

Consult electrical engineer before use.

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Washing Machine Motor Speed Controller



Instructions for use

Contents

Page 2 Disclaimer

Page 3 Introduction

Page 4-6 Bits to salvage

Page 7-8 Drive examples

Page 9 “Green deal kit”

Page 9-12 Joining up the filter

Page 13-15 Joining up the motor

Page 16-17 Variations in tachos

Page 18 Earth bonding

Page 19 Schematic

Page 20 Possible uses

Page 21 Testing recovered electrical items

Page 22 Notes

Notes

Testing recovered electrical items

The most common reason for scrapping a washing machine is due to failure of the program controller, this can cost up to half the cost of a new machine.

However you may be the exception to this and it is as well to check your recovered items so that they do not affect the project.

The motor should be checked for insulation resistance between the windings and the frame which in this application is bonded to ground. This insulation often breaks down due to dampness in the washer. Readings should exceed $10M\Omega$

Check though the mains filter with the low ranges of a multi-meter. Also check the insulation to between each spade and the casing. Again readings should exceed $10M\Omega$ but the capacitor may take some time to charge. This gives a low reading which increases to a steady value.

Disclaimer

No responsibility is taken for any damage or injury caused by the use or miss-use of the speed controller kit. It is up to the user to make sure that all electrical and mechanical work is up to standard. If there is any doubt that skills in electrical and mechanical engineering are not available then the controller should not be purchased.

Introduction

Washing motors were once all synchronous A.C. motors of 1500 rpm but sometimes wound for a higher spin speed. These were often used by enthusiasts to power small machine tools such as lathes and milling machines. Multiple stepped pulleys and gearboxes had to be used to obtain a variety of speeds.

With the advent of the introduction of the commutated electronically controlled motor these speed change complications are a thing of the past.

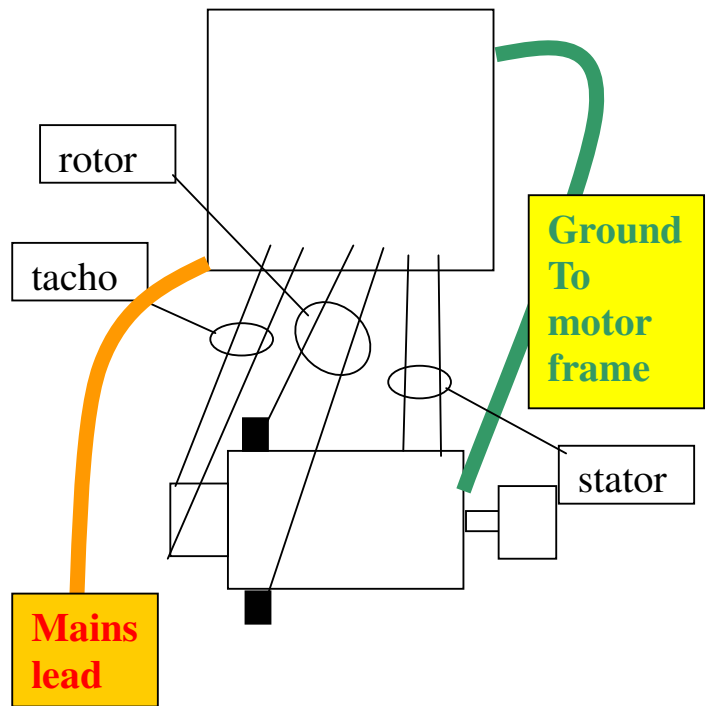
Most washing machines now use these motors and their reuse softens the blow to the male pocket book when the machine has to be replaced. A long neglected lathe may be brought to life by sacrifice of a washing machine. Domestic bliss is assured, she is happy with a gleaming new machine and a new era of metalworking dawns.

The TDA 1085c is the heart of this controller it senses the motor rotation by measuring the frequency of the tachogenerator signal unlike some washing machine boards which measure the rising volt/speed characteristic, this tends to make each manufacturer combination unique. It's a closed loop system so load does not alter the speed as long as the current limit is not exceeded.

Possible uses of the controller

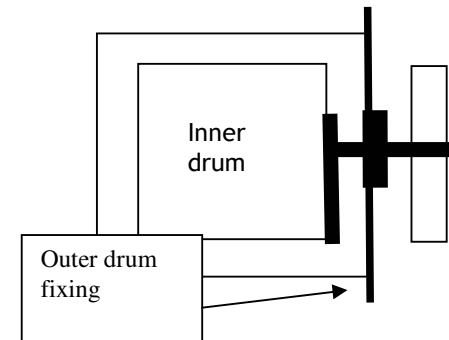
1. mechanical hacksaw
2. variable speed lathe (via drum pulley)
3. direct drive woodturning lathe(off the end of motor)
4. wooden bowl turning lathe (using washing machine spider)
5. cement mixer
6. variable speed fan
7. milling or drilling machine
8. variable speed stirrer or mixer
9. See video at <http://www.calenterprises.co.uk/lathevid.avi>

Schematic



Bits to salvage

Unless you are using the motor for a high speed application (up to 12,000rpm) e.g. miniature lathe, where direct drive is applicable, you will need to reclaim the drum bearings, shaft and large pulley. In most cases this gives a reduction of 11 to 1 and of- course an increase in available torque, just think of the weight of the washing machine full of wet clothes.



The back-plate and bearing assembly must be separated from the outer drum; this is usually held in place with bolts or spring clips. The older machines use a solid aluminum back-plate while the newer ones use a substantial plastic molding.

You will need more mounting holes with a plastic back-plate to spread the load.

Once you have removed the outer drum it's easy to separate the inner drum from the "spider", a three legged support with resilient mounting points.

At this point you will probably notice why the machine has been making so much noise, the aluminum "spiders" frequently rot through allowing the drum to rotate off centre.

The spider may be corroded but it still takes considerable effort to free the bearing and shaft.

This is because it has been cast around the shaft.

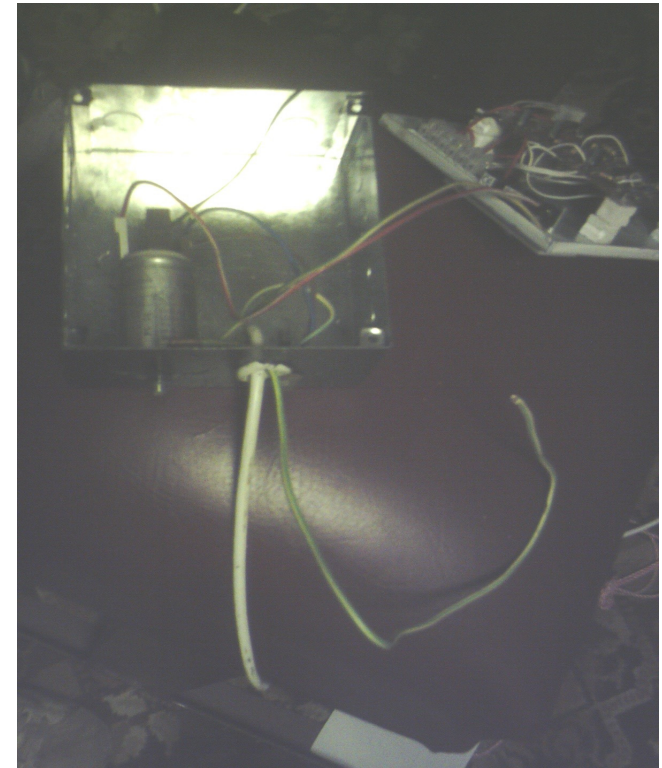
First remove the large nut at the pulley end of the shaft. If you remove the shaft from the back-plate then you can clamp the shaft in the vice and saw around the spider taking care not to damage the shaft (soft vice jaws). A combination of making these cuts and opening them up with a bolster chisel should do the trick but beware of flying bits of aluminum.

Or you may want to keep the spider and use it the turn wooden bowls.

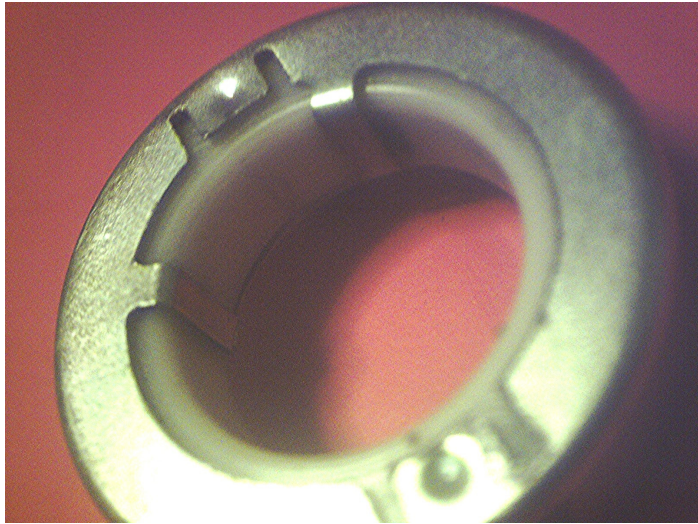
Use the following instructions to also recover some valuable electrical bits.

Earth-bonding

Be sure to connect the green lead provided to the motor frame after the speed controller has been mounted on the machine.



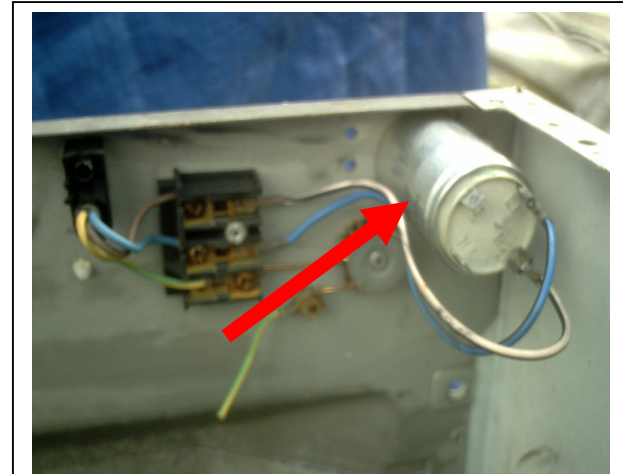
Here is a tacho-coil with 2-poles.



A 4-pole tacho gives a min R.P.M of 300 and a 2-pole tacho gives 600R.P.M

Extrapolating for max speed gives 6000RPM for the 4-pole and 12,000RPM for the 2-pole.

Extra thin iron poles can be soldered on or surplus ones cut-off as required.



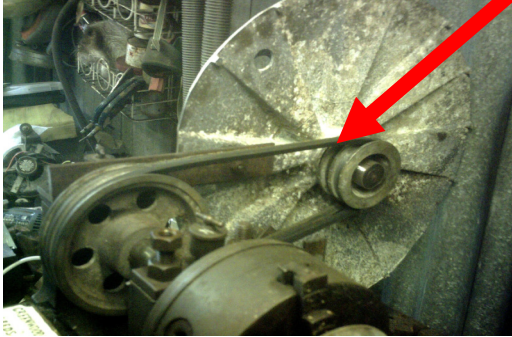
Mains filter in position on washing machine. Salvaging this will save £10

Be sure to remove the motor with 4ft of lead attached.

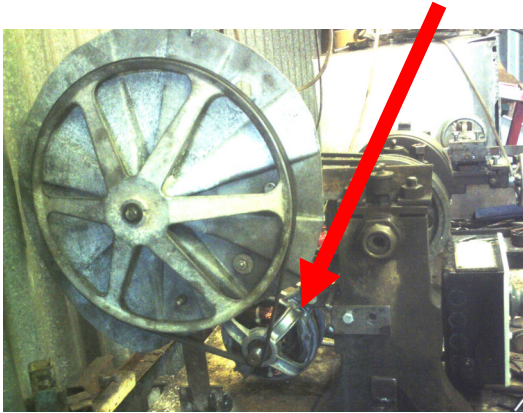


Drive examples

You may want to attach additional pulleys like here my double pulleys give a further reduction of 2:1.



On the other side the motor is low down.



Conveniently site support struts.
Drill bolt holes then elongate to tension belts.

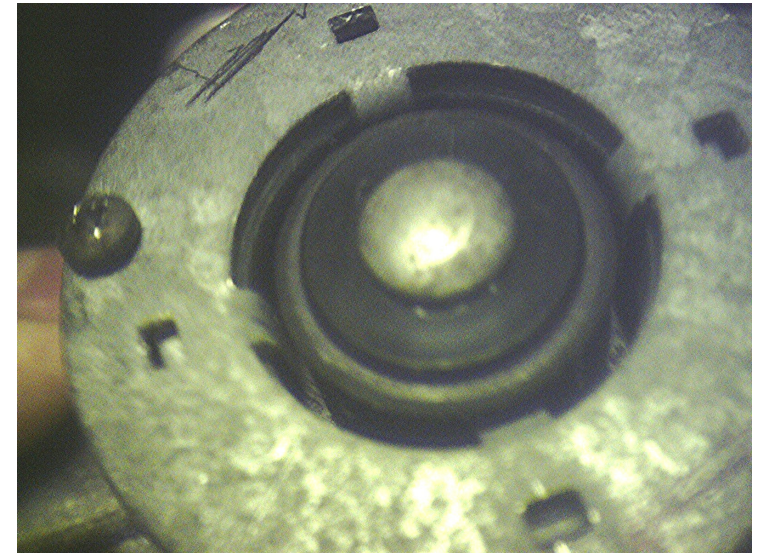
7

Variations in tachos

There are a great number of variations of tacho used with these motors. Different coil resistances give different voltage outputs. The controller is not sensitive to this as it responds to the frequency which is proportional to the speed of rotation.

However the number of pole pieces can affect the frequency /rotation relationship.

A 4-pole tacho-generator.



16

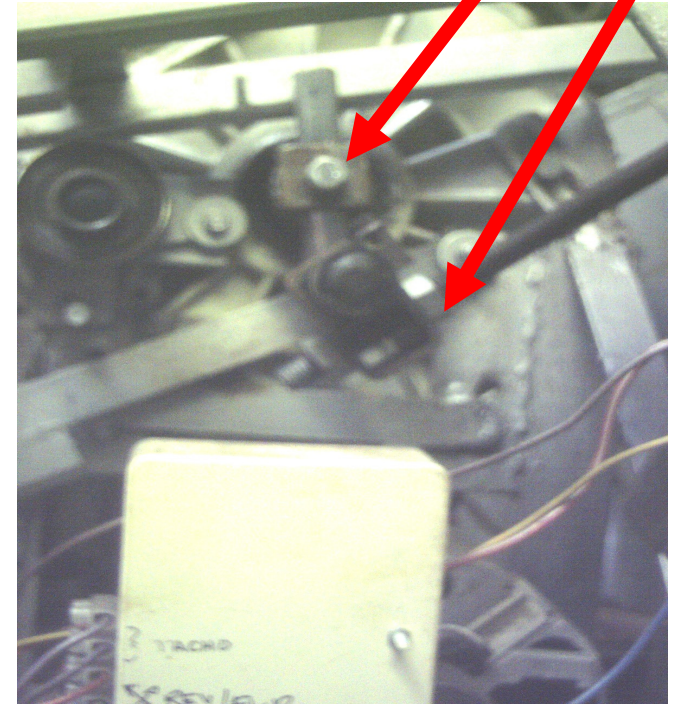
The terminals to connect the pairs of wires are clearly marked.



It does not matter if “WNDG” is connected to either stator or rotor windings as they are connected in series anyway.

If the motor rotates in the opposite direction to that required, then reverse one of these connections.
(How it is done in the washing machine).

Even attach a crank, this one is made from a cycle pedal and operates my power hacksaw. The treaded rod allows adjustment.



“Green deal kit”

For £55 you get the controller kit with completed /tested circuit board mounted in a 6in square box. All you have to do is join 6 wires to the motor and wire in the mains filter supplied. Or you can get the whole lot for £45 if you salvage a mains filter from the same washing machine as the motor (see page 5). The mains filter is a cylindrical item with 4 spade terminals it bolts inside the casing into a pre-drilled hole. It is most important that the copper grounding strip be sandwiched between the filter and the case using the mounting bolt. Also supplied is a heavy grounding wire which should be fastened to the frame of the motor or some metalwork in contact with it.

Joining up the filter

The filter body has a logo telling you about the connections. In this case the input terminals.



Having identified the first two windings any remaining wires must be for the stator. Here there is usually two wires but may be three. Some motors have a tapping for 115v. In this case you will need to determine the windings having the greatest resistance. Label the wires 1, 2 and 3 and take some measurements.

Example

winding	resistance Ω	use for 250v
1 - 2	4.6	no
1 - 3	8.4	yes
2 - 3	2.4	no

The rotor and stator are joined in series just reverse one of them to change the direction of rotation.

Off-course for 115v use the second highest resistance winding may have to be used to ensure enough current flows to achieve the higher speed/load

Joining up the motor

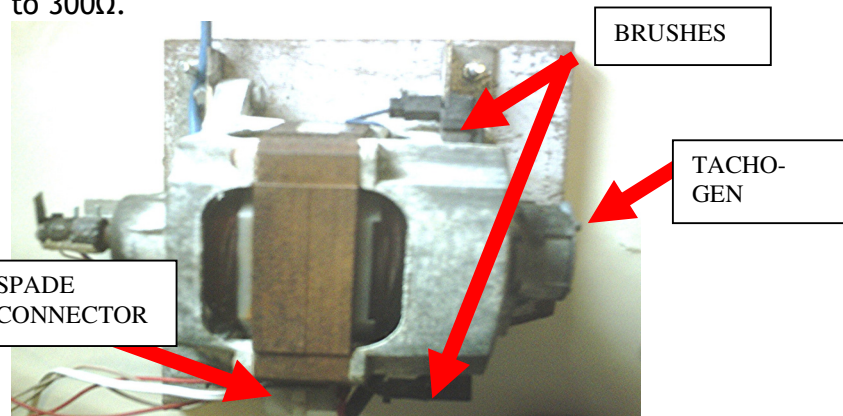
To be able to join up the six motor connections correctly you need to be able to identify-

1. rotor connection
2. tacho-generator connection
3. stator connection

A multi-meter measuring low-resistance is useful to complete these tasks. Conclusions reached can also be verified by tracing the leads.

The rotor connections go through the brushes and thro the windings are generally less than 10Ω resistance.

The tacho-generator has a higher resistance of approx 100Ω to 300Ω .



My test-bed motor with bits identified

13

This logo refers to the four terminals on top.



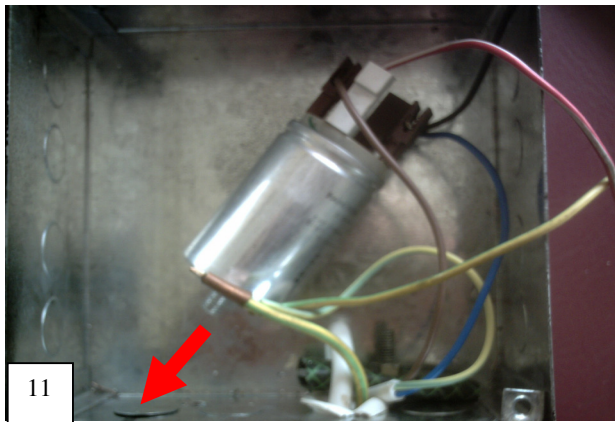
-and you can join the mains lead which comes directly from the 3-pin plug as indicated.
Next we look at the output leads to the control board.



Do the same here and you have linked up the mains supply through the filter so that no interference can get back into the mains.



All that remains is to secure the filter to the casing trapping the grounding lead in between.



11

Finally bolt to the casing.

