Foam PRO Rev1 Driver Board Kit

Thank you for purchasing our Foam PRO Rev1 kit. The following information and the step-by-step instructions will assure complete success and satisfaction. Please read through the following before beginning any construction to get familiarized with the process. NOTE: Machinery driven with this device can and will start without warning and may cause injury or even death. The builder of this device assumes sole responsibility for its use! IF YOU DO NOT AGREE WITH THIS RETURN THE KIT FOR FULL REFUND, LESS SHIPPING AND HANDLING FEE, BEFORE STARTING ASSEMBLY.

Specifications:

4 Axis Unipolar control. Individual OR simultaneous control of 2/4 Phase Stepper Motors.
5, 6, or 8 wire stepper motors. 4 wire (bipolar) types are not usable.
12-34 VDC input voltage. We HIGHLY recommend 12-14VDC.
500ma to 2 Amps per Phase Continuous. Individually adjustable throughout this range.
Full and Half Step mode.
PAT PEND Chip Protection helps against open or shorted motor coils blowing the driver chip.
Step and Direction Control.
Power On Reset.
On board voltage regulation for 5-volt logic and 12VDC cooling fan from motor power supply.
Auto heat and timer function on board via pre-programmed PIC microchip (software dependant)
Minimum of components to make assembly fast and easy.

Tools Required For Assembly:

15-25 Watt soldering pencil
1/32" diameter rosin or water soluble core solder
Side cutters
Pliers
Voltmeter

Construction Step by Step:

1. Insert the (13) 10K (R1-R13 Brown Black Black Red Brown) resistors. I ALWAYS measure the resistance on each resistor before installing to make sure I have NOT made a mistake. Simply bend the leads over to fit the PCB holes (.400" spacing typical) and solder in. Trim the leads.

2. Install R14 (2.15K Red Brown Green Brown Brown) for a 12VDC fan.
   Trim the leads. A fan and heat sink is **not** required at 1.25A or less steppers.

3. The (3) 4.7K (R15, R16, R17 Yellow Violet Red Gold) resistors go in now. Simply bend the leads over to fit the PCB holes and solder in. Trim the leads.

4. The (2) 1K (R18, R19 Brown Black Red Gold) resistors go in now. Simply bend the leads over to fit the PCB holes and solder in. Trim the leads.

5. The 150 (R20 Brown Green Brown Gold) resistor goes in now. Trim the leads.

6. The 10 (R21 Brown Black Black Gold) resistor goes in now. Trim the leads.

7. The 510 (R22 Green Brown Brown Gold) resistor goes in now. Trim the leads.

8. The 100 (R23 Brown Black Brown Gold) resistor goes in now. Trim the leads.

9. The 1.74K (R24 Brown Violet Yellow Brown Brown) resistor goes in now. Trim the leads.

10. Install (1) 750 (R25 Violet Green Black Black Brown) resistor next. Trim the leads.

11. Next are the (3) 249 (R26, R27, R28 Red Yellow White Black Brown) resistors. Solder in place and trim the leads.

12. Install MBR1100 (D1) diode. **Orient** the band as shown on the PCB silkscreen. Trim the leads.

13. Install (7) .1uF (C1-C7) Capacitors. These have NO orientation. Just put 'em in and solder. Trim the leads.

14. Install the (1) 10K resistor network next (RN1). It has a little white dot on it. **Orient** the dot as shown on the PCB silkscreen by a white dot. Be careful! DOUBLE CHECK BEFORE SOLDERING!

15. Install the TC4426EPA Mosfet Driver (U9) now. **Orient** the notch in the side as shown on the PCB silkscreen.

16. Install the 8 pin **socket** for U7 now. **Orient** the notch in the side as shown on the PCB silkscreen.

17. Solder the Opto Isolator H11L1 (U8) in place Look for a tiny dot on it and **orient** it towards the big white dot on the PCB silkscreen.

18. The Transistor 2N3904 (Q2) installs now. **Orient** the flat as shown on the PCB silkscreen. Spread the leads apart a little to ease installation. Do not confuse with Q3! Trim the leads.

19. The LM317L (Q3) installs now. **Orient** the flat as shown on the PCB silkscreen. Spread the leads apart a little to ease installation. Do not confuse with Q2! Trim the leads.

20. Install (4) Potentiometers (VR1, VR2, VR3, VR4) now.

21. (4) Capacitors 10uF (C8, C9, C10, C11) solder in now. **Orient** the longest lead into the hole marked "+". The body has "-" marked on it to help identify the proper orientation. Trim the leads.

22. Install 4.7uF (C14) Tantalum Capacitor. **Orient** the long lead thru the hole marked "+". IMPORTANT!

23. Install the red LED (LED). **Orient** the longest leg in the hole marked "+". Trim the leads. NOTE: This can be mounted to the case panel with wires extending to the PCB. Your option!

24. Install the (4) 1 X 2 header pins (J1,J2,J3,J4) now. The short legs are soldered into the PCB. Install the shunts before soldering. **Shunt on is full step mode, shunt off is half step mode.**

25. Install the 13 pin header (H1). No orientation is required.

26. Install the .1uF 160WVDC (C13 blue and rectangular) now. No orientation is required. Trim the leads.

27. The DB25 PCB (P1) connector solders in now. Take your time here. MANY pins close together! Solder the 2 mounting tabs to the PCB for durability.

28. Install the 6 pin terminal blocks (TB1, TB2, TB3, TB4). **Orient** the wire holes facing "out". Some traces are wide and will require a bit more heat to flow the solder.

29. Install the 4 pin terminal block (TB7). **Orient** the wire holes facing "out". Traces are wide and will require a bit more heat to flow the solder.

30. Install the 2 pin terminal blocks (TB5, TB6). **Orient** the wire holes facing "out". TB5 will require an extra moment or two to allow good solder flow as a lot of copper trace needs to be heated.

31. The 100uF (C12) Electrolytic Capacitor gets soldered in next. NOTE **orientation**! The PCB silkscreen shows a + sign yet the component identifies the – lead. Just be careful. Install the "minus" lead in the hole NOT identified as +. Trim the leads. This stores a lot of electricity! **MUST** wait for it to discharge completely before connecting/disconnecting any wires and soldering in U1-U4.

32. Solder in the Mosfet IRL540 (Q1) **Orient** the tab as shown on the PCB silkscreen. Do not confuse with U5, U6! Trim the leads. A heat sink is not required for normal use.

33. Now install the LM317 (U5, U6) regulators. **Orient** the Tab per the PCB silkscreen. Trim the leads.

34. The 680uF (C15, C16) Electrolytic Capacitors gets soldered in next. NOTE **orientation**! The PCB silkscreen shows a + sign yet the component identifies the – lead. Just be careful. Install the "minus" lead in the hole NOT identified as +. Trim the leads. This stores a lot of electricity! **MUST** wait for it to discharge completely before connecting/disconnecting any wires and soldering in U1-U4.

This completes the basic construction. DO NOT INSTALL U1,U2,U3,and U4 UNTIL THE FOLLOWING TEST IS MADE! To make sure no errors were made, apply at least 9VDC BUT less than 34VDC to TB5 labeled + and -. With a voltmeter verify that +5.0VDC to 5.2VDC is present at the pad labeled +5VDC. The black test lead touches the "-" on TB5. If not, review all steps, in particular steps #10, 11, and 33, and correct them. Failure to insure that +5.0VDC-+5.2VDC is present will BLOW the driver chips! OUCH!

35. Install (4) 23 pin Driver Chips (U1,U2,U3,U4) only after the above test is successful. **Orient** the metal tab away from the 6 position connectors (TB1-4). Some pads are large and need a few seconds to allow for proper solder flow. Trim the leads.

36. Install the pre-programmed PIC (U7) with the dot **oriented** towards the notch in the silkscreen. No heat sink is required.

37. Solder the auto/manual, heat control ON/OFF, and manual heat control adjust switches to their proper plugs in accordance to the wiring diagram provided after trimming the leads to an appropriate length. Use 3/32" Dia X 7/16" Lg heat shrink tubing on all of these connections. Use minimal heat to solder!

38. Clean the PCB with alcohol or a flux remover and inspect all solder connections with a MAGNYFING glass to assure against any solder bridges. These will cause ALMOST ALL failures!

Interfacing With the Printer Port

This section explains the connections the driver board makes to your computers parallel port. This is where the printer plugs into. The pinouts cannot be changed. These are as follows:

Pin	**Function**
2	LY direction
3	LY step
4	LX direction
5	LX step
6	RY direction
7	RY step
8	RX direction
9	RX step
10	timer
11	heat feedback
12	auto/manual heat control
13, 14, 15, 17	pads provided for convenience. No connections to these are required
16	heat
18-25	ground

all others are not connected.
The above currently work with Gilles Muller software.
Refer to your software for your specific requirements.
Be sure to use a DB25M to DB25F ALL lines wired straight thru parallel port cable.

Current Adjustment MOST IMPORTANT!

The stepper motor current **MUST be adjusted before connecting any steppers** to the driver board. Each axis can be adjusted to a different value. Current MUST be 600ma up to 2A per coil. With power applied to TB5 (12VDC min, 36VDC max) use a voltmeter with the black lead connected to TB5 terminal "minus" and the red lead touching the axis pad labeled "TP" below VR1, VR2, VR3, VR4. Clockwise movement increases the voltage, counter clockwise decreases the voltage. The following voltage MUST be set to achieve the correct amperage:
600ma = .103VDC
1A= .19VDC
1.5A= .285VDC
2A= .38VDC
For any amperage not shown use the following formula: desired amps times .19 equals Vref.

Use OHMS Law to determine any missing values you may have. These formulas may help:
"Volts divided by Ohms equals Amps"
"Volts divided by Amps equals Ohms"
"Ohms times Amps equals Volts"

HOT TIP!…. Adjust the Vref to **ONLY 70% of the required value** to keep almost ALL of the heat from the stepper motor! For example, a 1A stepper will normally be set to .19 volts. Try setting it to .133 volts (70% of .19 volts). You'll hardly notice the slight loss of power and really notice the lack of heat in the stepper motor after a long period of time. TRY IT! A fan and heat sink should be used at 1.25A or more. No need to isolate the driver chips when using a 1pc heat sink. Use heat sink compound to help with heat transfer.

Stepper Motor Hookup

This driver board will accept 5, 6 and 8 wire stepper motors rated at 500ma to 2A per coil. Over 1.25A per coil we recommend a heat sink and fan cooling. (4) wire BIPLOAR motors are not usable! The PCB silkscreen identifies which coil connects where. The coil commons connect to the 2 positions labeled "COM". Leads from "A" and "a" coil connect to positions labeled so. Likewise for "B" and "b". Simply reverse "A" for "a" and "a" for "A" connections to reverse the stepper motor direction. Most software allows for direction reversing. "Ballast" resistors are NOT required. Stepper motor leads should be kept as short as possible. 22ga stranded cabling will be fine for most applications. Never connect or disconnect any wiring with ANY voltage present as this will ensure blown driver chips! Measure for under .1VDC at TB5 before making any connections or disconnections. Be very careful when tightening the terminal screws so as NOT to twist the terminal block. This MAY cause the soldered pins to fracture causing intermittent operation.

Heat Control and Acquisition

The pre-programmed PIC (U7) controls the bow heat. It also handles the timer duties. The bow power supply must deliver DIRECT CURRENT to TB7 labeled BOW POWER. Keep this voltage below 35VDC. Above this and danger of electrocution is present. Polarity is required! The cutting bow connects to TB7 labeled "TO BOW". These connectors are not supplied. Most applications will be fine with 24-30VDC and up to 6-8 Amps. I suggest a DC power plug for the input. The bow out is non-polarized and banana plugs can be used. Please note that the heat control switch should be in the OFF position during boot up. Under Table Configuration, be sure to have "hardware interface with heat acquisition" checked. Under Foam Management "computer controlled heat" must also be checked.

To verify that the auto heat is working properly (GMFC software only) do the following tests in order: **No power to the bow during these tests.**

1. Open "TIMER TUNING" A value of 240-255 (4Khz timer) or 120-126 (8Khz timer) should be displayed. No adjustment is possible or required. Enter this value under "Table Configuration".
2. Open "ZERO AXIS". With the heat switch on, and auto/man in auto, click "TEST" in the Heat section. The LED should glow for the duration of the test.
3. Repeat step #2 with 30% heat instead of 80%. The LED should be dimmer.
4. Switch over to "Manual" and click test. The LED should be dim and the value displayed on the lower right hand portion of the screen should be @5%.
5. Repeat Step #4 and push the UP button to increase the heat value. The LED should get brighter along with a displayed increase in heat "percent".
6. Repeat step #5 and push the DN button to decrease the heat value displayed. The LED should dim.

NOTE: **The LED will not go out between tests when in manual mode, and the wire will be hot!** If all of the above tests check out then connect the bow heat and repeat the tests. BE CAREFUL!!! The wire will get hot!

Lastly, you'll need to establish the proper heat for each material, wire type, and length you have with trial cuts and a lot of experimentation. We cannot suggest any values as no single machine is the same as another. These values will be entered in "Foam Management"

CAUTON: NEVER connect or disconnect the stepper motors with power applied. This may blow the IC's! Be sure NO voltage is present at TB5 before connecting or disconnecting the stepper motors. Wait a few minutes! **Steppers will get warm**. Also the chopper frequency may be heard in the steppers. This is normal.

We welcome your comments and suggestions. All customer support is handled thru our Yahoo support group. A link is provided on the home page of our website. Just a brief sentence as to who you are and what you purchased in the comment field is required. Please join and share the experience!

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