

# Unimat DB200 / SL1000 Bi-Directional Variable Speed Power Feed

## Overview

I love my little Uni, but not being able to use the power feed attachment when milling, and only being able to feed in one direction (without figure 8ing the belt) left my arm tired. I searched for other power feed solutions and short of building a gear box, solutions using a stepping motor or permanent magnet DC motor seemed the easiest to implement.

First thing needed was to find a suitable motor. I talked to a few electro-geeks at work, and they said a stepper motor could be used, since they are relatively cheap, but would require a controller for it to work. They suggested looking at the Arduino site ( <http://www.arduino.cc> ), but this seemed too complicated and expensive.

I saw that a few others had used permanent magnet DC motors (PM) from old printers, so I thought I would start there. Working for a computer software company, I sent out an email asking if anyone had any old printers that wanted to get rid of, and after about 5 minutes, had to send out another saying I had enough thanks!

The printers I got (Epson and HP) had 2 to 3 motors, and usually a stepping motor. The HP printers have a larger PM motor to drive the carriage for the print head, and I noticed that another Unimat owner also used it along with the pulley and belt.

I searched for the part number on the internet and was able to find the following info:

### C4557-60003

max voltage 24V

medium voltage 15V

Max current 1.6A

no load current 0.1A

no load speed 3540 rpm

max power 8.72

starting voltage 3V

resistance 11.6 ohms

volts at 1000 revolutions: 6.4V

inertia 50 (gm.cm<sup>2</sup> ?)

moment on the shaft of 6.08 N\*cm/A

max moment 9.4 N\*cm

And that it was used in the following HP products:

Color Copier 160	Color Copier 170	Color Copier 180/190	Color Copier 260
Color Copier 270	Color Copier 280/290	DeskJet 710C Printer	DeskJet 720C Printer
DeskJet 722C Printer	DeskJet 810C Printer	DeskJet 812C Printer	DeskJet 815C Printer
DeskJet 830C Printer	DeskJet 832C Printer	DeskJet 840 Printer	DeskJet 841C Printer
DeskJet 842C Printer	DeskJet 843C Printer	DeskJet 843cxe Printer	DeskJet 882C Printer
DeskJet 895Cse Printer	DeskJet 895Cxi Printer	DeskJet 930C Printer	DeskJet 932C Printer
DeskJet 935C Printer	DeskJet 950C Printer	DeskJet 952C Printer	DeskJet 955c Printer
DeskJet 970Cse Printer	DeskJet 970Cxi Printer	InkJet FAX 1220	InkJet FAX 1220xi
OfficeJet G55 Printer	OfficeJet G85/G85xi Printer	OfficeJet G95 Printer	OfficeJet K60/K60xi Printer

OfficeJet K80/K80xi Printer	OfficeJet R40 Printer	OfficeJet R40xi Printer	OfficeJet R45 Printer
OfficeJet R60 Printer	OfficeJet R65 Printer	OfficeJet R80 Printer	OfficeJet R80xi Printer
OfficeJet T45 Printer	OfficeJet T45xi Printer	OfficeJet T65 Printer	OfficeJet T65xi Printer
Print/Scan/Copier 500	Print/Scan/Copier 500xi		

The printers are also a good source for little springs, gears, pulleys, belts and MANY small screws. I also saved the circuit boards to scavenge such things as wire connectors, heat sinks, electrolytic capacitors, etc.

## Modifying the Gear

Not much is needed to do here, just need to sand down the small gear so that it was flush, and screw it to the end of the power feed pulley using the same screw.



## Building the Mounting Bracket

Lucky for me, my Uni was attached to an 1/8" thick aluminum cafeteria type tray, which seems to have been the common practice back when they were new, and since I had added rubber feet that are about 1/4" thick, I could use a 1/4" aluminum to fab up a bracket.



In hind sight, I should have left some slack in the belt, and slotted the base plate to adjust the bracket, but it seems to be working fine as of now.

## Building the Variable Voltage Circuit

The circuit is based on the standard schematic for the LM317 adjustable voltage regulator (AVR), which I purchased from Radio Shack. The data sheet for the LM317 can be found here:

<http://www.national.com/mpf/LM/LM317.html#Overview>

Here is a list of the components I purchased from Radio Shack:

Part Number	Description	Price (US Dollars 2011)
276-150	Multipurpose PC Board with 417 Holes	\$1.99
271-1111	220 ohm 1/2W 5% Carbon Film Resistor pk/5	\$0.99
276-1778	Adjustable-Voltage Regulator LM317T	\$2.49
272-135	0.1 $\mu$ F 50V Hi-Q Ceramic Disc Capacitor Pk/2	\$1.79
271-1714	5K-Ohm Linear Taper Potentiometers	\$2.99
275-653	DPDT with Center Off Heavy-Duty Toggle Switch	\$3.99

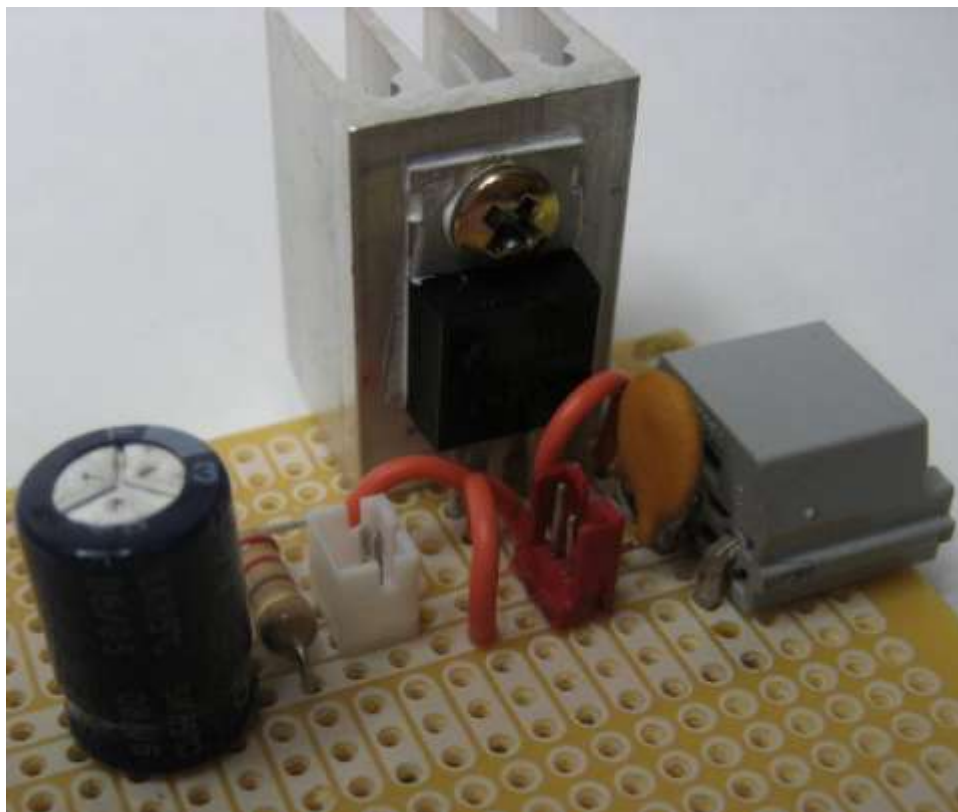
274-424	Silver Tone Knurled Knob	\$2.99
270-238	Aluminum Project Enclosure	\$2.99

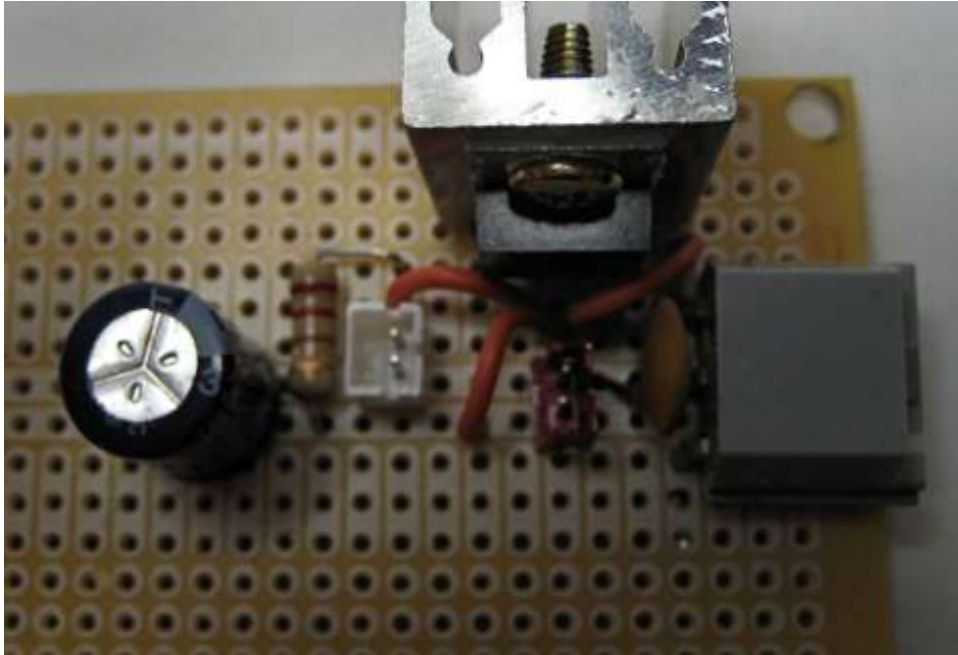
And the following if you don't scavenge the parts from a printer:

Part Number	Description	Price (US Dollars 2011)
276-1368	TO-220/TO-202 Aluminum Heat Sink	\$1.99
272-1029	220 $\mu$ F 35V 20% Radial-lead Electrolytic Capacitor	\$1.49

Note:

I used the wire connectors, heat sink and large capacitor (330uf 50v) from one of the Epson printer's circuit boards. I bought a 4.7uf cap from Radio Shack, but since anything from a 1uf to 1000uf cap can be used, and the bigger one looked cooler, I de-soldered it from one of the boards and used it. Radio Shack also sells screw mount PC terminals to mount the wire to the board from the pot and switch. I also already had the hook up wire, (Orange wire) otherwise you will need to pick up some of that to for jumpers on the board.





## Assembly

After the circuit board was completed, I used some  $\frac{1}{4}$ " x  $\frac{1}{4}$ " wood strips to attach the circuit board to the project box. I then transferred and cut the hole for the power connector, and through the mounting bracket for the motor in the project box, I screwed the circuit board to the wood strips, and JB Welded the wood strips to the project box. After that had dried, I attached the motor, and plugged in the wires to test it out.

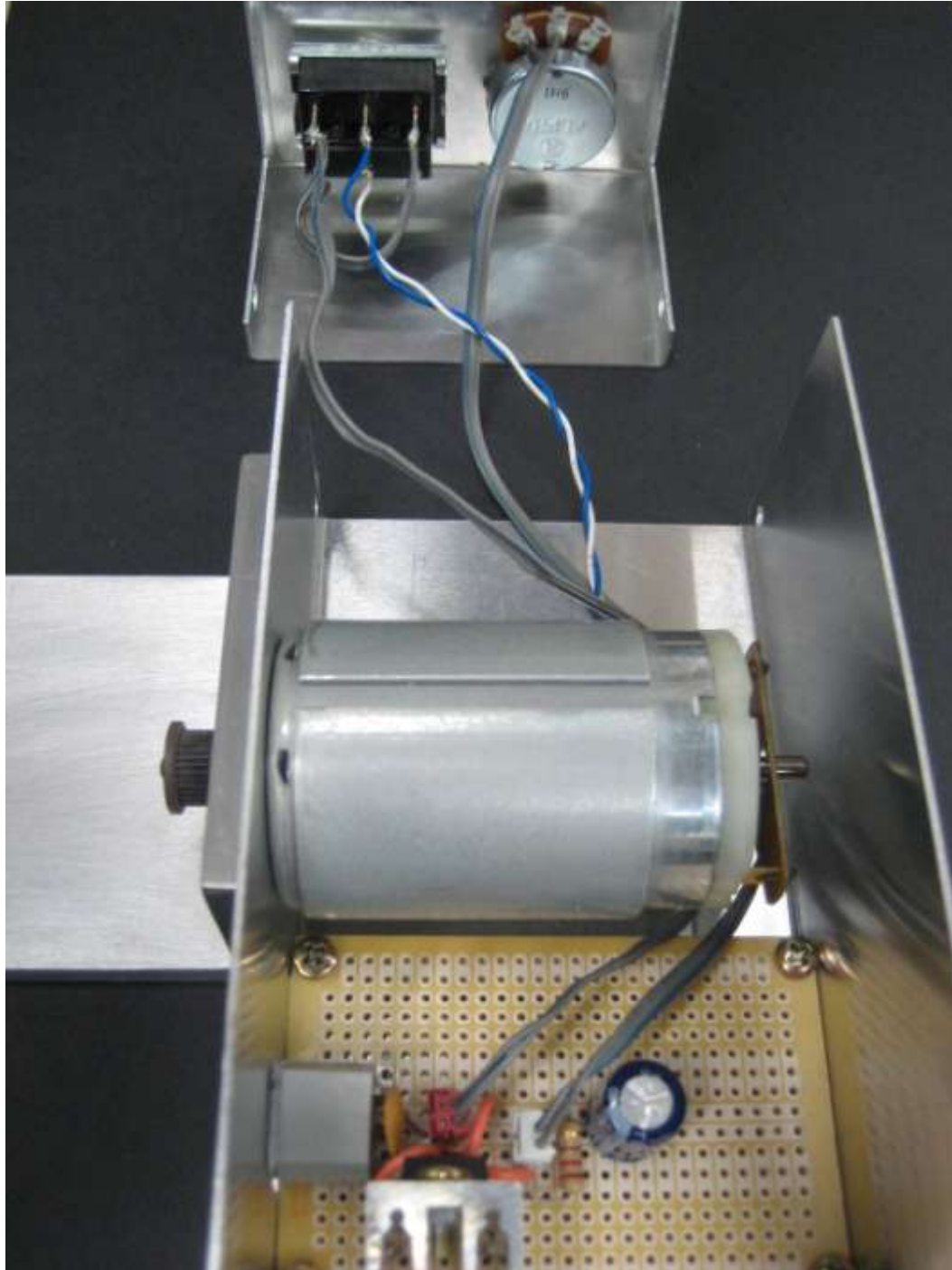


The switch I used is a double pole/double throw with center off type. The wires from the output of the voltage regulator to the switch should be soldered to one side of the switch, then wires from that side to the other side should be reversed to provide for reversing the motors direction. The wires to the motor should then be attached to the center lugs of the switch. You will want to use some test leads before soldering the wires to make sure they are operating in the proper direction.





The wires from the ADJ pin of the LM317 to the potentiometer should be attached to one of the outside lugs and the center lug on the pot. Again, you will want to test which outside lug to use on the Unimat first to make sure the motors speed increases when the knob is turned clockwise.



## The Finished Product

That's it! Works great, though a little more high end speed would be great. I could always get (or make) a larger diameter motor pulley, or smaller diameter feed pulley, but that's for another day.

