

Powering a 3-Phase Papst Motor

For what appears to be a suitable signal generator look here:-

[NEW 3-Phase Sinusoidal Signal Generator Adjustable Phase 0.1?2000 Hz | eBay](#)

The distortion levels are low, about 50~60 db down; the phases are adjustable in 1 degree steps, so you can use 2 phases 90 deg apart for a hysteresis motor or 3 phases 120deg apart for a Papst 3 phase motor as I am using for my Thorens TD124. The output is also adjustable from about 1V to 6V.

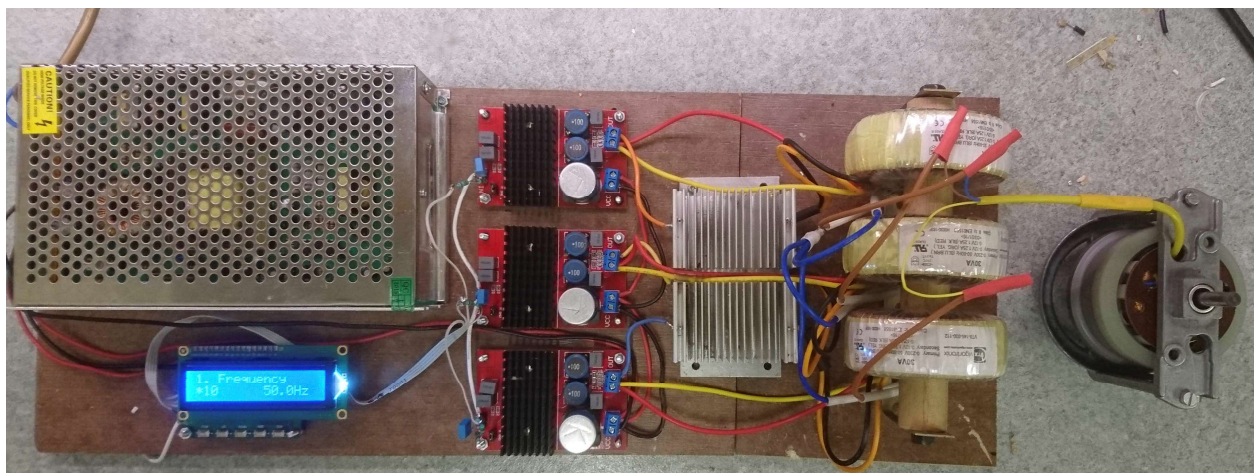
The 'power' side of the circuit will vary, depending on the motor requirements, but I am using these amps very successfully:-

[100W DC 12V-24V TPA3116 Mono Channel Digital Power Audio Amplifier Board BTL Out | eBay](#)

I like the fact that they will happily drive a 2 Ohm load, so in my case only need a 1 ohm ballast resistor between the amp and the transformer to limit the startup current.

Here's a picture of the first 'rough cut' of the 3 phase setup for my thorens td124. I'm using the items specified in my earlier post (#28). The extra components are :-
3 x 10W 1.0 ohm resistors in series with the output of each amp; these are fixed to a heatsink taken from an old pentium processor.
3 x 30VA 12V ~ 230V toroidal transformers. (these are needed to drive my larger Papst motor, smaller transformers would be ok for a smaller motor).
1 x 12V 120VA SMPS power supply, again a smaller psu would be fine for a smaller motor.

The only mod so far is to add a couple of resistors to reduce the input voltage to each amp and a capacitor across the input of each amplifier to reduce any noise/hash from the generator/psu.



I included the 1 ohm resistors because the amplifiers are spec'd for a minimum load of 2 ohms. I'm only using a 12v power supply so I worked out that an extra 1ohm in series with the transformer should do the trick in limiting the startup current. I actually bought a few

spare amplifiers just in case I guessed wrong 😊

I've been running the setup in the picture for a few days almost non-stop. The amps run almost cold, the transformers are at about 45 degC, in fact its only the heatsink over the resistors that get at all hot, and that's easily fixed by the addition of a 12v computer fan reattached to the heatsink.

The motors (I have 2 different Papst motors) run almost completely silently, only a very slight 'woosh' of the air moved by the external rotor gives any indication they are moving.

I tried leaving out the resistors and got no output, I suspect the Amplifiers see something too close to a short circuit across the 12v side of the transformer and won't start. Reinstalling the resistors all is well.

I do use a resistive divider on the input to the Amps, I also use a 0.47 uF capacitor across each amp input to reduce/eliminate any 'hash' from the generator.

The gain is, as you suspected around 30dB.

The next stage is to machine a suitable pulley for the motor, then swap out the E50 motor on my TD124 for the Papst, and see if I can detect any difference.

At that point I shall find a suitable case for the 3 phase generator and box it all up.

The transformers I am using are 0~12, 0~12 x 230 30VA toroidal

The first time around, using a 12V 20A supply I was using the primaries in parallel, so had 12:230V, being fed by a PBTL amplifier. With an amplifier output of around 6.5Vrms I was getting about 110V at the secondary of the transformer, but with some significant losses across the 1 ohm ballast resistors

I've revamped the setup as follows,

Now using a 24V 5A supply, with a 12v regulator to feed the 3 phase generator.

The transformer primaries are now in series so 24:230V, no longer need ballast resistors, but I've left 0.5 ohm resistors in to avoid a totally inductive load.

I've modified the input attenuator/lpf to allow a maximum amplifier output of around 15Vrms.

I've added 3x0.022uF 250Vac caps across each transformer secondary phase to eliminate any residual hf getting to the motor.

Here's a couple of pictures of the current setup, the first is the lashup version, soon to go into a suitable enclosure, and the second is the neutral - phase output, showing a clean, pretty accurate sine wave, with no HF noise.

I do think this is the most cost effective way of driving a multiphase motor, whether two or three phase.

The input attenuator/lpf between the generator and the amp is now as below.
With the supply voltage for the amps increased to 24V I could reduce. the attenuation to allow a larger output swing without clipping.

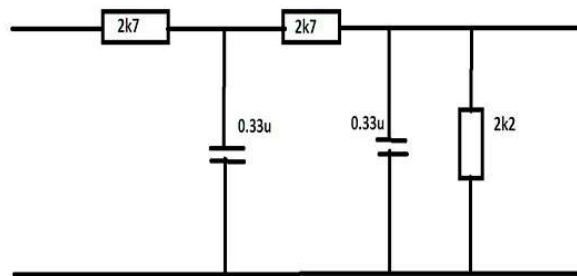
I have left 0.5 ohm resistors between the amp and transformer as I found that just occasionally, if I had the output of the generator set near the maximum, the amps could still lock out.

It was suggested above that a timed relay could be used to short-circuit the resistors once the motor had started, I do have some small 4 pole c/o relays and might try this, though I find that running the motor at about 75~80V provides more than enough torque.

Ralph if I understand this, you put the output of signal of the amp on a scope and adjusted the input signal voltage to get a amp output signal just before clipping. Real world measurements gave you 15.65vrms amp output and 109.5 vrms at the motor after the .5 ohm resistors.

From the 1st version to the 2nd you increased the amp input from 12 to 24 volts.(I am assuming that is like raising the B+ on a vacuum tube. I know very little about transistor amps). So now we have a higher signal and then you halved the set up transformers to get to 109.5 after the .5 resistors.

The voltage divider is used to lower the input signal so if you wanted a 100 volts at the motor would you do it here. Also maybe a pot here so you could adjust for each motor for least vibration. Also on the frequency gen it said 1-5 volt output so is the divider necessary???



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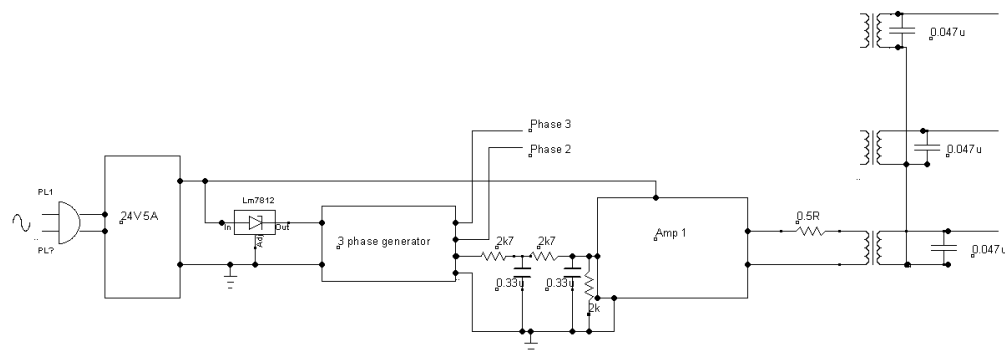
You've pretty much got it all correct. The only slight correction relates to the divider; a little experimenting gave me an effective reduction of 5:1 with the 24V supply, the capacitors were added to create a low pass filter, in my case with a cut-off frequency of around 200Hz in order to reduce any HF 'hash' from the generator, the values are somewhat arbitrary, anything from 0.047uF to 0.5uF should do fine.

It is important that the resistor values are accurate, I use 2% resistors to ensure the voltages of the three phases are as close as possible.

Any adjustment of the output can then be done using the generator.

I will be very interested to hear how you get on with your setup when the parts all arrive. Keep us informed, and if there are any other questions please ask.

I'm on the lookout for a suitable case, and in the meantime producing a pulley for my motor, non standard diameter shaft



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