

# Your CNC Evolution

News for Creative Evolution CNC owners

## More Parts or Less Time?

Accurate Pattern & Model builds prototypes of new products for visualization and sampling. In 1994, owner Bruce Williams was struggling with how to keep the shop busy. "How can I justify buying a new high speed control for my NC Systems mill when I have two CNC mills sitting idle?" Williams asked after losing a large job to a competitor. "I really like the idea of improving my productivity, but it won't do me any good without work to put on it," he said.

A review of the lost job revealed that if the work could be milled faster and more accurately, yet with a better finish as well, perhaps he could beat the competitor's pricing and make a profit too! One phone call to his customer changed Accurate's future. "Our customer said he'd prefer to give the business to us, but we had to compete on not only price, but delivery too. We put the challenge to the Creative Evolution CNC. Within a week, our old machine was performing beyond our expectations! We delivered the job on time. Our perspective for pricing and delivery has never been the same since."

"When the time came to add larger capacity in 1998, we looked first to Creative. With no new machines to offer, they recommended a Haas Evolution VF-6. It offered the large travels we needed with the performance of a Creative Evolution CNC, still at a low price."



Accurate Pattern's new HS-1100 continues their evolution into higher productivity

The future looks bright for Accurate Pattern with the recent addition of a new Strathclyde HS-1100 machining center featuring the Creative Evolution CNC. Premium machine design features are coupled with temperature controlled spindle cooling and premium Sony inductive measuring scales to deliver unparalleled accuracy.

Bruce Williams sums up high speed simply: "Before we could use all the productivity gains the Creative Evolution CNC could offer us, we first had to get our work done in less time. Today we deliver more work in less time than we could ever have imagined. Even 8 years after buying our first Creative Evolution CNC, we continue to evolve. It all began with taking that first leap of faith."



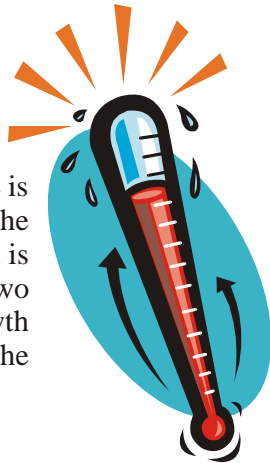
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# Thermal Stability is Key to Accuracy

*As speed increases, so can heat, distorting your machine*

For years, CNC machine owners and operators have known the key role that heat and thermal growth plays in machine accuracy. While the importance is fairly obvious, the source of the problem and how to deal with it is often more elusive. There are two main ingredients to thermal growth in most milling machines, the spindle and the ballscrews.



## Head and Spindle Growth

Ever notice how the head heats up when you run the spindle faster on your CNC mill? On most all machines with spindles up to 15,000 rpm, the faster your spindle speed, the hotter the head gets. Heat sources include the spindle bearings, belt and/or gear drive system, and the motor itself. The problem arises that as the head casting heats up, the spindle “moves” relative to the machine axes. Naturally, this creates inaccuracies in the work coming off the machine. Unfortunately, the head heats differently at different spindle RPM and under different load conditions, so the growth can vary widely. Still worse, the head of the machine does not generally grow parallel with the machine axes, but rather will distort out of square because of the head casting and webbing design.

Some machine builders nowadays circulate the machine’s coolant fluid through channels around the spindle cartridge, in an attempt to control the thermal growth. While this is a very cost-effective means to reduce the effects of thermal growth, it is often less than satisfactory. Rather than cooling the spindle, the coolant may warm up, failing in its attempt to stabilize the machine.

A more efficient means of cooling the head is a refrigerated closed-loop chiller system. Chillers are used on premium machines to keep the spindle and head temperature within a narrow range to maintain the highest accuracy. Chillers also provide longer spindle life by helping preserve the designed bearing preload. High speed spindles may circulate chiller fluid about just the bearings or just the motor windings. Ideally, both the bearings and motor windings should be cooled,

again to maximize both accuracy and spindle life.

## Ballscrew Growth

The faster we machine, the faster our ballscrews turn, heating them up. The basic turning in the nut causes heat, but additionally, the balls in the nut are preloaded, adding constant pressure that generates heat. The faster they turn, the more they heat. I once tested this on a small part that was less than 2” cubed. Over a test cut of just 20 minutes, the X and Y axes lost position by over 0.0020” each. To prove that this was simply thermal growth of the ballscrews, I allowed the machine to cool off for a couple of hours. Sure enough, my setup was once again within less than 0.0002” in each axis. In a similar, but more extreme case, a large Droop & Rein vertical mill was shown to lose Z position by over 0.0200” in under 20 minutes after the ballscrew was rebuilt. In an attempt to eliminate lost motion (backlash), the customer had preloaded the ball nut so tightly that the balls couldn’t work correctly.

Some machines today use ballscrew cooling in an attempt to control thermal growth of the screws. While this approach is an improvement, the machine system accuracy is still relying on the accuracy of the ballscrew and its drive system.

A better approach is the use of linear feedback scales. Rather than relying on encoders plus the thrust bearings and ballscrew integrity, linear scales simply measure the axis’ direct displacement from its saddle. Scales provide a true closed loop system, providing a measurement of the actual motion, not the assumed motion that should result from the motor’s position. The primary benefit to this closed loop system for high speed is that the scales are relatively immune to thermal growth.

One common claim is that the use of scales slows down a CNC machining center. While this is often true for competitors’ CNC’s, the Creative Evolution CNC suffers no performance loss when measuring from scales.



Sony Magnescales are more reliable than glass scales. The magnetized steel rods are impervious to contamination.

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*(Stability, continued from page 2)*

### **Accuracy And Scales**

Scales can make a CNC machining center much more accurate, especially as relates to thermal growth. Scales are not a cure-all for accuracy, however. The scales tell the CNC control where the machine axis is at any given time, but the CNC still relies on the motor, thrust bearing and ballscrew to move the axis into position.

For that reason, the machine must still be maintained in good mechanical condition regardless of whether or not it is equipped with scales. If a ballscrew becomes worn, the control will command motion, but the lost motion in the drive system (backlash) doesn't provide the expected response when commanded. By the time the linear scale shows motion on to the control, the ballscrew is "wound up," moving too fast to stop instantly. It now over-corrects, causing divots in the milled surface.

The point is to emphasize that scales do not make an inaccurate machine accurate. Rather, scales simply make an accurate machine more accurate.

### **Thermal Compensation**

Thermal compensation is a relatively new feature that is intended to correct for the inaccuracies produced by thermal expansion of machine components. In general, this feature is neither accurate or efficient. Thermal compensation requires testing the machine growth and calibrating it to your specific growth conditions. As an example, if your X axis shows growth on a particular program, you can add thermal compensation to correct for that growth. While this may be acceptable for production operations, the one-up nature of tool making renders this approach impractical. We seldom have the opportunity to make two parts the same, much less test each operation to see how much thermal growth results.

### **The Perfect Machine**

All materials grow and shrink with temperature changes. To get the best results from your CNC milling, first stabilize the temperature in your facility. Don't locate precision machinery near overhead doors or in line with heating and air conditioning ventilators. Then solve the issues of thermal growth with chilled spindles and linear scales. You can improve the accuracy of your work. In today's competitive marketplace, the quality of your work can help distinguish you as the "preferred source" for your customers!

## **What's New?**

Current software version 1.34e

Current manual version 1.34e

### **High Speed**

The Creative Evolution CNC's performance has been ahead of its time for nearly 10 years now. We are continually improving the look ahead and acceleration features to maximize productivity for you.

### **Probing**

We've added both touch and laser tool probe capabilities to your software, as well as part location probing. Your tools can be set more accurately and consistently. Your part locations can be automatically set and/or checked by routines working with a Renishaw part probe.

### **Diagnostics**

Software versions 1.33 and later support on-screen display of inputs and outputs, dramatically simplifying troubleshooting. In one recent case, a customer reported his spindle wouldn't turn on and his tool changer was inoperative. By displaying his I/O, the problem was quickly isolated to be a faulty "tool clamped" sensor. Within a half hour of the occurrence, the customer was back up and running by simply cleaning the dust-packed switch.

### **Linear Motor Support**

The Creative Evolution CNC is constantly evolving to provide more features and a higher level of productivity. Over the past year, extensive work has been done on support for linear motors, providing our most advanced customers with a new level of performance. Though linear motors aren't yet practical for most companies in the tooling industries, they show promise. The great benefits are the speed, acceleration, and reliability from the elimination of the ballscrew drive system.

### **Documentation**

We are continually working to improve the manuals for the Creative Evolution CNC. Recent improvements include additions to complex program examples, leadscrew compensation implementation, and error code descriptions for troubleshooting.

### **Upgrade Cost**

Software upgrades with 1 year support and new documentation sell for \$1,995. Quantity discounts are available for two or more control licenses.



Optional laser probes can check runout as well as length offset.

## Getting the most from your Creative Evolution CNC

Do you want to differentiate yourself from your competition? Show your customers how accurate you are with machine calibrations from Creative. We now offer laser machine calibration for your Creative Evolution CNC control (and others) using an Optodyne MCV-2002 laser with dual measuring beams. Measurements are accurate to 1 millionth of an inch over a range of 33 feet, and the laser is calibrated annually to ensure adherence to NIST standards (National Institute of Standards and Technology).

Our technician runs a program to move each axis in 1" steps. The laser system measures the actual results of each move and stores that measurement. The technician then enters a compensation table into the CNC control, so that it adjusts the motion within each 1" increment by that correction amount. Laser calibration can make your machine more accurate. You and your machinists will gain confidence knowing what you can expect from your equipment.

Laser calibration can't always make your machine as accurate as you want, though. Laser calibration can not make up for worn ballscrews and thrust bearings. On the other hand, laser calibration can show you where a problem area exists or is developing on your machine.

Call Creative Evolution and ask to set up your machine calibration visit to get the most accuracy out of your Creative Evolution CNC.

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## Out With The Old...

### ...In With The New

## Selling or Buying?

Are you thinking of updating your CNC capability? Or do you want to update your CNC department without the investment of a new machine? Either way, let us know. We offer a complete line of new high speed machines by Strathclyde, equipped standard with the Creative Evolution CNC. We can take your used machine on trade, or help you sell it to someone else who wants to get started with the higher performance a Creative Evolution CNC has to offer. Give us a call!

## Attention Haas Evolution Customers

A recent change in the design of new Haas axis amplifiers has rendered them incompatible with Creative Evolution CNC controls delivered prior to March of 2002. If you need service on Haas drive systems, be sure to call Creative Evolution first. A brief service visit can make your Creative Evolution CNC compatible with the new drive design. Failure to update your Creative Evolution CNC first can cause Haas amplifier failure and extend your down time.



The Optodyne laser system not only calibrates machine axes for linearity, but also offers "ballbar" tests to check contouring performance.

## Improve Your Old CNC

When we introduced the Creative Evolution CNC nearly 10 years ago, many customers elected to take the conservative upgrade path, adding the Creative on as a "co-exist" control. In this way, you could switch between the original CNC control and the Creative. Now the Creative Evolution CNC's performance and support is well proven. The weak link in the machine's reliability is generally the old control.

Get rid of the old control and get more from your Creative Evolution CNC. When you remove the old CNC, you gain spindle and tool changer control in the Creative Evolution. You can achieve a whole new level of performance through the freedom to optimize the machine to the Creative Evolution CNC control. Call for a quote. You'll be glad you did!