



June 2018

## Build converters with E400 controllers

E controllers are simple:

Turn-on when the generated voltage is below  $V_{min}$ .

Turn-off when this is above  $V_{max}$ .

These two voltages are relative (change with changing input voltage) and are near the nominal input.

E senses accelerating load motors and generates the boost currents to accelerate them fast.

The internal thyristor engages the start capacitor at zero volt difference between the capacitors.

Self-protection: A time-out turns the thyristor off should  $V_{max}$  not be reached within seconds.

The output sine wave is pure, distortion is extremely low.

Output voltages with E are not balanced but are much improved when the R controller is added.

Use T or F controllers for balanced output voltages.

A large start capacitor and a low impedance motor guarantee best performance.

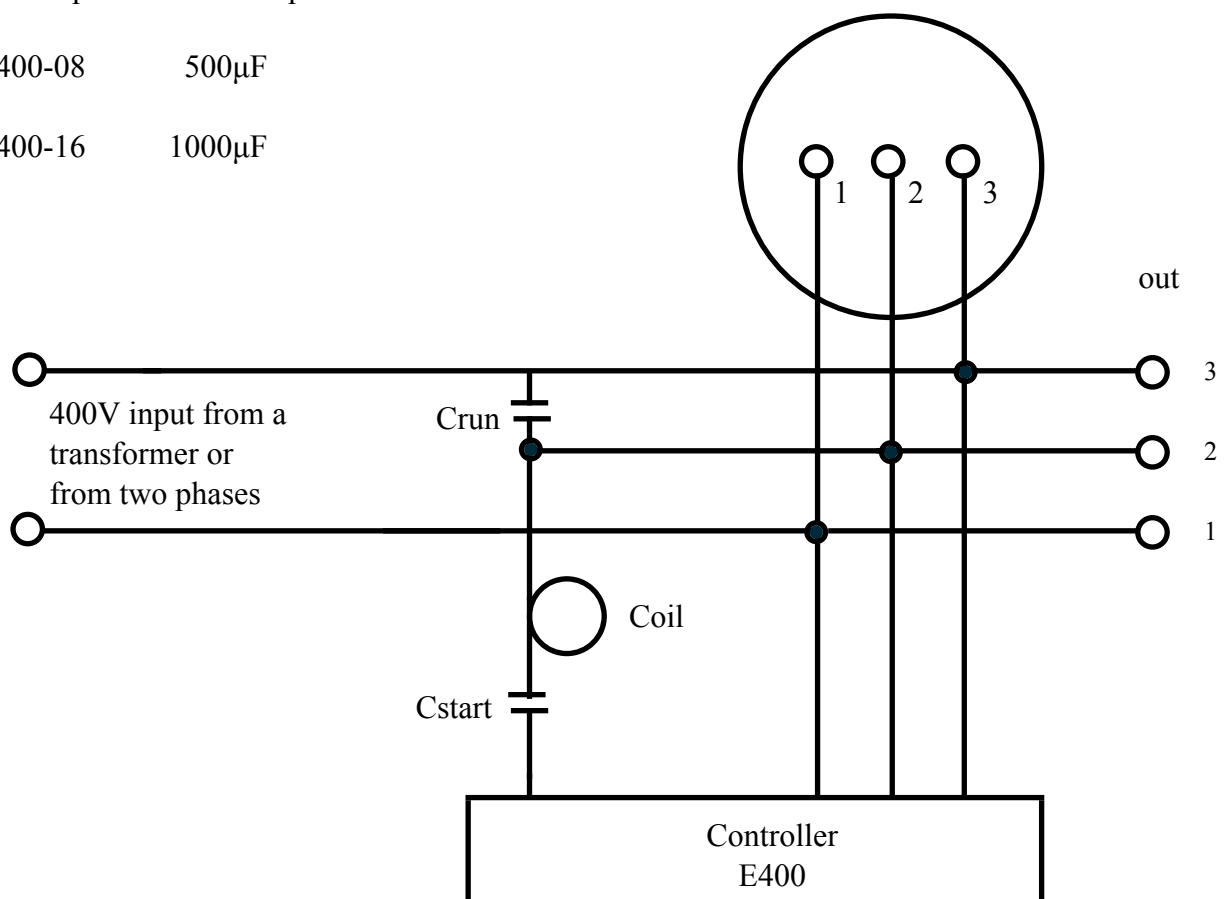
A 150-200 $\mu$ H air coil is essential for an unlimited thyristor life.

Use a discharge resistor on Cstart.

Start capacitors can be up to

E400-08      500 $\mu$ F

E400-16      1000 $\mu$ F



The start capacitor is kept charged with peak DC voltage when a converter is on: 340V DC. This has no effect on the lifetime but creates the soft spot for connecting Cstart and Crun. Recommendations for discharge resistors: Use one 200k 5W per capacitor on Cstart only.

A 150-200uH air coil is a vital part for protecting the thyristor. Never run an E controller without a coil.

Make a coil by laying turns of wire by hand. Fix the shape by using cable ties. A coil can have more turns than recommended below but not less.

Wire size, heat:  
The current through a coil at 50Hz is 13A/100μF.

A coil conducts current for up to several seconds when a load motor is connected to high inertia. Overload protection: The E controller disengages the start capacitor after some seconds.

Do not use any material inside a coil other than air. Keep a coil away from large metal surfaces. See air coil calculators on the Internet. A typical circular coil: 22 turns in a tight bundle.

Diameter:

for up to 15hp	8 inch or 20cm
for up to 30hp	10 inch or 25cm
for up to 60hp	12 inch or 30cm



For easy phone support, mark the motor connections (from left to right) as 1 - 2 - 3 and outputs exactly as in the wiring diagrams.  
Use 450V capacitors for 50Hz.

Recommendations:

50Hz 400V

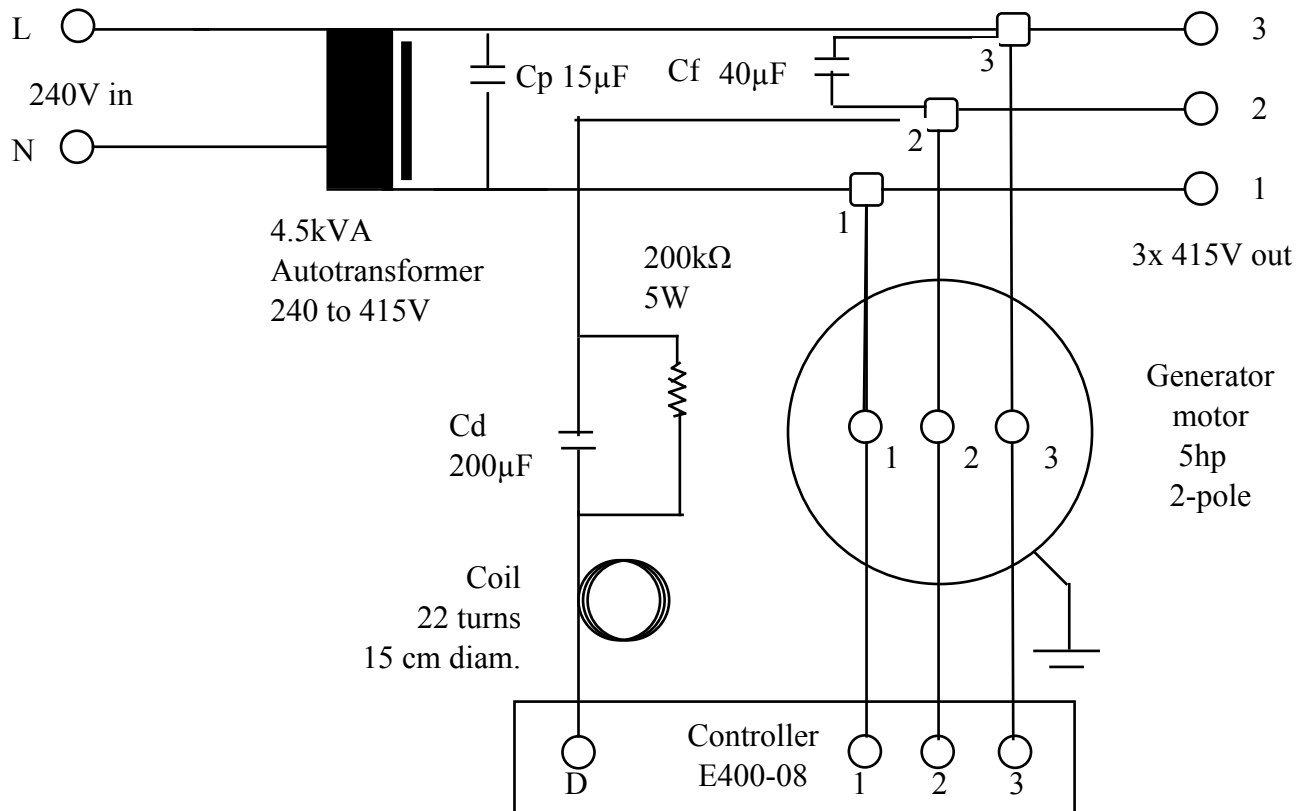
kW	Cd in $\mu$ f	Cf in $\mu$ f
2	100	20
4	200	40
8	400	60
12	600	100
16	800	140

Tuning:

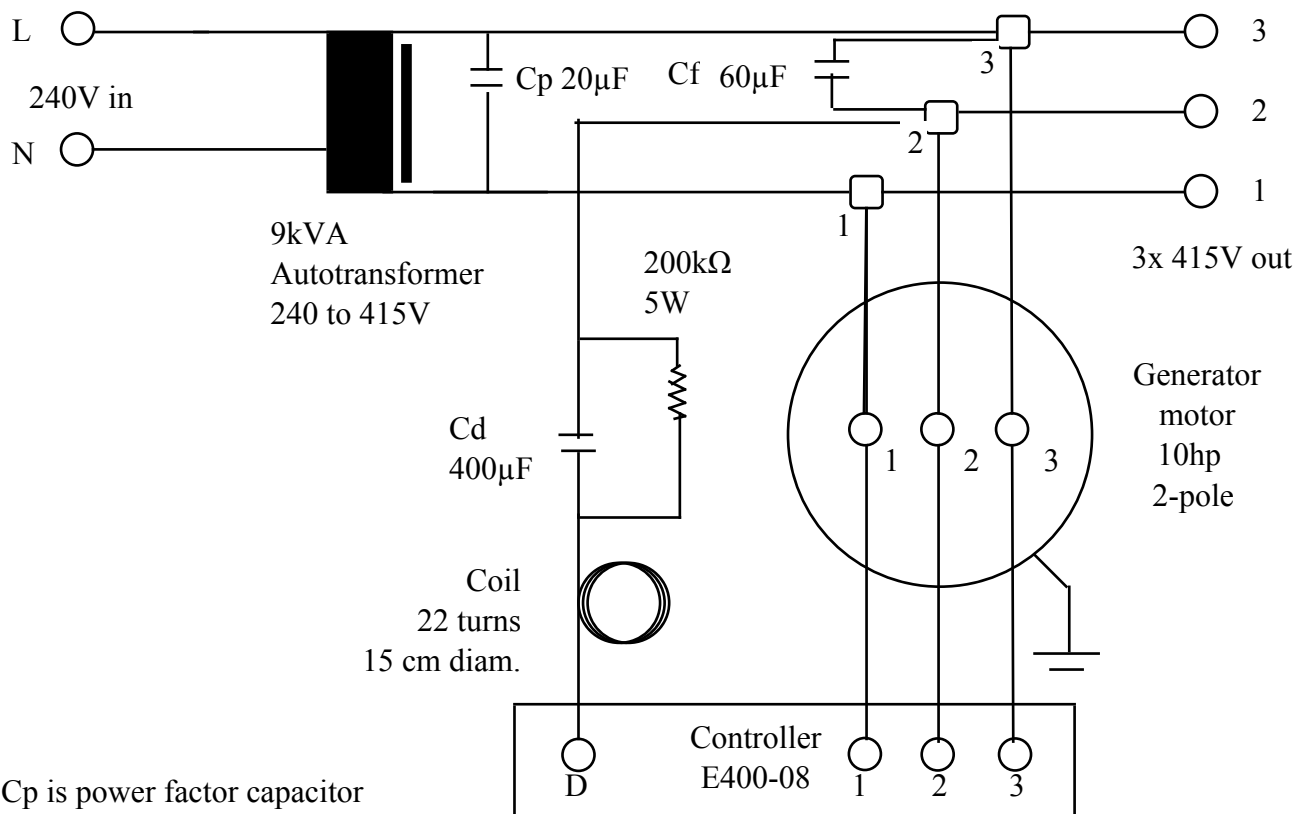
The output voltage symmetry is not electronically controlled as with T and F controllers.  
Select Cf for best output voltage symmetry at about 50% load.  
This may result in 8% overvoltage when idling with a motor the kW size as the converter throughput or about 5% overvoltage with an idler motor twice the size of the throughput.



### 5.5hp 4kW 50Hz converter with E400-08 controller



### 11hp 8kW 50Hz converter with E400-08 controller



$C_p$  is power factor capacitor  
 $C_f$  is run capacitor  
 $C_d$  is start capacitor