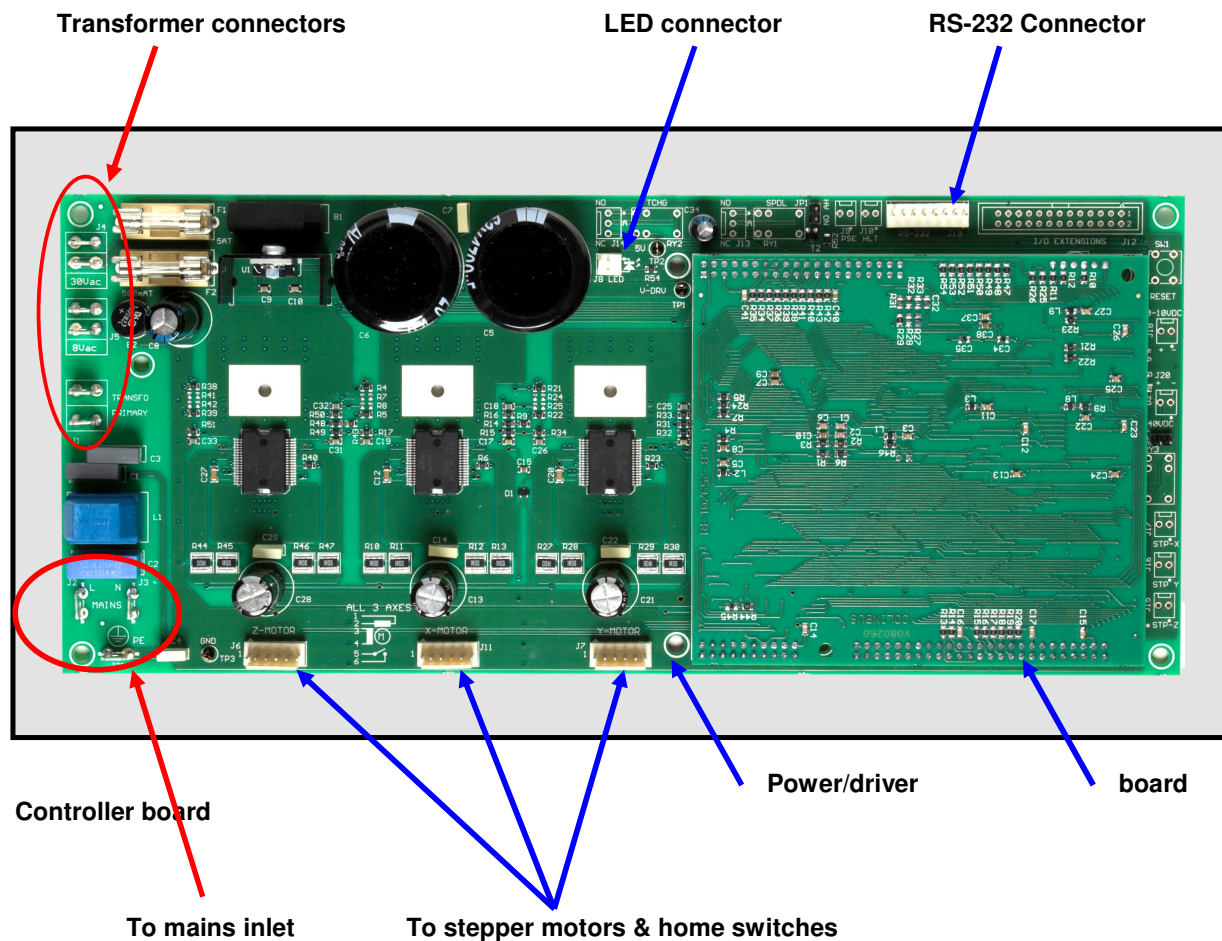


# PROFILER ELECTRONICS

## ASSEMBLY INSTRUCTIONS



### GENERAL OVERVIEW OF THE POWER/DRIVER & CONTROLLER BOARDS

# 1 SCOPE

This document will guide you through the assembly of the electronics system that controls your Profiler, a versatile General Purpose Milling Machine. Please read carefully through this instruction manual before attempting to assemble any of the electronics parts. Failing to do so might result in assembly mistakes that could cause permanent damage to your equipment!

# 2 GENERAL OVERVIEW

The heart of the electronics control system is composed of a main board comprising the power supply and motor drive electronics and a powerful 16/32 bit controller board plugged onto it.

The assembly of the electronics control unit is very straightforward and will be explained step-by-step in this document.

To communicate with the electronics, after assembly, you will need a PC with an RS-232 port (or a USB to RS-232 converter). The serial port needs to be set as follows:

- 8 data bits
- 1 stop bit
- no parity
- No flow control

All communications will be handled by the user software supplied with the Profiler. There is no need for you to do any programming.

# 3 CHECKLIST

Below is a checklist of all the parts needed for assembling the electronics of your Profiler machine. It is recommended that you run through this list and check mark all items before starting assembly.

- ☐ 1 metal enclosure
- ☐ 1 ring core transformer 80VA + mounting kit
- ☐ 1 mains inlet with switch and fuse holder
- ☐ 1 glass fuse 20 mm x 5 mm, 1AT
- ☐ 3 pieces of 0.75mm<sup>2</sup> mains wire (blue, brown or black and green/yellow) with fast-on plugs at both ends
- ☐ 3 short pieces of 0.75mm<sup>2</sup> wire with fast-on plugs at both ends (used on the mains inlet)
- ☐ 1 LED, red, 5mm
- ☐ 1 plastic LED holder
- ☐ 4 female DB-9 connectors with fixing screws and nuts
- ☐ 1 plug, 2-way, with 30 cm wires pre-attached to it
- ☐ 3 plugs, 6-way with 30 cm wires pre-attached to it
- ☐ 1 plug, 8-way, with 30 cm wires pre-attached to it
- ☐ 1 set power/driver board with controller board plugged onto it
- ☐ 7 plastic PCB supports

The above material is intended for the electronics system unit. There are additional items that you will need to connect the motors, i.e.:

- ☐ 3 male DB-9 connectors with matching plastic cap
- ☐ flexible cable with 6 stranded conductors
- ☐ flexible tubing for routing the cables
- ☐ 3 micro-switches to be mounted near the motors (so called homing switches)

## 4 ASSEMBLY INSTRUCTIONS

### 4.1 Wiring diagram

An overall wiring diagram of the electronics unit is also supplied with this construction kit. (See file Profiler\_Wiring\_Diagram\_Rev1.pdf) Please use this drawing in conjunction with the instructions listed below in case of doubt.

### 4.2 Cable assemblies

Start with preparing the various cables. Make 3 sets of cables using the 6-way plugs and the female DB-9 connectors. Refer to figure 1 for the electrical connection diagram.

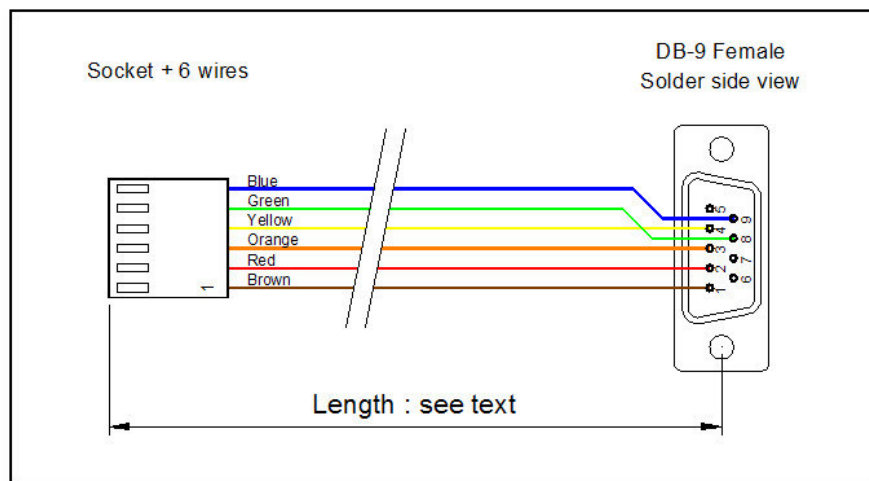


Figure 1

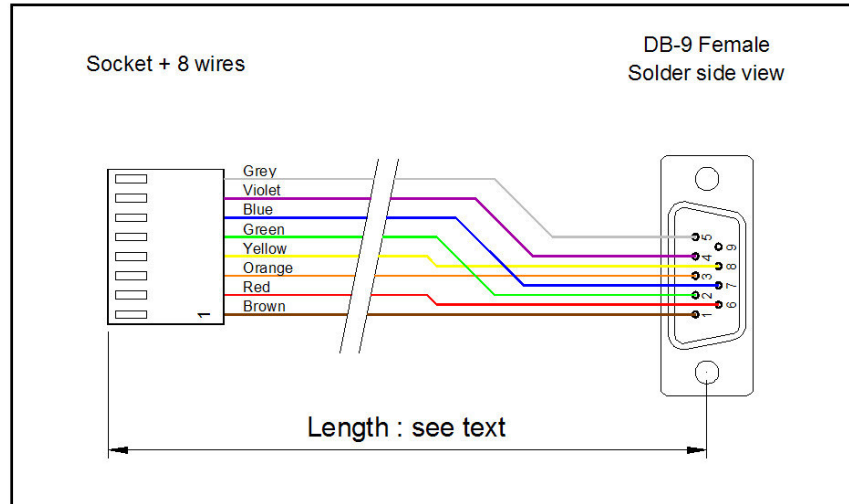
- The length of the 3 cables may be left as supplied or cut to minimize excessive wire loops. In the latter case, make sure to check the wire routing before cutting them!
- Solder the wires to the female DB-9 connectors as shown in figure 1
- Pass the 6-way plastic socket through the mounting holes of the DB-9 connectors and fix the connectors to the enclosure as shown on the overall wiring diagram.

Next, make the cable for the RS-232 interface using the fourth female DB-9 connector and the 8-way socket with pre-attached wires. Be very careful to respect the interconnection sequence of the wires and the DB-9 connector as shown in figure 2 and on the overall wiring diagram. A mistake in these connections will not only make communications with your PC impossible but might even damage your PC's serial port and/or the Profiler electronics!

It is recommended to shorten the wires prior to soldering them to the DB-9 connector to avoid excessive wire loops inside the electronics enclosure.

To do this, plug the 8-way socket onto the header (J19), place the electronics board in the enclosure and align it with its mounting holes. Now hold the DB-9 connector in its mounting hole and check how much the wires need to be shortened to avoid excessive wire loops. Do not cut them too short, the wires should not be too tight!

Once soldered, mount the DB-9 to the enclosure in the same way as the other 3. You may need to pass the 8-way socket sideways through the hole in the enclosure.



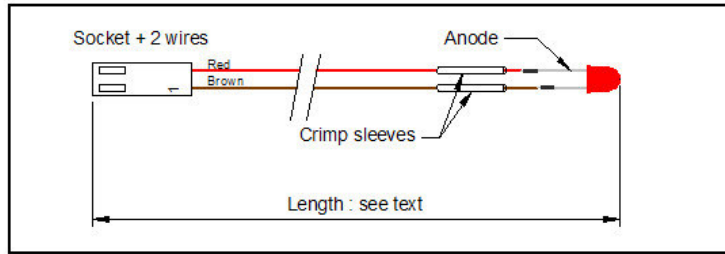
**Figure 2**

### 4.3 Mounting the boards

- Plug the 7 plastic PCB supports into the holes provided in the bottom of the enclosure.
- Carefully press the board onto the supports until it locks in place (keep the wires and sockets out of the way by taping them temporarily to the enclosure).
- Once the board is fixed in place, press the sockets for the motors & home switches onto the corresponding headers making sure to respect the sequence shown in the overall wiring diagram.
- Press the 8-way socket onto its header.

### 4.4 LED Mounting

- Mount the plastic holder and secure it with the fixing ring.
- Mount the red LED onto the side of the enclosure by means of the plastic holder. Make sure both LED wires are in a horizontal plane, this will make soldering easier.
- Fix the LED holder in place with a bit of silicone glue and let it set.
- Once the glue has set and the LED is firmly held in place, cut the longest lead (the anode) to approximately 12 mm and the other to approximately 10 mm length. Do NOT cut them to the same length or you will not be able to identify the anode anymore!
- Press the 2-way header onto its socket (labeled LED), check the required wire length to solder them to the LED and cut them accordingly.
- Place a piece of heat shrink tube over each wire.
- Strip the wires, tin them and solder them to the LED as shown in figure 3 (red = anode).
- Move the heat shrink tube over the solder joints and shrink them in place.



**Figure 3**

## 4.5 Transformer Mounting

- Press the transformer mounting bolt through the plastic support (you may need to enlarge the hole in the plastic part).
- Pass the bolt through the hole in the enclosure.
- Place one of the rubber mats over the bolt and let it rest on the bottom of the enclosure.
- Place the transformer over the bolt, center it and rotate it till the various wires are in the ideal position to connect to the power/driver board.
- Place the second rubber mat and the metal plate over the bolt; press them onto the top side of the transformer.
- Put the nut on the bolt and tighten it to fix the transformer in place.
- Connect the transformer primary and secondary windings to the matching fast-on tabs on the power/driver board. In case of doubt, double check on the overall wiring diagram.

## 4.6 Mains Inlet

- Place the 1AT fuse in the holder of the mains inlet.
- Place 3 wire bridges on the back of the mains inlet as shown on the wiring diagram.
- Connect the 3 mains wires with fast-ons to the remaining tabs as shown on the wiring diagram. Obviously the green/yellow one has to be used for the earth connection.
- Now press the mains inlet in the cut-out provided for it on the enclosure's side wall.
- Connect the mains inlet wires to the fast-on tabs on the power/driver board.
- Connect the free end of the earth wire to the tab provided on the metal enclosure itself.

## 4.7 Final Check

Before closing the enclosure, double check all connections with the overall wiring diagram.

When done, close the electronics housing. It is now ready for mounting into the Profiler.

The last section of this document describes how the stepper motors and the home switches have to be connected to the driving electronics. Please read carefully through section 5 before attempting to connect any motor and/or switch to the driving electronics.

## 5 CONNECTING MOTORS & SWITCHES

Each axis of the profiler is driven by a stepper motor and has a so called “home position”. This is the position that corresponds with the axis mechanical end-of-travel position in negative direction, i.e. the axis absolute origin. Moving an axis in negative direction until it reaches its origin is called “homing”.

During homing, detection of home position is done with a micro-switch that will be actuated when the mechanical origin is reached. Because the motor has to stop instantly as soon as the switch is hit, homing is done at a rather low speed.

At start up, the controller will first of all home the Z-axis. This is the highest point since the positive direction for the Z-axis is downwards. When done, the other 2 axes will also be moved to their respective home positions.

Each axis requires a 6 wires connection with the electronics, i.e. 4 wires for the stepper motor and 2 for the micro-switch. The micro-switches are mounted near the stepper motor and their NC (normally Closed) contacts are used to detect the home position.

The stepper motors used on the Profiler have 6 wires but only 4 of them are used. The remaining 2 are left unconnected but make sure they don't touch any metal parts. Therefore we recommend you shorten them to about 2 cm and isolate the ends individually with tape or heat shrink tube.

The X and Y motors are connected in the same way but on the Z-motor one of the winding connections need to be inverted. The correct wirings are shown in fig. 4 for X & Y and fig. 5 for Z.

Both figures do not show any color codes for the wiring from the motor/micro-switch to the male DB-9 connector as the choice of colors is not really important. What counts is that the motor wires are connected to the DB-9 according the wiring diagram shown in figures 4 & 5.

In some cases the stepper motors delivered will have only 4 wires. Please see which applies in your case from the pictures down bellow. (Note: connecting principle is the same, however only the color code is different).

For the six lead motors the figures that apply are 4 & 5.  
For the four lead motors the figures that apply are 6 & 7.

In both cases when connecting the Z axis motor one motor winding connection has to be inverted.

# CONFIGURATION 1

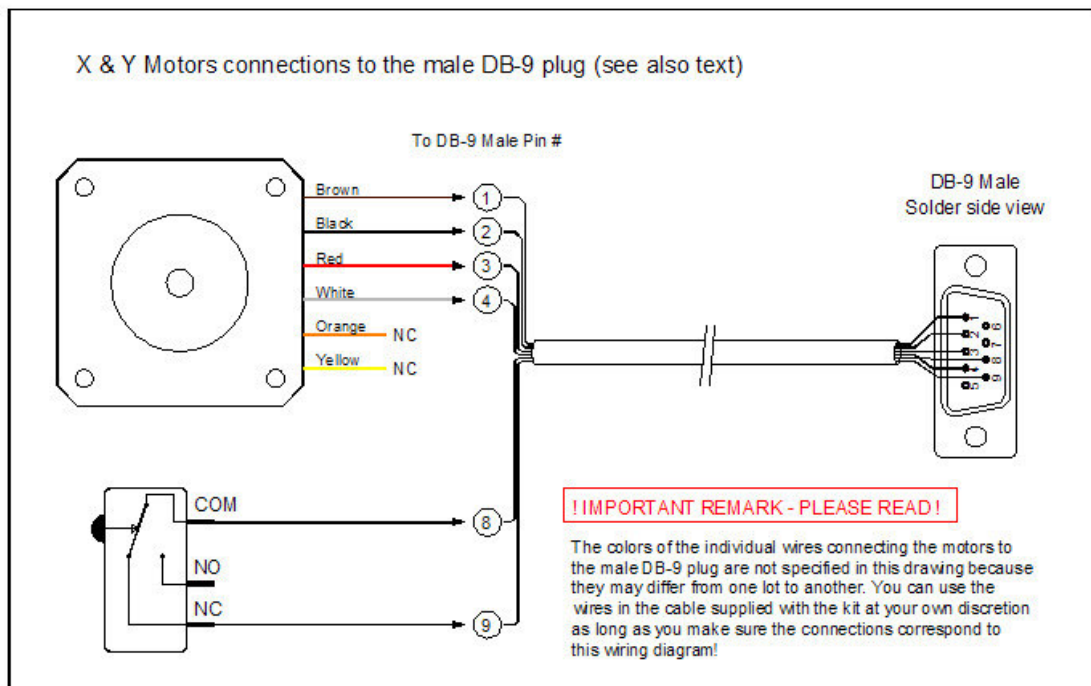


Figure 4

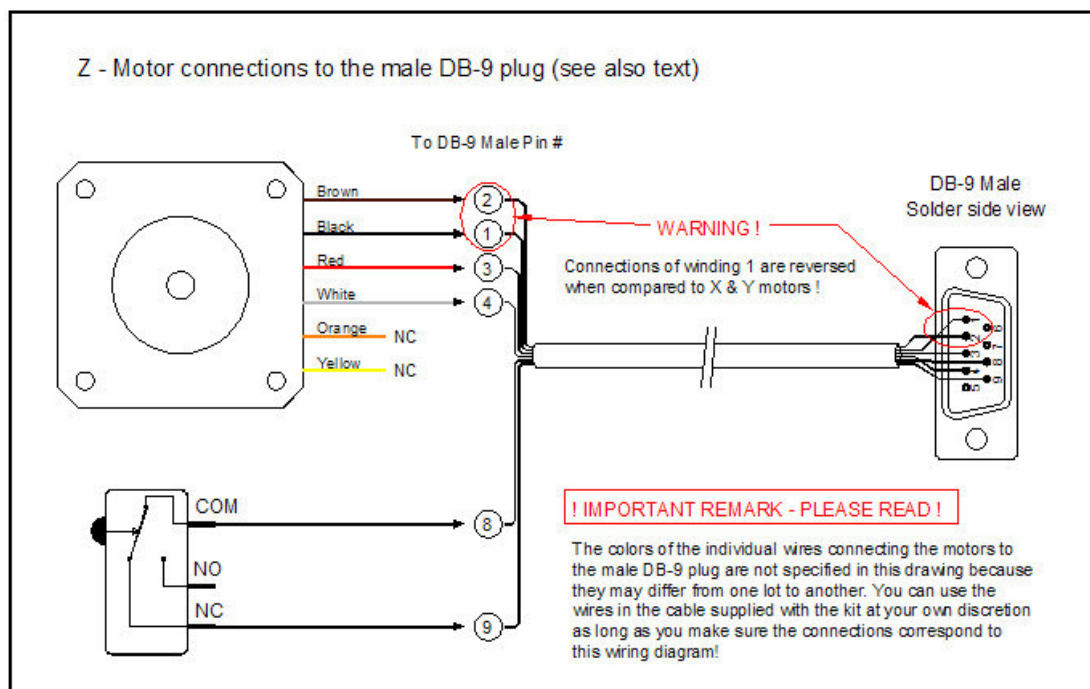


Figure 5



## CONFIGURATION 2

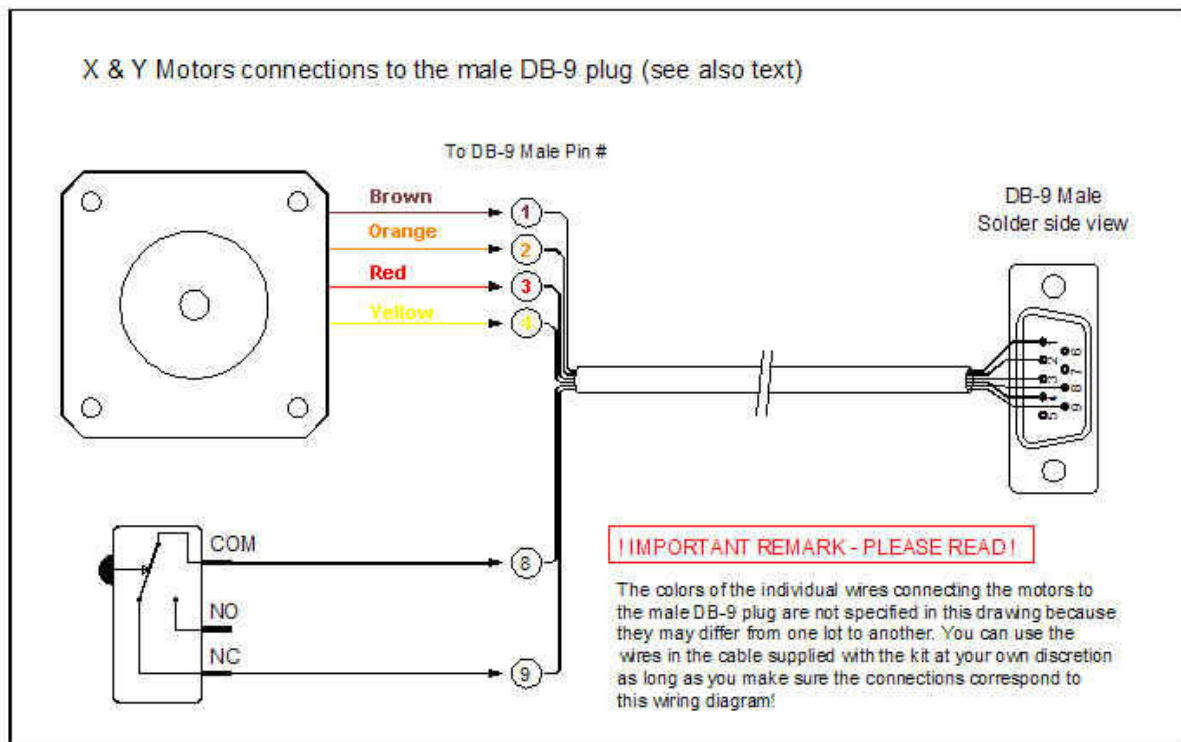


Figure 6

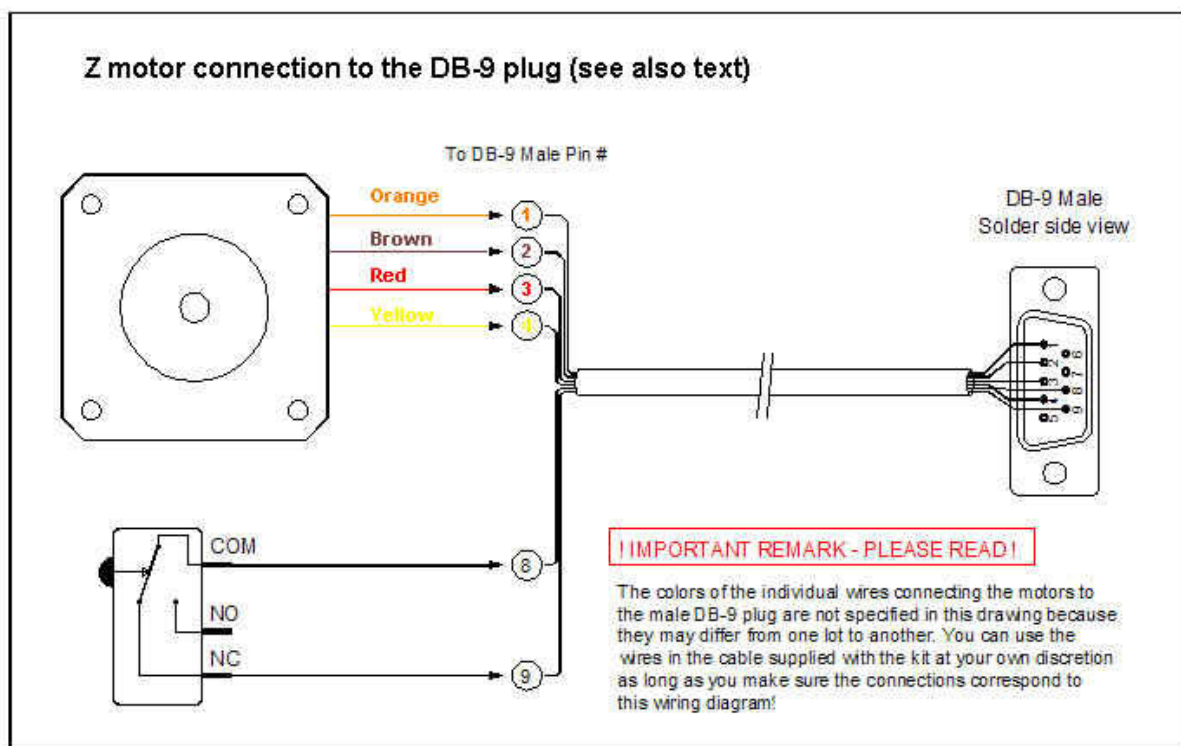


Figure 7



## 6 TESTING

To test the electronics the box does not have to be mounted in the machine. You may leave it aside before the final mounting.

**Hint:** *Don't place the DB-9 covers before you have tested the electronics and motor connection. Do this after you're sure that all is properly connected. (To see how to make the tests, see here below).*

When building the machine, make sure the moving parts of each axis are more or less in the middle of their travel range. This will allow them to move in either direction at first power up. When you have finished building the machine and the electronics unit, proceed with the testing of the electronics:

### Test 1:

Connect Z-axis only and switch the power on.

If the Z-axis moves upwards, its connections are OK. Switch the power off and go to test 2.

*If the Z-axis moves downward or doesn't move at all, correct the wiring and try again.*

**Hint:** *If the Z-axis moves downwards you have to swap the connection of the Z motor winding. If the Z-axis doesn't move at all check the wiring diagram.*

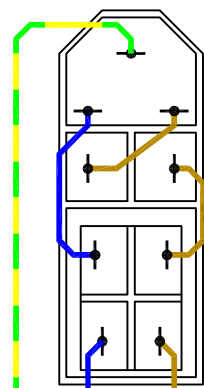
### Test 2:

Now connect all 3 axes to the electronics and switch the power on. The Z-axis will start homing. Wait until it's done and then check if the Y-axis starts to move towards its home position.

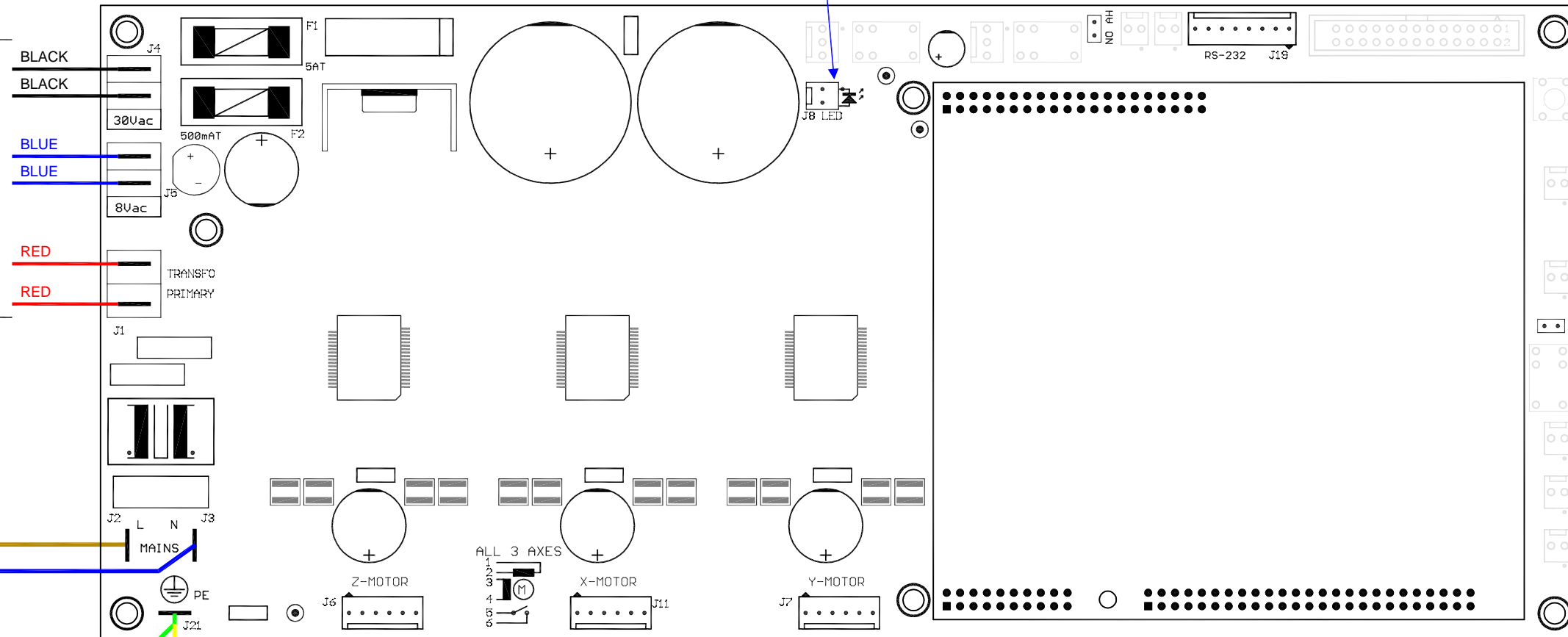
- *If not, switch off the machine, check and correct the Y-motor wiring and try again.*
- *If so, wait until the Y-axis hits its home position and check that next the X-motor starts to move towards its home position.*
- *If not, switch off the machine, check and correct the X-axis wiring and try again.*
- *If so, wait until X-homing is completed.*

<b>CONGRATULATIONS! YOUR PROFILER IS NOW READY FOR USE!</b>
---

# MAINS INLET (REAR VIEW)



TO TRANSFORMER

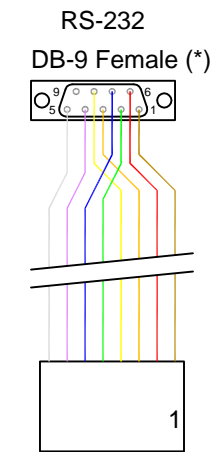


ENCLOSURE EARTHING TAB

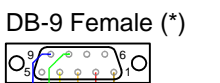
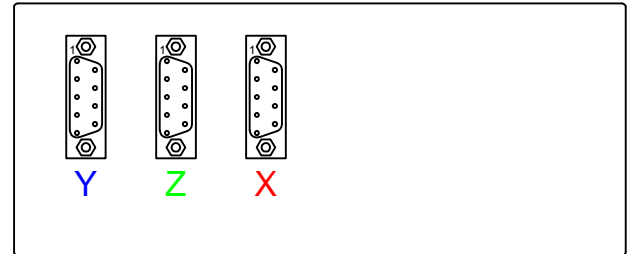
PROFILER ELECTRONICS

WIRING DIAGRAM - REV. 1 - FEB. 2007

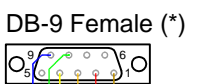
J19	DB-9
1 Brown	1
2 Red	6
3 Orange	3
4 Yellow	8
5 Green	2
6 Blue	7
7 Violet	4
8 Grey	5



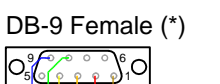
Mounting of DB-9 connectors for the 3 motors  
(as viewed from outside of enclosure)



"X"



"Z"



"Y"

PCB TO MOTOR DB-9 CONNECTORS		
PCB HEADER	PCB HEADER	SIGNAL DESCRIPTION
1	1	A : Motor winding 1, pin #1
2	2	B : Motor winding 1, pin #2
3	3	C : Motor winding 2, pin #1
4	4	D : Motor winding 2, pin #2
5	8	Home switch pin #1
6	9	Home switch pin #2

(\*) All DB-9 connectors are female and shown as viewed from their solder side !