

An Introduction to the FireBall V90

About FireBallCNC

The Fireball V90 was developed by John Hansford of Hagan, Georgia. There have been about 12 iterations of FireBall machines since their inception. The first were smaller machines intended for precise milling of electronic circuit boards. Those machines were too small for general use and demand for a larger working area eventually lead to the FireBall V90 CNC router.

PROBOTIX began reselling the V90 in 2008. Popularity and demand quickly outgrew production capabilities, and production gradually was shifted to PROBOTIX's facilities. By the end of 2008, PROBOTIX purchased John's company and machine designs, and the rest of the machine production was shifted to PROBOTIX's facility in Peoria, IL.



The Fireball V90

The Fireball V90 CNC router is an owner assembled kit that bolts together in an hour or two with common screwdrivers, allen wrenches and a 7/16 nut driver or wrench. Each part has been carefully test assembled several times to assure trouble free assembly and reliable operation for an end user.

To assemble the V90, you will need:

- 7/16" Nut driver and wrench
- 3/32" and 7/64" allen wrenches
- #2 & #3 Phillips Screw Driver
- Large Flat Screw Driver
- Acetone

The machine is constructed of Fiber Board, Acetal, PVC, and Industrial Urethanes. It includes high quality precision linear rails and acme threaded rods for precise and accurate production of parts in wood, waxes, plastics, foam, and many other softer materials. Gantry type routers are not intended to be a metal-working machines, but some users have had great success cutting and drilling thin soft metals, such as brass and aluminum, with the V90

The V90 is a computer controlled general purpose router tool positioning device. Anything you could do with one of these tools can now be done with better accuracy and repeatability than by hand.

The included tool holder is for a Dremel Model 300. It is recommended that the owner start with the Dremel until they are comfortable with the software and have had a chance to witness how these machines work and the forces in play when driving a tool through stock.

The machine has a footprint of approx. 25" wide and 27" depth with a height of 17". It weighs about 40 lbs. A motor will extend out from the front, side, and top of this adding about 5 inches and 7-8 pounds.

The V90 ships with a sample spoil board. The owner will need to be able to make replacement spoil boards periodically. The owner must also supply their own table fixtures for attaching material to be machined. Possibilities are endless, so it's left to the owner to decide how best to fix their material of choice in place. MDF with T-Nuts are recommended, but that will vary from application to application.

The base machine is offered for those who already have a motor/driver system. The V90 uses standard NEMA23 frame motors with 1/4" shafts. It will come complete with all needed hardware to attach the motors, including the shaft couplers and motors mounts.

Assembling the machine should be done on a scrap piece of carpeting or soft material to avoid scratching the painted parts. There are no greasy parts except for a light layer of oil in the bearings.

The machine should be loosely assembled only finger tight at first, making sure all sliding parts move well, while alternately tightening nuts gently. Nothing should be excessively tight...ONLY ½ to 1 turn past finger tight is all that's necessary. NO Power Tools should be used for assembly.

Lead screws go in last after making sure things move well. There will be some friction or "contact resistance" in the machine. That is normal, but shouldn't be excessive. Properly sized motors will have no problems with normal friction.

Reference pictures are available on the PROBOTIX web site.
http://www.probotix.com/manuals/V90/V90_manual.htm

As the machines are individually hand crafted, No two of them are exactly alike. The machines will perform exceptionally well with just a first time general assembling of them. But as with any machine, care and time must be spent to get the machine squared and trued, and dialed in perfectly. The owner may need to widen holes or place shims between mating surfaces to get it exactly right.

With the motors attached and test running of the machine, it should be very apparent where and how to do any desired "fine-tuning" of the assembly. Alternately adjusting nuts around the machine can bring it into near perfect squareness.

The table fixture heights can be adjusted to the tool height by use of paper shims under one layer of the owner provided fixture. Shims are a common method of alignment and adjustments on commercial and industrial machinery.

When all is aligned and adjusted, the machine will do exceptionally accurate and precise work, reliably, for a long time.

FireBall machines are the same ones used to make some of their own parts, and have been doing so for years.

The Motor/Driver System

The V90 is offered with or without the motors and driver system. The easiest way to get started is with one of the available motor/driver systems offered under available options on the V90 product page. The SideStep red motor kit is the least expensive kit that will drive this machine. The largest power supply that the SideStep kit can use is 32 volts.

The ProboStep motor/driver system is perfectly matched to the V90s 2-start leadscrews for maximum speed. The ProboStep kit can also handle the larger 40V power supply option, which translates to higher speeds and more torque.

The basic motor/driver kit is a user assembled kit that requires mounting and wiring, and possibly some light soldering. Instructions for wiring a motor/driver kit can be found here: <http://www.probotix.com/tutorials/1/>

Although many users enjoy the challenge of wiring the electronics, most prefer to have us do that work for them. Choosing the Ready-to-Run option will get you just that. We take all of the electronics and mount and wire them in a professional electronics enclosure. The cost of this includes the wire, connectors, fuse blocks, fuses, a power switch, and connectors - plus the labor to wire it all up. Because we buy in bulk, the cost of the materials alone is nearly what it would cost the owner to put together.

When choosing the Ready-to-Run option, we have two different enclosure sizes. The small enclosure can hold a basic 3-axis kit, but the large enclosure is needed if you want one of the power supply upgrades, or if you want to add a relay board for spindle control. The large enclosure can also hold a 4th axis driver for future upgrades.

Many people ask about the larger green motors for the V90, but they are just not a good match. The larger rotor inertia and higher inductance works against them in this application and machine speed will not be as much. The green motors are better suited for high torque, rather than high speed, applications, such as lifting the head of a square column mill.

What To Expect...

The Fireball V90 is a "Hobby Class" machine. It'll do amazingly fine work photoengraving in plastics or wood or it'll do general cutting of larger parts like clock gears. Many users produce PCBs and electrical panels with their V90s

The V90 is intended to be "Hacked" or modified to an end users application. It's a "base" machine that should be thought of as a basic mechanical positioning device for many, many possible end uses.

The design is simplified to make modifying easy and inexpensive with common hardware store materials. An infinite number of attachments could be created for work holding. Many different attachments could be made for the Z axis. There are truly endless possibilities for infinite uses and modifications and enhancements with quick interchangeability between them all.

Used within it's limitations, and kept indoors, the V90 should be trouble free and last for many years.

Getting Started

Those who are interested in the V90 are encouraged to shop around and study the many choices available. Depending on what someone may expect to use their machine for, there may be a better choice. Metal working, for example. There are many fine machines better suited to several specific tasks. It's best to do some homework beforehand and be sure of any decisions before making any commitments.

There are basically 3 steps needed to get up and running with a small home CNC router like the V90...

Mechanical Machine
Electronics, power supply, and motors
Software

PROBOTIX makes 1 and 2 simple and inexpensive matter.

Software is where the true learning of using any home CNC machine begins.

How It Works

The CNC machines we make use step motors. These motors are small and powerful little motors that turn the leadscrews precisely and accurately depending on how many pulses the motor receives from the computer.

A step motor is different from a regular motor with a free spinning shaft. The step motor we use has 200 positions of 1.8 degrees in a single 360 revolution. Use of "microstepping" can increase the positioning greatly.

One pulse from the computer will turn the motor one step. Fortunately modern computers and electronics can send, count, and time pulses, between all 3 axes simultaneously, fast enough to make the CNC machine fast and efficient.

The small motors combined with the leadscrews provide plenty of power to cut through hardwoods and dense industrial plastics with the appropriate cutting bits.

Though it all looks very complicated, it's actually very simple how it all works. A design is converted into a regular text file with lines of coordinates, via the use of software. The resulting "G-code" file can be opened and viewed in any text file editor. To do editing needs a program that doesn't add invisible character formatting, though. Notepad is a good editing application when the file size isn't too large. The Gcode files can be extremely simple or complex for specific commercial or industrial machines. Even a very simple file like...

X1
Y1
X0
Y0

...can be run by the CNC control software. That file would make the machine move into a perfect 1" square.

You can read more about g-code here:
<http://linuxcnc.org/docs/html/gcode.html>

The Gcode file is opened in a program that reads the file line by line, such as Mach3 for Windows XP, EMC2 for Linux machines, or Turbocnc for an old DOS machine. The correct number of pulses is calculated (at lightning speed), then the software sends a series of pulses to the "Driver" or "Controller" electronic card/board. The driver board then increases the power of the pulses to the motor to do useful work. Very simple!

Depending on the type of design being machined and the size of the file, it can take a few minutes or many hours. As long as everything is carefully assembled, adjusted and tuned, the process is precisely and reliably repeatable as many times as needed or desired.

EMC2 for Linux is free and readily available. Mach3 for XP is also free for up to 500 lines of code.

As being familiar with the "CNC control" software is where learning to make practical use of the V90 begins, anyone can get started immediately, and with zero costs, to begin to learn.

A small home CNC machine like the V90 in combination with the carefully chosen and proven electronics packages from PROBOTIX, simplifies getting started immensely. Model makers, jewelry designers, RPD applications, employee training, educational training, wood workers, small businesses, and thousands of home hobbyists, experimenters, inventors, all can benefit from having a small compact, reliable, simple machine that's capable of doing things nearly impossible by hand.

In the very near future, these machines will be the must have tool for most any home shop. The value of what they're capable of doing is immeasurable. And now they are finally affordable.

Probotix

<http://www.probotix.com/>

Fireballcnc Support Forum

<http://www.fireballcnc.com/>

Fireballcnc Yahoo Support Group

<http://groups.yahoo.com/group/Fireballcnc/>

EMC2

<http://www.linuxcnc.org/>

Mach3

<http://www.machsupport.com/>

Turbocnc

<http://www.dakeng.com/turbo.html>