V x 5A or, in this case, 11.75V x 4.25A. (VA is simply volts x amps, as used when specifying AC transformers, whereas watts refers to the current being **in phase**, or a purely resistive load.)

Second: Using a suitably rated **insulated** and flexible cable, pass five continuous turns through the centre of the toroid, strip the ends and screw them into a terminal block for ease and safety. Now apply mains voltage to the primary winding, recheck the original secondary winding voltage and then measure the new winding's voltage. Divide this voltage by 5 and that gives you the volts-per-turn used in the transformer's construction.

Let's say the transformer's original secondary output voltage was 12 volts and the new winding measures 1 volt, then 1 volt divided by 5 equals 0.2 volts per turn. In the same way, if the new winding reads 2.5 volts, then 2.5 volts divided by 5 equals 0.5 volts per turn. With this new information, you can either add (or subtract) the "new winding's" voltage to (or from) the original secondary voltage.

But….do not forget the power rating of the transformer – watts or voltamps – do **not** exceed it.

Recalculate the maximum output current from the transformer ie new winding is 4 volts, plus original 12 volts = 16 volts. For a transformer rated at 50 watts (50 VA) the new max current is 50 VA divided by 16 volts = 3.12 amps, **not** 4.25 amps!

This calculation **must** be applied whether adding or subtracting voltage, as all windings are carrying power and current!

Although this is the quick and easy way of getting the voltage you require, you may feel ambitious, as I have done in the past, and stripped the old secondary windings from the transformer, remembering to do an output voltage check, then remove 10 turns and recheck the new lower voltage to give you the "volts per turn" figure that you will need when you rewind the new winding(s). Most importantly, accurately measure the length of wire which constituted the "removed" 10 turns so you know how much wire you will need for the rewind.

Unless you have one of those wonderful winding machines for winding toroidal transformers, you need a big floor space and no kids or pets to tangle up your winding wire!!!

The following information is taken directly from the British Standard Copper Wire Table as published on page 163 of the Radio Data Reference Book by our very own Terry G4CDY and George G6JP. (I'm never without it as a reference guide…. Thank you Terry and George)

Current rating is based upon 1,200 amps per square inch of copper, eg 0.1 sq in = 120 amps.
Alternatively use 1.86 amps per sq mm.
10 SWG = 3.25 mm diam = 15.4 amps
12 SWG = 2.64 mm diam = 10.2 amps
14 SWG = 2.03 mm diam = 6.0 amps
16 SWG = 1.63 mm diam = 3.8 amps

For higher currents, the windings become very difficult to handle. Don't attempt to wind two identical windings in parallel to double the current. It may be okay in theory, but I've never managed to make it work in practice. It's much better to get a transformer nearer the voltage you require.

There is of course another way to get more volts and that is to use two (or three) transformers of equal rating and connect the secondaries in series, but you must make sure that the transformers have adequate insulation to withstand the maximum working voltage of 3 x 250 volts AC = 750 volts AC. Look for BSEN60742, ENG60950 or BSEN60950 on toroidal transformers and for BS3535 for metal laminated ones. This specification indicates primary to secondary insulation of 3000 volts AC.

Otherwise, refer to previous "Shak Nowtz" for rectification, smoothing and regulation.

Have fun – and don't get bitten by volts.

Articles to come:
ATU ideas
Wire aerials and earths
Little whips and big whips (not kinky ones)
Friggin' with the riggin' (knots and erections)
Beams and yagis
Basic Circuits
Basic AF amps and pre-amps
Basic RF amps
Rx and Tx mixers
Plus … ? what do you want? Tell me and I'll write something

See Yer !
Mad Frank G3ZMF