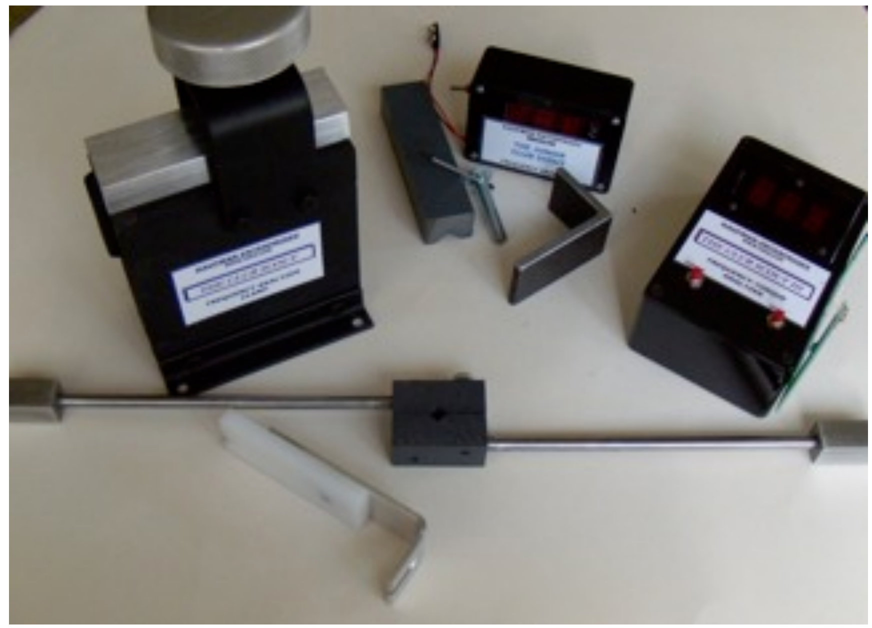
CLUBSCOUT OPERATING INSTRUCTIONS

General Background A frequency analyzer is designed to measure the stiffness of a shaft. The actual stiffness of a shaft is defined as E times I or just EI. E is Young's Modulus, basically what is the material, steel, wood? "I" is the moment of inertia of the shaft. By the term "I" we really mean the cross sectional shape of the shaft. For instance an I beam is stiffer than a flat plate even though both may be made of steel and therefore have the same value of E. Frequency is an indirect measure of EI. If a shaft is clamped at the butt end and a weight placed on the tip end you effectively have a cantilever beam. If you look at the equation for the natural frequency of such a beam, (see my Tech Note #1 on my web site, www.csfa.com) you'll see that frequency is directly proportional the the square root of ExI. There are, of course, other things in that equation that directly affect the frequency such as the beam length, a measure of the distance from the face of the clamp to the center of gravity if the weight on the end of the shaft. The weight on the end of the shaft also effects the frequency. To measure frequency you simply clamp the butt of the shaft and give it a twang to get it oscillating at its natural frequency. A frequency analyzer such as the CLUB SCOUT will time these oscillations and compute frequency since period of oscillation and frequency are basically reciprocals of one another.

THE CLUB SCOUT FAMILY The CLUB SCOUT family consists of four analyzers, the CSII, the CSIII, CSIV and the Jr.CS. They all operate in very similar fashions and their internal workings are virtually identical. The CSII just measures frequency. The CSIII measures frequency and torque. The CSIV is identical to the CSIII but will measure frequency to a tenth of a cycle per minute. This is a picture of the Club Scout III and Jr.CS. There is a Clamping Unit on the left and the CSIII Electronics Unit on the right. In the foreground are the accessories to measure torque. In the center toward the rear are the Jr. Club Scout components.

CLAMPING UNIT The Clamping Unit supplied with the CSII, III, and, IV is designed to rigidly hold the butt end of the shaft. It will clamp a raw shaft or a gripped club. It has a lower V block imbedded into the base. There is a free or floating V block which is placed on the top of the shaft. An upper U shaped bracket contains a slip clutch which applies the force to clamp the shaft between the two V blocks. When tightened, the clutch will slip with about 300 pounds of force on the shaft. To provide accurate readings the Clamping unit must be firmly mounted to a work bench and the bench itself must be reasonably solid. A loose clamp or wobbling of the bench will lower the frequency by one or two



cpm's. There is a movable back stop at the rear end of the clamp which is convenient for sorting out raw shafts

Electronics Unit The Electronics Unit is a separate box which is placed near the end of the shaft typically right behind the hosel. It's location is not critical. A sensor board is plugged into the side of the box. The board will be pointing upwards like a set of goal posts. The shaft will oscillate between these "goal posts." On the top of one end is an infrared light source, a pinkish device, and on the the opposite post is a black phototransistor.

A note of caution: Outside IR light sources such as sunlight coming through a nearby window or an overhead incandescent light, can cause the transistor to fail to see the passages of the shaft. You might not get any reading or a very low reading. An E1 might be displayed.

The unit is powered by a wall transformer which is supplied with the unit. It can be operated off of a 9 volt battery as well. A battery cable is available.

When measuring a raw shaft, it's tip end will line up between the two sensors. With a gripped club because of the taper of the grip, it will be below the sensors. The butt should be clamped so that about a 1/4" of the grip protrudes from the back end of the clamp since that's where the shaft ends inside the grip. With this adjustment the frequency can almost always be accurately measure even though the initial

alignment is a bit below the sensors. The grip will result in dampening and lower the frequency by about 5 to 7 cpm.

The Reset button simply clears the display so you're ready for another twang. I prefer to twang the shaft and then press reset.

The Club Scout IV has an additional push button on the electronics unit. When pressed, the display will shift one digit to the left. A reading of say 250 cpm might change to 49.8

when this button is pushed indicating the more precise value is 249.8. This is useful in finding the minimum stiffness plane of the shaft (more later).

The Club Scouts III and IV also can be used to measure the torque of a shaft. They include a small L shaped bracket which gets bolted to the work bench near the tip of the shaft and supports the shaft so it can only twist or oscillate in torsion.

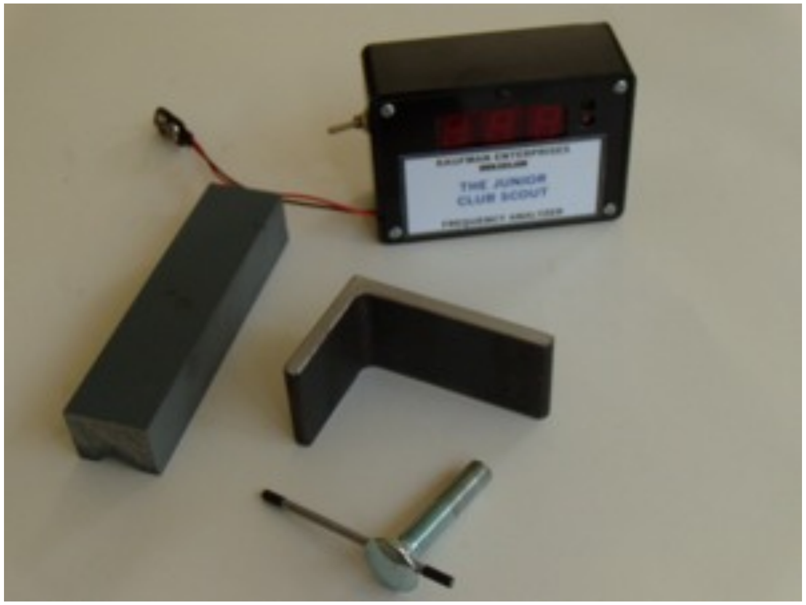
The other part (it comes folded up for shipping) is a torsion arm which looks like a set of barbells. Its central hub is clamped to the tip of the shaft in a horizontal position.

The Electronics Unit is placed directly behind one of the weights on the ends of the torsion arm. When one end of the torsion arm is tapped the shaft will oscillate in torsion. The Electronics unit will measure this torsional frequency of oscillation. When the Torque button is pressed, this frequency will be converted to torque. There is a mathematical relationship between the torsional frequency of the shaft, the moment of inertia of the torsion arm and the torsional stiffness of the shaft or its torque in degrees. For instance if you measure a torsional frequency of 366 cpm, you'll get a torque reading of 3.3 degrees. Pressing the torque button while taking normal shaft frequencies will give meaningless results.

THE JUNIOR CLUB SCOUT The Jr.CS is a low cost version of the Clubscout designed for the amateur clubmaker building only a few clubs. It consists of a simplified electronics unit which runs on a 9 volt battery and a few parts to make your only clamping unit. With a modest number of tools or access to them the a clamp can be fashioned very quickly.

The Electronics Unit uses a reflective sensor approach rather that beam break approach mentioned above. The upper right hand corner of the box contains a window with a IR light source and a phototansistor. The transistor senses the reflection of the IR beam off of the shaft. For non reflective shafts a small piece of reflective tape must be attached to shaft to get a reflection. The Jr.CS is more sensitive to outside IR light source so caution is advised. The on/off switch doubles as a reset switch.

The unit comes with an upper V block, an L shaped bracket and a T bolt. To build a clamp you need a 5" piece of hardwood with a 90 degree V notch cut into the top. This is easily done with a circular saw. A 5" pice of angle iron is glued into the V notch. The L bracket needs to have a hole drill in the lower or the longer portion of the arm. This hole is used to bolt the bracket to the side of the base. A hole must be drilled and tapped into the top of the bracket to line up with the center of the V notch in the base. The T bolt provided has a 3/8” x 16 thread. The tap drill needed is



5/16”. Of course you’ll need a 3/8” x16 tap as well.
The base can be mounted to your bench by attaching a couple of pieces of angle iron to act as legs near the bottom of the base. The picture may help clarify this process. Of course there are any number of ways to fashion a clamp. It should however be 5” long. Which is pretty much the industry standard.

Clamping pressure is not real critical unless you’re looking for some very precise results (unless you plan on zone profiling). From almost no clamping pressure to nearly breaking the shaft, a steel shaft will have a frequency change of about 6 cpm. Graphite will only change about 2 or 3 cpm.

Here’s rough rule of thumb for the Jr.CS clamping technique. If you grab the body of the T bolt between your fingers and tighten it on the shaft and follow this by about 1/2 a turn on the T handle you’ll get plenty of clamping pressure and good frequency measurements. With very little practice you’ll get very consistent results.

FREQUENCY MATCHING Building a frequency matched set is very straight forward. Deciding what the frequency should be is the art of club fitting. There are many books on that subject.

To begin with, you must remember, there is no standard or definitions of what the flex terms, Stiff, Regular, Ladies, etc. really mean. In an attempt to make some sense of this absurd situation, the Clubscout fitting chart at the end of these instruction sheets is based on data published by

Dynacraft, Golfsmith, FM Precision and Apache. It is somewhat an average of all these sources. These terms in the chart are for rough guidance purposes only. What's important is what the frequency is not whether you call it R or S. The slope of the chart is about 4 cpm per 1/2" which is typical of what most clubmakers feel works best. In other words the long iron will have a lower frequency than the wedge. This makes sense but there are clubmakers who take more of a flat line approach. This is your choice. My own feeling is the irons should have a sloped characteristics but woods should be much flatter. See the Tech Note on this subject on my web site.

Basically, building a matched set is an iterative process. You simply tip trim to get the frequency you want. To start the process, take the set of shafts and measure their frequency using a tip weight. First make sure they are all in the ball park. Then sort them in ascending order. The lowest frequency shaft will become the longest iron in the set and the highest the wedge. Start with the longest iron and dry fit the head to the shaft. To get the head to firmly attach to the shaft, use some sort of shim material, monofilament line or a small piece of the bubble pack material the head came it. Mark the butt end at desired length. Clamp the dry fit club with the cut off mark at the rear end of the clamp. This will result is several inches sticking out of the back end of the clamp. Measure the frequency. If you picked the right stiffness to start with, the frequency will be at or below the desired value. If it's low remove the head and tip trim the shaft which will increase its frequency. Remeasure its length and measure its frequency again. It will be somewhat higher. Repeat the process until you get the frequency you're looking for. You should be able to get within one cpm with at most three trimmings. Once you have tip trimmed the first one or two clubs, you can pretty much guess how much to trim on subsequent clubs.

If you have purchased raw shafts that are too stiff to begin with, there is nothing you can do to lower the frequency. You'll have to buy lower flex shafts. Most shaft manufacturers will give you an idea what the frequency is of their S, R etc. with a 205 gram tip weight.

SHAFT ALIGNMENT Spine aligning is what you do to a basically lousy shaft to make it perform better. Any rod whether it's an arrow or golf shaft has a stiffest plane, technically called the Principal Plane, (in a shaft it's called the spine or S1-S2 plane) and a weakest plane called the Neutral Plane (we call it the weak plane or the N1-N2 plane). These are planes, not sides, contrary to what you might hear. That means if you bend a shaft upwards one inch and it takes 500 grams, it will also take 500 grams to bend it downward one inch. This is basic physics (well maybe not so basic). These two planes are always exactly 90 degrees apart. See the Tech Notes on this subject for much more detail.

These two high and low frequencies are the two natural frequencies of the shaft. If you twang it in either of these two planes, only one of the natural frequencies will be excited and you will get what's called flat line oscillation or FLO. If you twang in between these two plans both natural frequencies will be excited and the shaft will wobble, sometimes very severely if there is a large difference between the two frequencies. The CSIV with its 0.1 cpm resolution makes it easier to find these planes. A laser attachment accessory is available facilitate the location of the FLO planes.

To align a shaft find the low frequency plane and mark it with a grease pencil. When installing the head, align this plane in your swing plane, called the 9:00 - 3:00 plane. A minority opinion is to align the strong plane in the swing plane. Tests I'm familiar with indicate the weak plane is better. Random alignment is the worst of course. Having said all that, I think it's best to buy shafts that are uniform and alignment is not critical. There are shafts out there like that, such as SK Fiber.

ZONE PROFILING Graphite shafts have become very customized as to their stiffness profile. Extra wraps of pre-preg placed on various portions of the shaft can dramatically change its playing characteristics. Two shafts can have exactly the same overall butt frequency and yet have totally different playing characteristics.

The stiffness profile can be accurately measured by a process called zone profiling. The process is pretty simple. It has been standardized by the PCS. Clamp a shaft so 41" is sticking out from the clamp (37" for an iron shaft). Since wood shafts are typically 46" long you will automatically have a 41" beam length. A 454 gram tip weight is attached to the tip. It has a through hole so it is flush with the tip of the shaft. The frequency is measured. The shaft is now slid 5" deeper into the clamp and the process is repeated until the beam length is down to 11". The 7 data points, if plotted will look like an exponential increase in frequency. Two shafts may start out at the same frequency but at 11" they may be dramatically different. For instance one shaft brand might have a 41" reading of 180 cpm (due to the heavy tip weight) and an 11" frequency of 700 cpm. Another brand might have measurements of 180 and 850. These two might both be labeled R flex yet they will play totally different. One is designed for the slow swing with a slow tempo and an early release. The second is for the quicker tempo with a very late release. That is not to say one shaft is better than the other they are just designed for different swings.

The only way to really determine the true characteristics of shaft is to profile it. The Club Scout II, III, and IV are ideally suited for zone profile. Two accessories are needed, the 454 gram tip weight and an upper V block to clamp the narrow diameters near the tip of the shaft.

When you get down to 16" and 11" a small block about 3/8" to 1/2" thick will have to be placed under the Club Scout Electronics Unit to raise it up to more closely align it to the sensors. The CS Jr. will require a pretty solid clamping system to get precise results.

SUMMARY The Club Scout family of frequency analyzers will give the clubmakers information about a shaft allowing precise building of a of club. I would suggest you read the Tech Notes on my website and these instructions. All of my analyzers are guaranteed for life (mine not yours). There are number of accessories available for the Club Scout analyzer. Access the web site for details.

I will make any repairs free of charge unless you just might happen to run it over with your car. If for any reason you are unhappy with it, you can return for full refund within 90 days.

KAUFMAN ENTERPRISES
S68 W20768 STONECREST RD.
MUSKEGO, WI 53150
262 679 3179
john@csfa.com
www.csfa.com

Made in the U.S.A.