SeeMeCNC™

H-1

Electronics Manual
for
3-Axis Parallel Board with EasyDriver

Authors:
Michael Hackney
Steve Wygant
John Oly

These instructions are available free of charge on http://seemecnc.org/assembly

SeeMeCNC ~ 65695 U.S. Highway 33 ~ Goshen, Indiana 46526

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The SeeMeCNC™ H-1 is a functional 3D printer and not a toy. It is important to read and understand the following safety information before building and operating the machine. **USE AT YOUR OWN RISK.**

CAUTION: **RISK OF FIRE AND ELECTRICAL SHOCK.** You do not need to modify any electronics inside the 12 volt power supply. Never work on your machine or its electronics with the power supply connected to the line voltage (120VAC or 240VAC line voltage). Pay particular attention to short circuits. A short circuit can cause damage, fire, or unexpected motion of the CNC machinery. Under no circumstance should you experiment or change anything electrically if you are unfamiliar with what you are doing. Only YOU know if you are capable of performing the electrical work required to build and operate your machine.

CAUTION: **IT IS RECOMMENDED TO INSTALL AN EMERGENCY STOP SWITCH** (not included) to quickly shut down the machine in an emergency.

CAUTION: **THIS MACHINE IS NOT A TOY. USE THIS PRODUCT AT YOUR OWN RISK.** You are responsible for injury or property damage resulting from use of this product.

CAUTION: **THE MACHINE OPERATOR AND ALL OBSERVERS MUST WEAR Z87 RATED EYE PROTECTION.** Children under 18 years of age must be supervised by adult. This machine is not a toy.

CAUTION: **COMPUTER NUMERICAL CONTROLLED (CNC) MACHINERY CAN START UNEXPECTEDLY CAUSING INJURY**. Keep hands, fingers, body parts, loose clothing, jewelry, or long hair away from moving parts. Always disconnect the machine from the power supply when building or modifying it.

WARNING: **THE HEATED BARREL ASSEMBLY, NOZZLE, AND EXTRUDED PLASTIC RESIN WILL CAUSE SERIOUS BURNS IF TOUCHED.**

RESPONSIBLE USE

Thank you for purchasing a SeeMeCNC H-1 machine. Please use this technology responsibly and ethically. By purchasing and using a SeeMeCNC machine, you are assuming all liabilities associated with building and using it. Please respect the copyright of the intellectual property of others. Under no circumstance will Blackpoint Engineering, LLC, be responsible for uses of the equipment.

It is YOUR responsibility to research state and local laws for use of SeeMeCNC machines. USE AT YOUR OWN RISK. Further, use of your SeeMeCNC machine, by any operator, is your acknowledgement of all warnings, cautions, ethical use, and safety concerns written in this document or understood by the common practice of the art.

FOREWORD

Thank you for purchasing a SeeMeCNC H-1 3D printer.

The Open Source RepRap (see *RESOURCES* below) 3D printer community has popularized DIY desktop 3D printing. These machines typically use on-board controller electronics based on the Open Source Arduino platform and are designed to be able to print a copy of themselves; they are self-replicating machines.

The SeeMeCNC H-1 is a very powerful little machine based on the Open Source RepRap Huxley that anyone can use to unleash his or her imagination to create a physical real world object. We built the H-1 with two objectives:

1. significantly lower the cost of building a 3D printer by using injection molded rather than printed plastic parts
2. introduce the user to a more conventional and professional level of computer numerically controlled (CNC) machinery

To achieve the second objective, we have chosen a regular desktop personal computer and ArtSoft's Mach3™ software as the controller rather than the dedicated on-board Arduino controllers used in typical RepRap machines. Both hobbyists and professionals use Mach3 to control many types of CNC equipment. Mach3 users will have a lower learning curve entering 3D printing while users just starting out will be able to leverage their new CNC skills if they decide to expand to other machinery like lathes, routers, or milling machines.

The H-1 is controlled by g-code, a universal programming language developed decades ago as a way to control machinery using computers. While most g-codes are universal and common among machines, including the H-1, some machinery manufacturers have created custom codes not universal to all CNC machines. All CNC machines have their own startup and shutdown procedures as well. Please refer to the *Startup and Shutdown* section of this manual for these procedures for the H-1 3D printer. Following these procedures will ensure safe operation and that you do not damage the electronics of your machine.

3D printing involves a number of operations from design of the 3D part itself, to generating g-code, and sending that g-code to the machine to print the part. A number of Open Source and commercial software products are used in this software chain. The following sequence describes this process at a high level:

1. A three dimensional (3D) computer aided drawing (CAD) model is created. Commercial as well as free programs, such as Google SketchUp™, Blender, OpenSCAD, and FreeCAD are available for CAD model creation.
2. The 3D CAD model is exported to a sterolithography (STL) file.

3. Convert the STL file to g-code using a computer aided manufacturing (CAM) program. Slic3r or a special SeeMeCNC version of the Open Source ReplicatorG program is used for this step.
4. Open the g-code file in the Mach3 machine control software. Mach3 controls the H-1 through the stepper motor axis control board connected to the parallel port of your computer.
5. Turn on the heater to the "hot end" of the H-1. It takes about 3 minutes to warm up to 430°F.
6. Jog the H-1 to X, Y, Z home positions and set Zero.
7. Press "Cycle Start" to begin printing.

Even if you are not skilled at CAD or do not know what you'd like to print, a large community of shared STL files for thousands of interesting (and amazing!) printable things is available at Thingiverse® (see *RESOURCES* below). Starting with one of these STL files eliminates steps 1 and 2 in the sequence described above.

RESOURCES

General Background

RepRap: http://reprap.org
Open Source Huxley: http://reprap.org/wiki/Huxley
H-1: http://reprap.org/wiki/SeeMeCNC
g-code: http://en.wikipedia.org/wiki/G-code
Thingiverse: http://www.thingiverse.com

CAD Programs

Google SketchUp: http://sketchup.google.com
Blender: http://www.blender.org
OpenSCAD: http://www.openscad.org
FreeCAD: http://sourceforge.net/apps/mediawiki/free-cad

CAM Programs

Slic3r: http://slic3r.org
SeeMeCNC ReplicatorG: http://seemecnc.org/download/RepG_Skeinforge

Machine Control Programs

Mach3: http://www.machsupport.com

H-1 Construction Resources

SeeMeCNC Official Forum: http://forum.seemecnc.com
SeeMeCNC Yahoo Group: http://tech.groups.yahoo.com/group/SeeMeCNC
SeeMeCNC.org: http://seemecnc.org

H-1 Assembly

There are three manuals available for building your H-1: the *H-1 Mechanical Assembly Manual* this *H-1 Electronics Manual* and the *H-1 Operations Guide*. This manual will guide you in assembling the electronics and wiring your new machine. You should complete the mechanical assembly of your H-1 before proceeding with this manual. The *H-1 Operations Manual* presents software, configuration, H-1 operations, and some useful modifications to enhance your machine. In addition to these manuals, the SeeMeCNC forum and the "seemecnc" Yahoo group (see *RESOURCES* above) are great places to find more information and ask questions about building and using your machine.

We recommend that you follow the assembly steps in the order presented in the manual. It is a good idea to read through the entire manual and gather the required tools and supplies prior to starting construction. Also make sure to read and understand the warnings and cautions listed on page 3.

Assembly steps and figures are numbered in this manual. These help you keep track of where you are and can be used to refer to a specific operation. For instance, *step 1-1*, refers to cutting the connectors off the power supply's leads and *Figure 1.1 - 450 Watt ATX Power Supply* is a photo of the supply.

The stock H-1 is designed for 1.7mm plastic filament. Modification of the hot end to allow 3mm filament is presented in the *H-1 Operations Manual.*

Take your time completing the electronics and wiring your machine and enjoy your new SeeMeCNC H-1!

Tools and Supplies

In addition to the electronics items provided in the kit, you will need a few basic tools and supplies to complete wiring and assembly.

Tools:

Note that you can substitute an adjustable wrench for the 1/4", 3/8” and 7/16” wrenches.

- small wire cutter
- soldering iron
- wire stripper
- small screw driver
- ruler or tape measure
- needle nose pliers
- tweezers

Supplies

- one 10K to 18K Ω resistor
- non-lead electronics solder
- 16 feet of 18 AWG four conductor wire
- 1/16” diameter heat shrink tubing or electrical tape
- several dozen small (3”) zip ties
- high temperature silicone adhesive or gasket maker, like Permatex Ultra Copper™ (available at auto parts stores)
- several dozen staples or 24 gauge solid wire
- high temp silicone

H-1 Electronics Overview

The basic process for completing the wiring for your H-1 includes these steps:

1. prepare the power supply (ATX PC power supply)
2. assemble the hot end thermostat kit (Velleman MK138)
3. make several 3-Axis Parallel Stepper Driver Board modifications
4. wire the EasyDriver extruder stepper motor driver
5. wire the hot end resistors and thermistor
6. completing the wiring

H-1 Electronics

Step 1 - ATX Power Supply Preparation

Figure 1.1 - 450 Watt ATX Power Supply

Tools needed:

- wire cutters
- wire stripper
- soldering iron

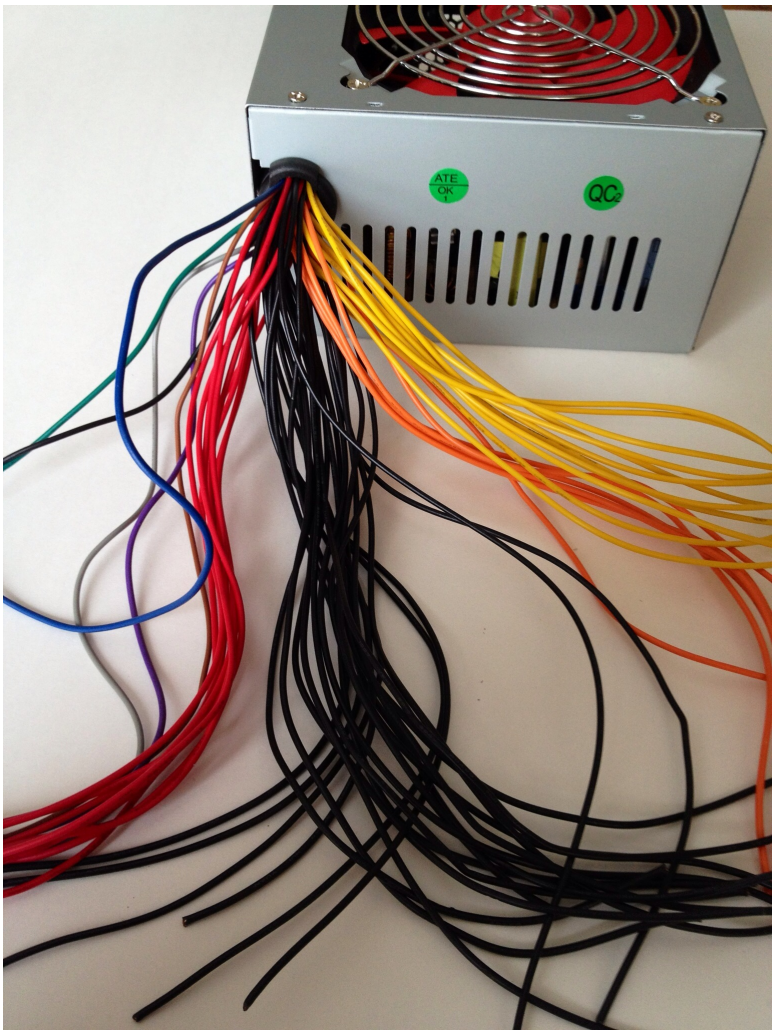
Supplies needed:

- solder
- heat shrink tubing or electrical tape
- 3” zip ties

The ATX power supply comes configured for use in a PC. It outputs 12volts, 5volts, 3.3volts as well as a few others. The H-1 electronics systems only require the 12v lines from the supply. Luckily, ATX powers supplies have a standardized color coding for their wiring. Yellow wires are +12v, red are +5v, orange are +3.3v, and black is ground. There are a few other individual wires that are green, brown, blue, grey, and purple. Only one of these, the green one, is required to configure the power supply.

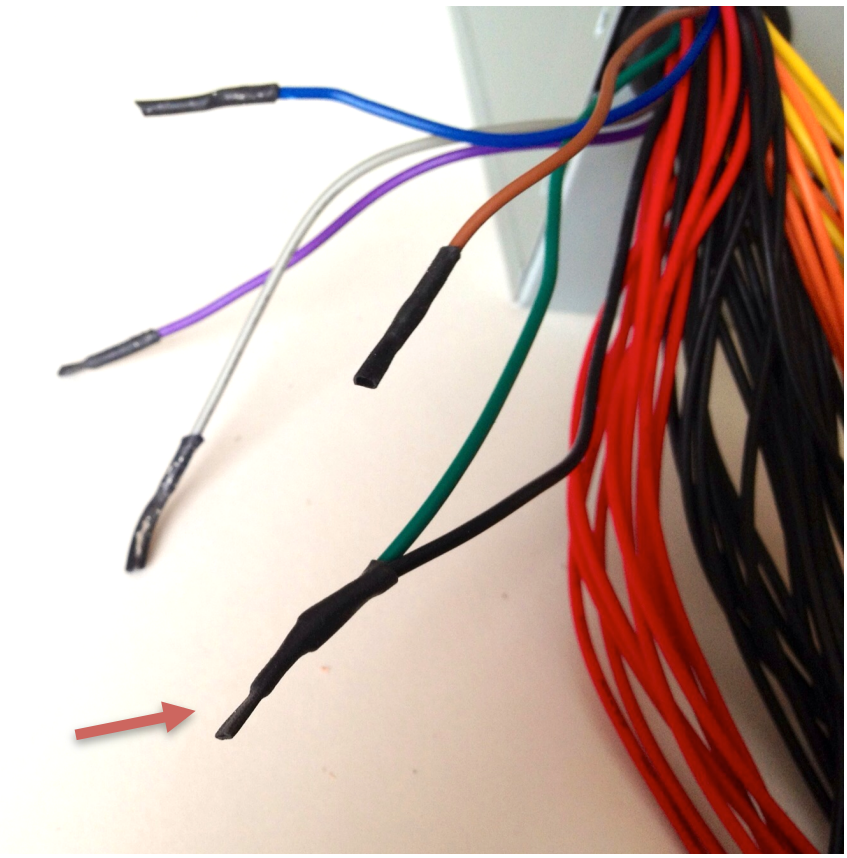
1. First, cut off all of the connectors with the wire cutters as close to the connector as possible. You do not need these so you can reuse them in other projects or discard them.
2. Separate the wires into bundles by color: all yellow wires, all red wires, all orange wires, all black wires, and a group of miscellaneous colored wires. See *Figure 1.2 - Separated Wire Bundles*.

Figure 1.2 - Separated Wire Bundles



3. Locate the green wire and one black wire. The green wire is the power supplies' enable line. It must be connected to ground (black wire) in order to turn the power supply on. Simply twist these wires together, solder and then protect with either heat shrink tubing or electrical tape as shown in *Figure 1.3 – Connecting Green Wire to Ground*.

Figure 1.3 - Connecting Green Wire to Ground

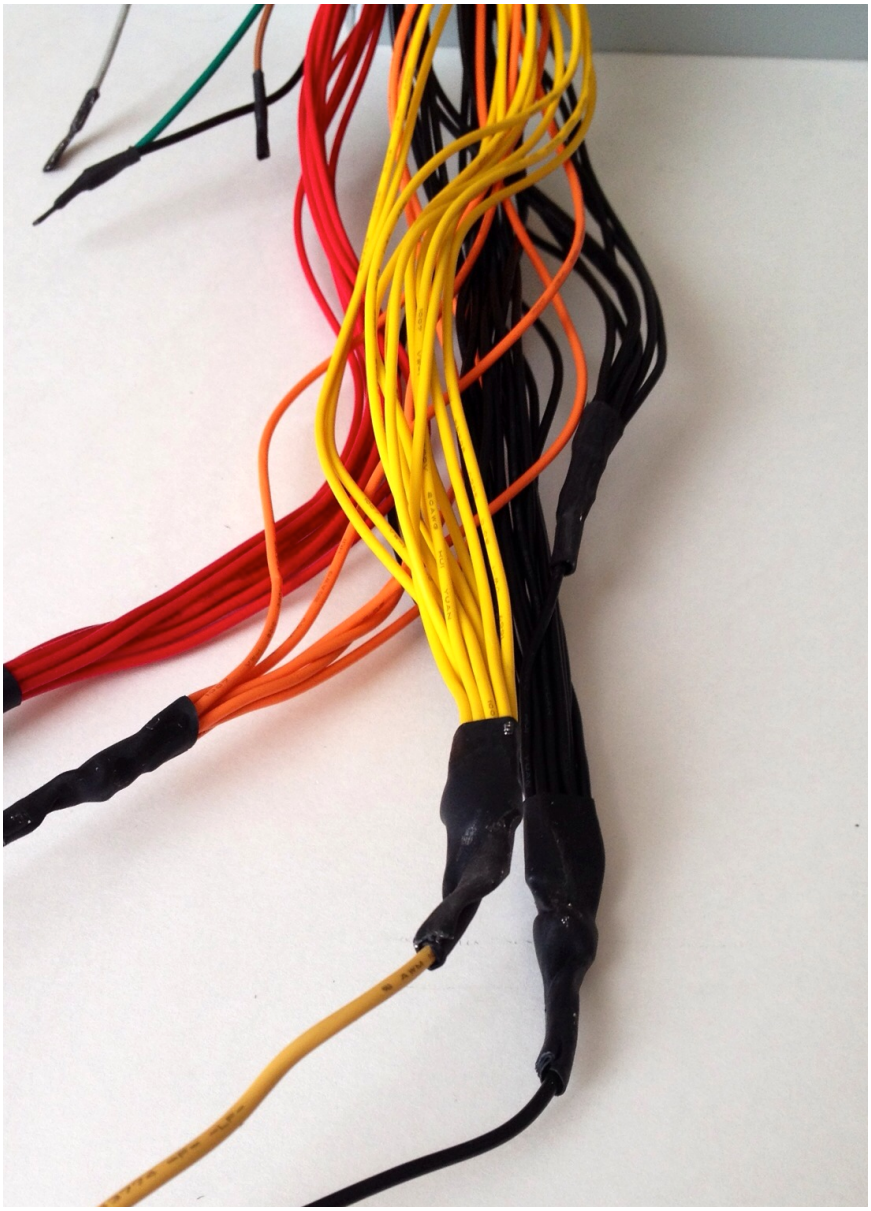


TIP: You can install a simple On/Off toggle switch between the green and black wire as a convenience to turn the power supply on and off. Radio Shack #275-602 is an example.

4. Clip the other colored wires shorter (about 6”) as shown in *Figure 1.3* shorter and protect their ends with heat shrink tubing or electrical tape.
5. Bundle the orange wires and make sure they are the same length. Wrap off the ends of the orange wire bundle with electrical tape or a large diameter heat shrink tubing. You will not need this bundle.
6. Bundle the red wires with electrical tape or a large diameter heat shrink tubing. You will not need this bundle.
7. Cut the wires in the yellow bundle to the same length. Strip about 1/2” of insulation from each wire.
8. Tie the yellow wires (12 volt) together along with a short (8”) lead of single wire. Solder the bundle and lead and wrap with electrical tape or heat shrink tubing as shown in *Figure 1.4 - Bundling Yellow and Black Wires*.

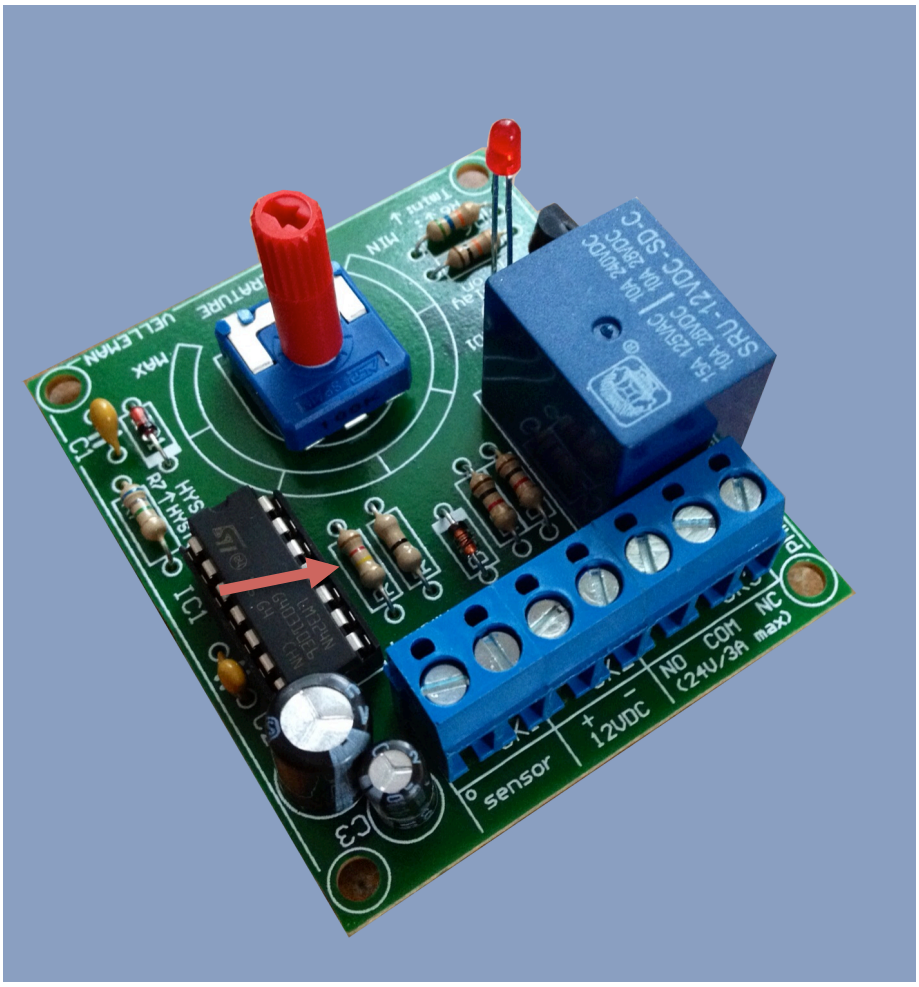
9. Repeat step 8 with the black (ground) wires.
10. Bundle all of the red, yellow, orange and black wires and wrap them with electrical tape or small zip ties to make a neat cable from the power supply.
11. Strip about 3/8” insulation off the end of the yellow and black single wire leads. These will connect to your 3-Axis Parallel Board to provide its 12v power.

Figure 1.4 - Bundling Yellow and Black Wires



Step 2 - Assemble the Velleman MK138 Thermostat

Figure 2.1 - Completed Velleman MK138 Thermostat



Tools needed:

- wire cutters
- wire stripper
- soldering iron

Supplies needed:

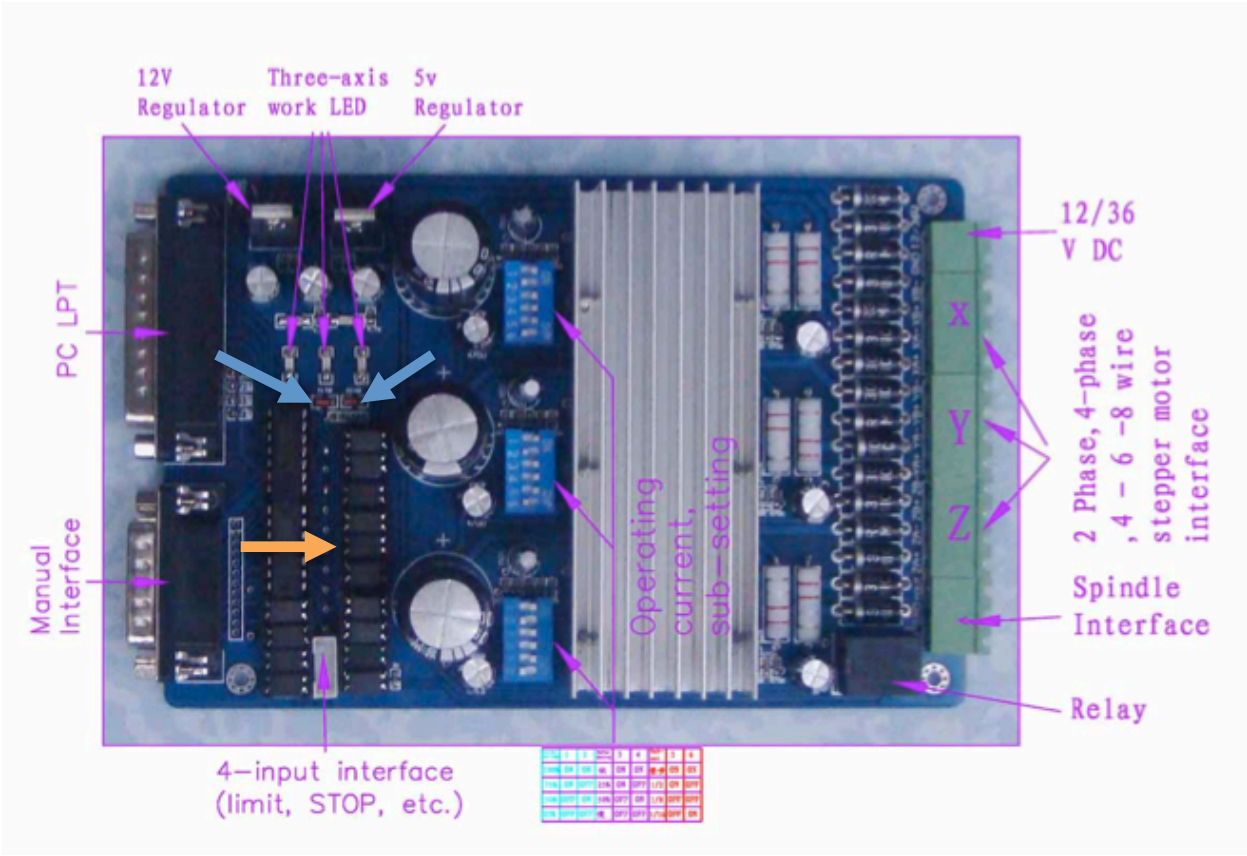
- solder
- 10k to 18k Ω resistor

Assemble the Velleman thermostat kit as per the included instructions. However, you will need to make one change – substitute the kit's 120K Ω resistor at R5 (indicated by the arrow in *Figure 2.1 – Completed Velleman MK138 Thermostat*) with a 10k to 18k resistor. Pay attention to the following:

- Make sure to install the diodes, zenner diode, the two electrolytic capacitors (the small blue cylindrical capacitors) and LED in the proper orientation.
- Use a magnifying glass to identify the small diodes, they look very similar to the zener diode.
- Do not install the red handle on the potentiometer until after the thermostat is finished.
- Make sure the leads on the IC do not bend when you insert it into its socket.

Step 3 - 3-Axis Parallel Driver Board Modifications

Figure 3.1 - 3-Axis Parallel Driver Board



(photo from the *User Guide for 3 axis TB6560 driver board*)

The 3 Axis Parallel Driver Board controls the stepper boarders via signals from the Mach 3 (or other) control software. It interfaces to the parallel port on your PC. Unfortunately, a few minor issues with the circuitry on the 3-Axis Driver Board can cause perplexing problems driving the stepper motors. It is best to perform these modifications before attempting to use the H-1.

Tools needed:

- wire cutters
- wire stripper
- soldering iron
- needle nose pliers
- tweezers
- small screw driver

Supplies needed:

- solder
- staples or solid core 24 gauge wire

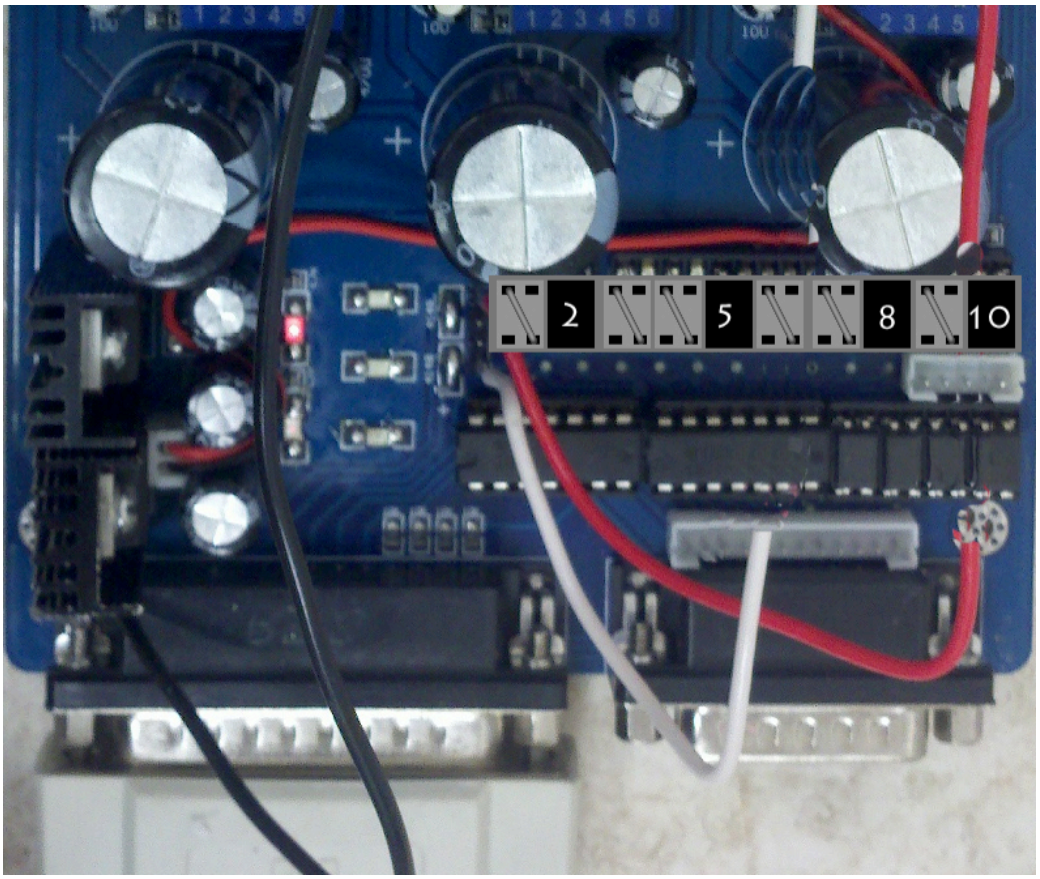
3.1 - Remove and Jumper Two Diodes

1. Refer to *Figure 3.1 - 3-Axis Parallel Board* to locate the two small marked with the blue arrows.
2. Remove one of the diodes by heating it with the tip of your soldering iron. It should come off easily. You may need to use tweezers to pull it off when the solder melts.
3. Once the diode is removed, jumper across its pads with a small bridge of solder or a short length of wire.
4. Repeat steps 2 and 3 for the second diode.

3.2 - Remove and Jumper The Optical Isolators

The row of ten optical isolators built onto the board do not perform their intended function and can actually degrade the signals to the stepper drivers. The simple fix is to remove and jumper them. The orange arrow in *Figure 3.1 - 3-Axis Parallel Board* shows where the opto isolators are located on the board. You will not remove all of them – refer to *Figure 3.2 - Opto Isolator Jumpers*. The easiest jumper material to use is steel staples from a desktop stapler. You will have to bend the staples slightly to get them to line up with the sockets properly.

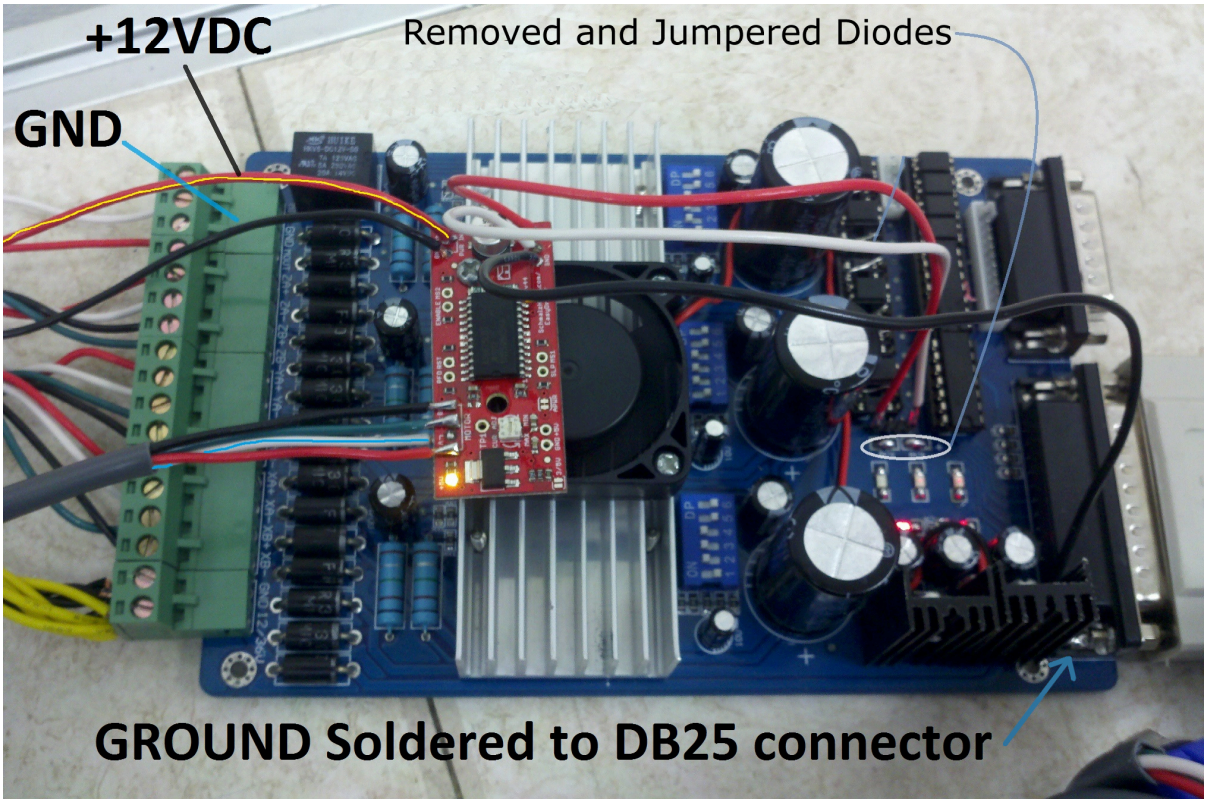
Figure 3.2 - Opto Isolator Jumpers



1. Remove the opto isolators located at positions 1, 3, 4, 6, 7, and 9 using a small screw driver to gently pry them from their sockets.
2. Insert a staple or small length of wire into the diagonal holes from the top left to bottom right as shown in *Figure 3.2 - Opto Isolator Jumpers.*

3.3 - Attach Wiring for EasyDriver Board

Figure 3.3 - EasyDriver Wiring



Two pins on the 4 pin connector on the 3-Axis Board must be connected to the EasyDriver STEP and DIR pads along with ground. The pins are located near opto isolator #1 you removed in the previous step. The EasyDriver pads are at one corner and are labeled DIR, STEP and GND (from the corner inward).

Locate the 4 pin connector on the 3-Axis Board. The inner two pins are both ground, the outer pins are passed through from pins 16 and 17 on the parallel port. The pin nearest the parallel port is pin 17 and is wired to the STEP pad on the EasyDriver board by convention. The pin furthest from the parallel port is pin 16 and is wired to the DIR pad on the EasyDriver. The GND pad on the EasyDriver is connected directly to the parallel port's DB 25 connector metal housing.

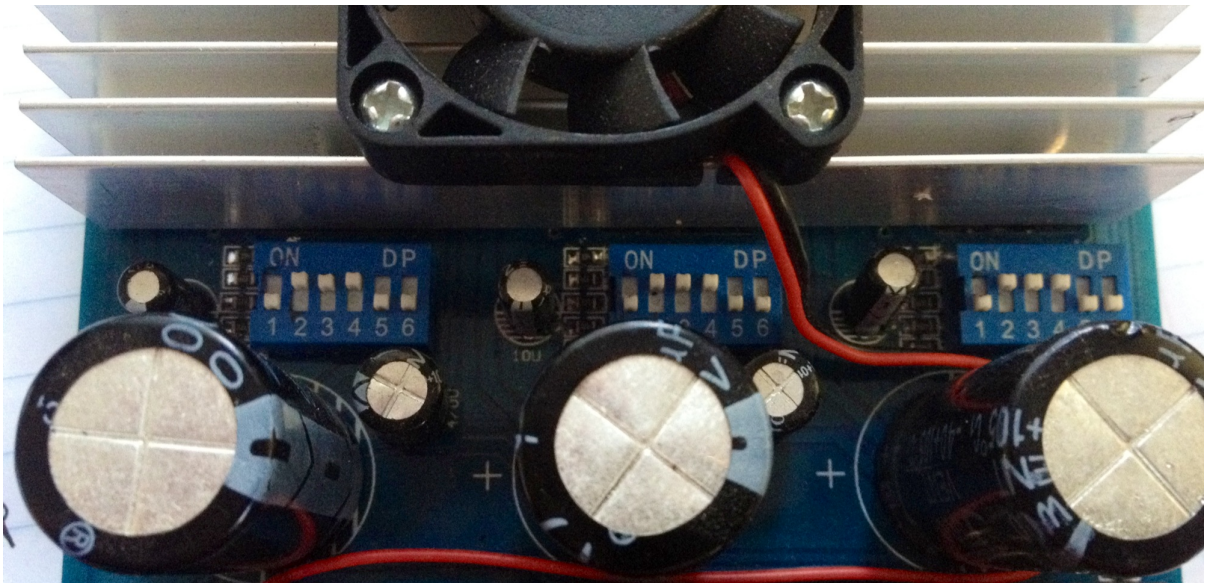
TIP: You can use a 4 pin connector to simplify the wiring and to allow easy removal of the EasyDriver card. The pins on the 3-Axis Board are on .1" centers.

1. Solder a 6” wire to pin 17 (nearest the parallel port). This is the white wire shown in *Figure 3.3 - EasyDriver Wiring*.
2. Solder the other end of this wire to the STEP pad on the EasyDriver board.
3. Solder a 6” wire to pin 16 on the 3-Axis Board’s 4 pin connector. This is the red wire shown in *Figure 3.3 - EasyDriver Wiring*.
4. Solder the other end of this wire to the DIR pad on the EasyDriver board.
5. Solder an 8” wire to the parallel port’s metal housing. By convention, ground wires are black. The blue arrow in the lower right corner of *Figure 3.3 - EasyDriver Wiring* shows the black wire ground connection.
6. Solder the other end of the ground wire to the GND pad on the EasyDriver board.

TIP: The EasyDriver board can be mounted to fan housing on the 3-Axis Board as shown in *Figure 3.3 - EasyDriver Wiring.* Remove the fan mounting screw at the upper left as shown in the photo. The EasyDriver board has two mounting holes, use the hole nearest the STEP, DIR and GND connections you just completed. It is a good idea to put a short (1/32” or so) plastic washer or cut off section of 2mm Teflon tubing between the EasyDriver and the fan to raise the board above the fan a little. In addition to providing a neat setup, the fan helps cool the EasyDriver board too.

3.4 - 3-Axis Board DIP Switch Settings

Figure 3.4 - 3-Axis Board DIP Settings



Refer to *Figure 3.4 - 3-Axis Board DIP Settings* and set the positions of the switches on your board to the same positions. The description if these switches can be found in the *User Guide for 3 axis TB6560 driver board*.

- Switches 1 and 2 set the max current to the stepper motor. These are set to 50%.
- Switches 3 and 4 set the decay mode. These are set to FAST.
- Switches 5 and 6 set the Stepper MicroSteps. These are set to 8 microsteps.

Step 4 - Hot End Resistors and Thermistor Wiring

Figure 4.1 - Hot End Wiring

NEED PHOTO HERE

You assembled the hot end along with the heating resistors and thermistor in the *H-1 Assembly Manual*. If the hot end is attached to your machine, remove it for the following steps.

Tools needed:

- wire cutters
- wire stripper
- soldering iron
- needle nose pliers

Supplies needed:

- solder
- two crimp connectors
- 3' piece of 4 conductor cable
- high temp silicone

The hot end gets very hot (over 400°F) and can get hot enough to melt solder. It is best to connect the heating resistors using crimp connectors to eliminate a source of problems later.

1. The heating resistors are wired in parallel – meaning that the two leads coming out of each side of the hot end are connected together. Leave the leads full length and connect one wire from the 4 conductor cable to the two leads on one side using a crimp connector.
2. Connect the two leads on the other side of the hot end to a second wire in the 4 conductor cable using a crimp connector.
3. Make a note of the two wire colors you used for the heating resistors.
4. Solder the leads of the thermistor to the other two wires in the 4 conductor cable. Make a note of the wire colors used.
5. It is a good idea to insulate the leads on the thermistor with a high temperature insulation. The high temperature silicone that you used to assemble the hot end works well, use a toothpick to apply a thin layer of silicone around each lead.

Once the hot end wiring is attached, it is necessary to bend and fit the wires so the hot end can fit into the X Axis carriage so that the wires do not touch each other or other metal parts. If they do, **a short circuit will result that could cause damage, extreme heating and even a fire**. Routing these wires is an individual process. Take your time and check your work often. Here are some tips to help:

- Refer to *Figure 4.1 - Hot End Wiring*, a picture is worth a 1000 words!

- Install the hot end onto the Extruder Mounting Plate and note the back end of the plate. The goal is to route all wires out the back without touching plastic or metal parts.
- One of the thermistor lead can be looped up over one of the arms of the PEEK Extruder Nozzle Mount to help isolate it from the other lead. Keeping the thermistor leads isolated is very important since short circuits can cause extreme heating of the hot end. See caution in red above.
- Bend the heating resistor leads backwards immediately after they exit the extruder barrel. Make sure they do not touch the thermistor leads or other plastic or metal parts.

Once you are satisfied with the wire routing, reinstall the Extruder Mounting Plate on the machine. Double check the wiring and readjust if necessary.

Step 5 - Wiring

Refer to *Figure 5.3* for the wiring diagram. Each of the steppers has four color-coded wires. These connect to the A+/A- and B+/B- lines for the X, Y and Z axes on the 3-Axis Board (the large green connectors at one end of the board). The A axes (extruder stepper motor) connects to the equivalent position on the EasyDriver board. It is important that these are connected properly, pay attention to the color-coding shown on *Figure 5.3*.

NOTE: Color-coding on stepper motor wires is not standardized. You may need to locate the datasheet for your stepper motors if you are not using the motors supplied with the H-1 kit. Also note that some steppers may have more than four wires. Refer to the *User Guide for 3 axis TB6560 driver board* for a wiring diagram for 4, 6, and 8 lead stepper motors.

Tools needed:

- wire cutters
- wire stripper
- soldering iron
- needle nose pliers

Supplies needed:

- solder
- four 3’ pieces of 4 conductor cable
- 2’ piece of 4 conductor cable
- heat shrink tubing or electrical tape
- zip ties

5.1 - Stepper Motor Wiring

1. Solder the X-Axis stepper motor wires to the four wires at one end of the 4 conductor cable. It is best to try to match colors to those in the cable. Insulate the solder joints with heat shrink tubing or electrical tape. Make a note of the connected wire colors.
2. Attach the wires using the screw clamps at the other end of the X-Axis cable to one of the green 4 terminal quick disconnect connectors. Make sure that the motor wires are connected properly:

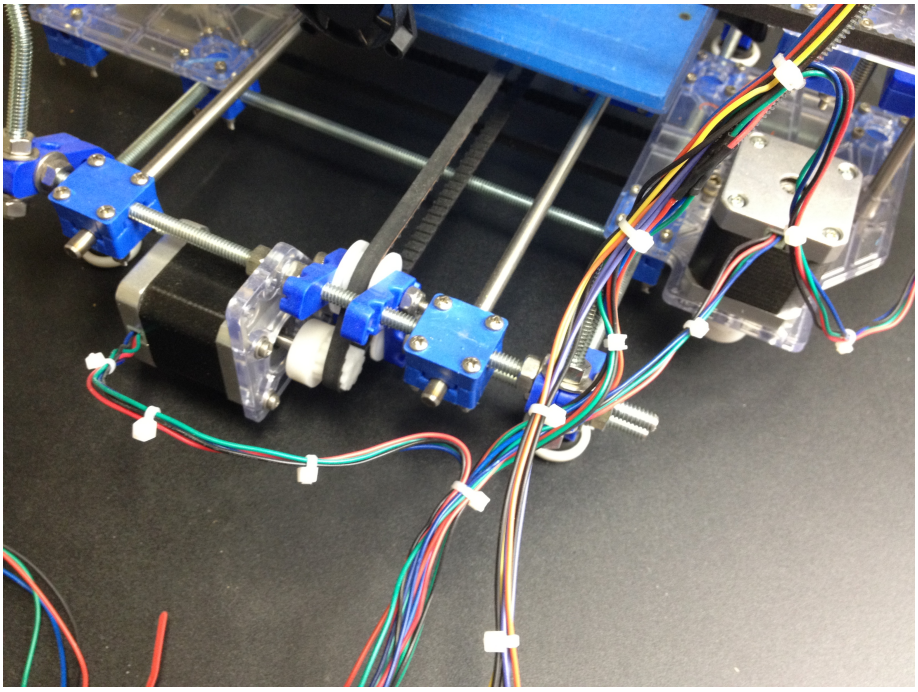
    - motor red wire to A+
    - motor blue wire to A-
    - motor black wire to B+
    - motor green wire to B-

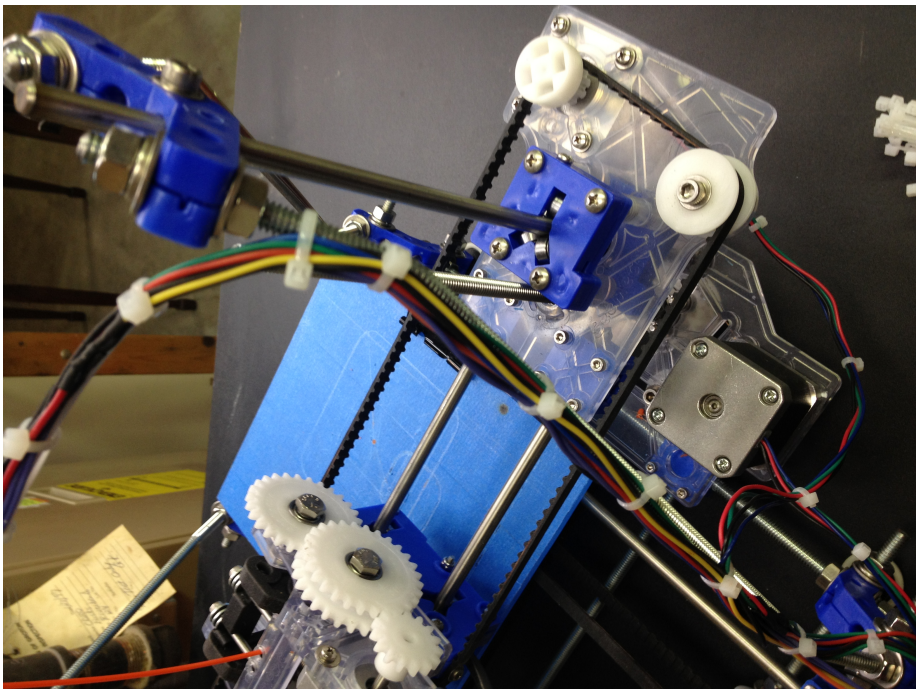
3. Repeat steps 1 and 2 for the Y-Axis cable.
4. Repeat steps 1 and 2 for the Z-Axis cable.
5. Repeat step 1 for the remaining piece of 4 conductor cable used with the A-Axis stepper motor.

6. Solder the wires at the other end of the cable to the appropriate positions on the EasyDriver board. These are marked “Motor A” and “Motor B” on the board. Connect the red, blue, black and green motor wires from left to right as you read the label.

5.2 - Wire Routing

Figure 5.1 - Cable Routing





At this point, it is a good idea to route all the cables on the machine to the back left corner of the machine. This is the simplest configuration since the Z-Axis stepper is on the left side of the machine. The cables can be secured to the threaded support rods with zip ties or electrical tape. A good sequence to follow is:

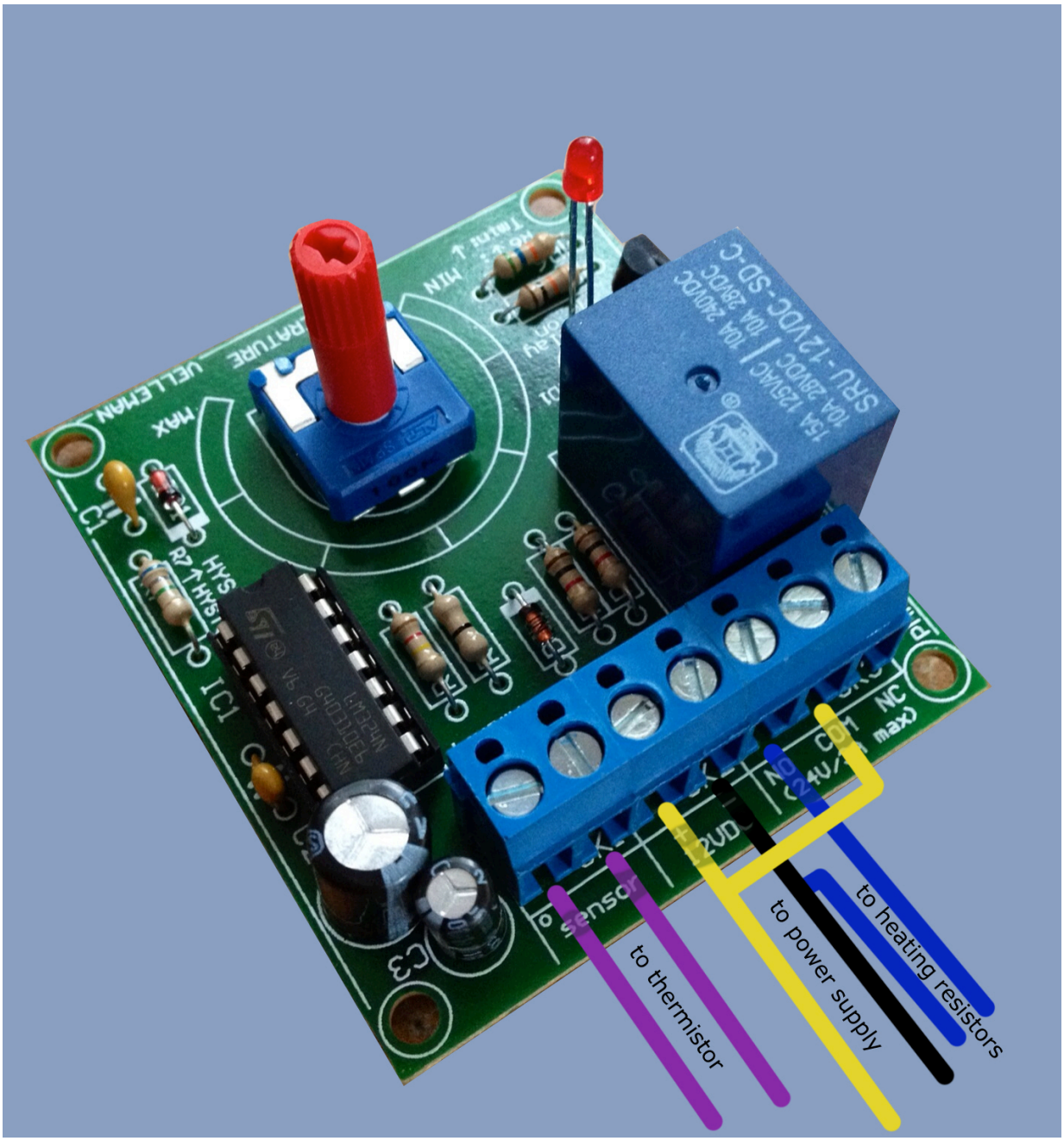
- **Y-Axis cable.** Make sure to leave enough slack so the table travel its full length without binding.
- **Z-Axis cable.** Make sure to leave enough slack so the Z-Axis carriage can travel its full length up and down.
- **X-Axis cable and Resistor/Thermistor cables.** These cables require the most attention for routing since the X-Carriage traverses both left and right as well as up and down with Z-Axis movements. A common configuration routes the cables in an arc above the machine. The other end of the arch is attached to the top-most point of the machine's upright with zip ties or electrical tape. Also attach the two 4 conductor cables to each other with zip ties or electrical tape. The two bundles of 4 conductor cables typically have enough rigidity to support themselves in this arch.

5.3 - Final Wiring

With the cables routed and secured to the H-1, it is time to make the final connections to the power supply, 3-Axis board, and Velleman thermostat. Refer to *Figure 5.3* as you make the connections.

1. Connect the ATX power supply to the 3-Axis Board's terminal block using the screw clamps. The black wire from the power supply goes to the ground connection and the to the 12 volt connection.
2. Plug the Z, Y, and Z terminal blocks from the stepper motors into their connectors on the 3-Axis board.
3. Strip the cover off the 2' section of cable.
4. Locate the power input pads on the EasyDriver board. They are marked "PWR" with GND and M+ pads.
5. Solder the end of one wire to the EasyDriver's GND connection. If possible, use a black wire for this connection.
6. Solder the end of another wire to the EasyDriver's M+ (12 volt) connection. If possible, use a yellow or red wire for this connection.
7. Attach the EasyDriver's GND and M+ wires to the 3-Axis Board's GND and 12 volt terminals connected in step 1 above.

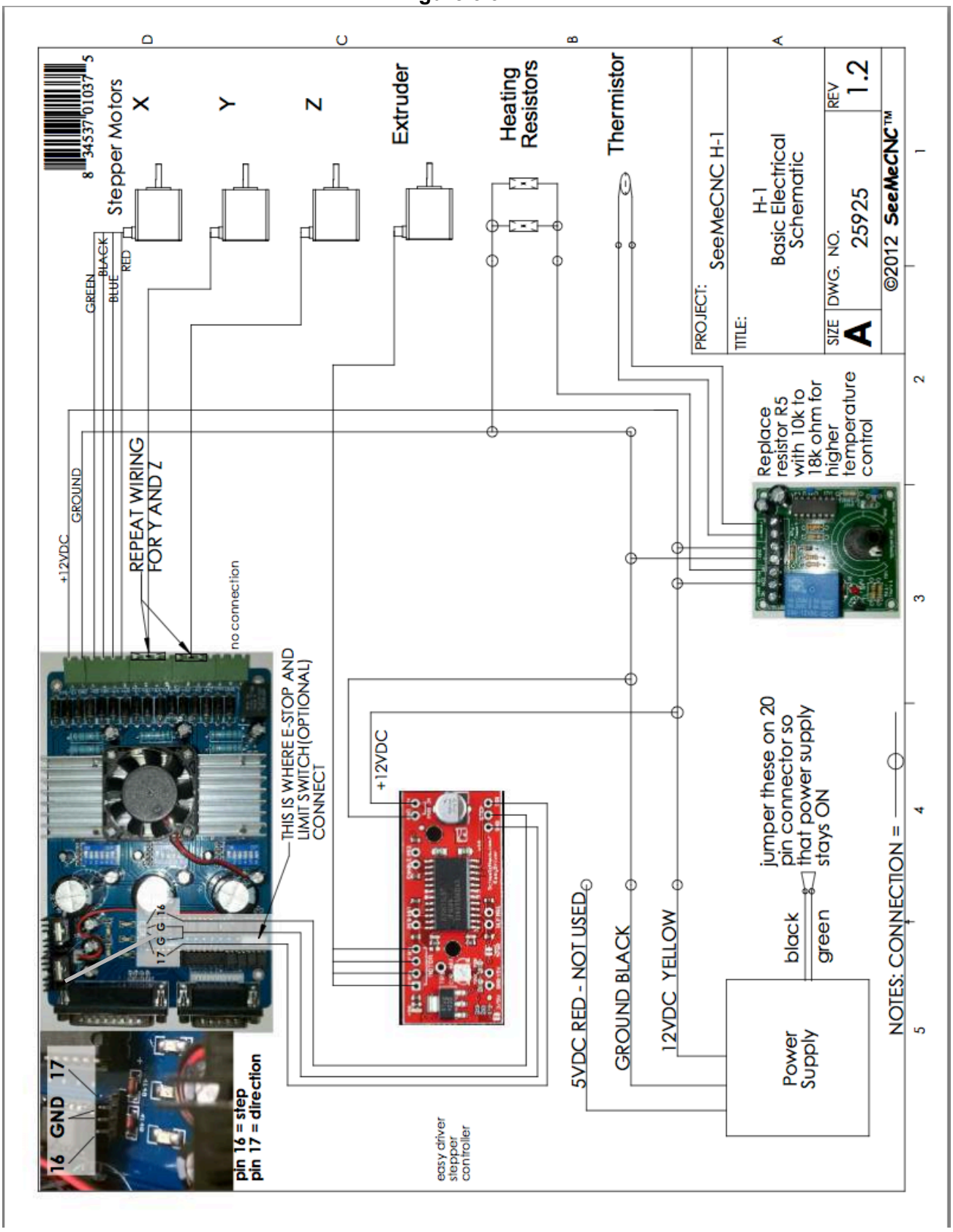
Figure 5.2 - Velleman MK138 Connections



8. Refer to *Figure 5.2 - Velleman MK138 Connections* to connect the thermostat.
9. Connect the wires from the thermistors to the Velleman MK138 thermostat at the screw terminals marked “Sensor”. It does not matter which thermistor lead goes in which sensor terminal.
10. Using a short length of wire, stripped 3/8” at each end, jumper the across the 12 volt and COM terminals (yellow wire in the figure).
11. Connect the terminal marked “NO” to one of the leads from the heating resistors. It does not matter which lead.

12. Attach the other heating resistor lead to the GND terminal. These are the blue wires in the figure.
13. Connect the Velleman board to the ground and 12 volt terminals on the 3-Axis Board using two 2' lengths of wire. If possible, use black wire for the ground connection and yellow or red for the 12 volt connection.eem

Figure 5.3


Stepper Motors
X
Y
Z
Extruder
Heating Resistors
Thermistor
GREEN
BLACK
BLUE
RED
+12VDC
GROUND
REPEAT WIRING FOR Y AND Z
no connection
THIS IS WHERE E-STOP AND LIMIT SWITCH(OPTIONAL) CONNECT
17 G G 16
16 GND 17
pin 16 = step
pin 17 = direction
+12VDC
easy driver stepper controller
5VDC RED - NOT USED
GROUND BLACK
12VDC YELLOW
Power Supply
black
green
jumper these on 20 pin connector so that power supply stays ON
Replace resistor R5 with 10k to 18k ohm for higher temperature control
NOTES: CONNECTION =
PROJECT: SeeMeCNC H-1
TITLE: H-1 Basic Electrical Schematic
SIZE A
DWG. NO. 25925
REV 1.2
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Step 6 – Mach Configuration

Step 7 – Powering Up and Testing

Troubleshooting

T1 - Velleman MK138 Thermostat

If your kit does not work after completing it, double check the orientation of the diodes, zener diode, capacitors and LED. In particular, if the LED is in backwards, the thermostat will work but you will not have visual confirmation. The relay will click when the output toggles on and off. Test by slowly turning the red potentiometer knob clockwise and then counter-clockwise. If you do not hear the click, double check the components listed above.

If the thermostat was working fine and then stops working altogether, the diodes D1 and D2 (1N4148) may be the culprit. These can be purchased at Radio Shack or most electronics suppliers and are very inexpensive. Simply replace the two diodes and your board will likely work.

T2 - Stepper Motors