case study

Haydon kerk Motion Solutions

Accuracy of Measurements Rely Heavily on the Precise Movement of the Rail

RGS helps Diamond Analyzer achieve Dazzling Accuracy

"Repeatability is absolutely essential."

– Kurt Schoeckert,
GemEx Co-Founder

Most people are familiar with the four "C's" that help determine the quality of a diamond: Clarity, Carat, Color and Cut. These standards are commonly accepted as the determining factors for identifying a superior diamond. The problem is, the traditional 4C information does not in actuality help separate a superior diamond from a diamond of inferior appearance. What makes a diamond beautiful and eye catching is the way it plays with light, otherwise referred to as Light Performance. GemEx Systems, Inc., a company committed to applying the latest in digital optics technology to the worldwide diamond industry, understands this concept. GemEx explained:

"Three of the 4 C's - Color, Clarity and Carat weight have very little effect on the appearance of the diamond. These 3C's determine the rarity of the diamond. The fourth C, Cut, does affect the appearance, but it is not well-defined and it ignores the light characteristics of the diamond material. Even so-called "ideal cut" diamonds do not guarantee you great light performance... to experts and consumers alike, light performance is the overwhelming factor that determines diamond beauty."

Not satisfied with simply educating the public on the importance of light in a diamond's make-up, GemEx Engineers created a sophisticated instrument called the BrillianceScope™ Analyzer. Developed and patented with substantial venture and angel funding, the BrillianceScope Analyzer is an imaging spectrophotometer that measures the ability of a diamond to refract and focus light. Using complex optic technology, the device measures three types of light returned through its crown: white light (sometimes called "brilliance"), colored light (sometimes referred to as "fire") and scintillation (commonly known as the "sparkle"). Superior performance in any one of these light categories will yield a beautiful diamond; the choice of the four C's is made between the diamond professional and the consumer.

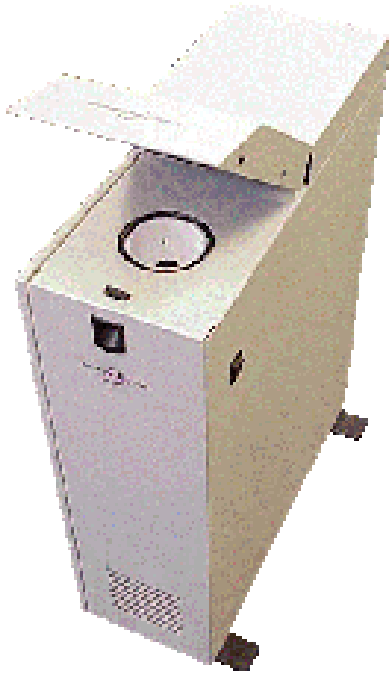
USA: +1 267 933 2105 **EUROPE**: +33 2 40 92 87 51 **ASIA**: +86 21 5763 1258 • www.**haydonkerkpittman**.com

Haydon kerk Motion Solutions PITTMAN

AMETEK ADVANCED MOTION SOLUTIONS

> "...had to reside in the exact same five spots every single time we run an analysis."

– Kurt Schoeckert,
GemEx Co-Founder



The BrillianceScope measures the diamond in a controlled lighting environment consisting of multiple lighting angles. To initiate the evaluation process, the gem is placed within a three-inch integrated sphere with a one-inch hole in which the diamond is firmly positioned. If you draw a direct line from the 2.5-inch ring light through the one-inch hole directly to where the diamond rests, an angle of light is created.

After measurements are made at this initial angle, the ring light is repositioned at five different pre-set areas, each one a fixed amount closer to the diamond to create a slightly different angle of light. This movement is achieved via a motion system consisting of a stepper motor attached to a rail, on which the ring light is situated.

As one might expect, the accuracy of the measurements relies heavily on the precise movement of the rail. The smallest level of inaccuracy in the motion of the arm can affect the angle of the light and, as a result, the final analysis of the diamond. Thus, repeatability is absolutely essential.

"We had to be very accurate in where the rail stops," explained Kurt Schoeckert, GemEx Co-Founder and a Mechanical Engineer who was instrumental in the design of the BrillianceScope. "Because of its comparative scale, the diamond had to reside in the exact same five spots every single time we ran an analysis. Without this precision, the device's accuracy would certainly be called into question."

Playing an integral role in the motion system's meticulous performance is a lead screw assembly from Haydon Kerk Pittman (HKP). The lead screw is integral in each of the five movements that the ring light makes; in fact, it helped the BrillianceScope achieve a repeatability factor of +/- 5 percent, more than sufficient to ensure the validity of the test results.

The Lead Screw was not part of the machine's original design. In order to create the necessary movement, Schoeckert had designed his own "homegrown" system – an assembly constructed from a U-shaped piece of sheet metal, a 3/16-inch diameter drive screw, and a power nut with two bearings on the end of it. Unfortunately, this first iteration did not perform up to GemEx standards.

What's more, HKP's proprietary Kerkote® TFE coating was developed specifically for its lead screw and nut materials for maximum self-lubrication.

"Our ScrewRail helped GemEx save space, and eliminated the device's existing offset rail," said Jim Bostwick, HKP's Director of Sales, Americas, who was involved in the GemEx project. "More importantly, it provided the device with a much smoother, repeatable motion, which is exactly what they were looking for."

GemEx used the assembly for a couple of years before turning to HKP for a slight redesign, after experiencing some minor issues where the ring light cantilevered off of the ScrewRail. The drive nut/bushing would rock on the screw as a result of some extra clearance in the system. HKP showed GemEx its RGS® Slide with an extrusion that prevented the rocking action, further enhancing the stability of the device and, subsequently, its accuracy.

"The RGS was able to do a better job of resisting the rocking motion," said Bostwick. "It created the increased rigidity and reduction in torsional play that GemEx needed to ensure that the light that shines through the stone stays absolutely still."

"It wasn't very robust, and we also had other problems like backlash, recalled Schoeckert. It became clear that we'd have to identify a more accurate alternative." While reading a machining trade publication, Schoeckert happened upon an editorial piece on HKP Products. One thing in particular caught his eye. "I noticed that HKP specialized in small drives," he said. "Most of these motion drives are quite large, and obviously our device gave us limited space. Short of completely redesigning a custom drive, we found nothing else that looked like it would work in this application, so we gave them a call.

HKP subsequently provided GemEx with a ScrewRail® assembly consisting of a drive screw, with a concentric rail, a combination nut and bushing, and a support positioned on the end. On the ScrewRail end support, HKP provided 6-32 threaded mounting holes, after which GemEx simply ran the ScrewRail through a base. The HKP products delivered a wear compensating unit with low drag torque and high axial stiffness.

Schoekert added, "The motion of the rail was about as smooth and precise as it can possibly be. If there were any problems with the readings from one of our BrillianceScopes, we would immediately look to some other aspect of the device. We're confident that the rail system is the most efficient part of the machine."

GemEx evaluated literally thousands of diamonds to determine the range of light performance achievable, and these numbers were directly applied to form the foundation of GemEx's Comparative Light Performance Evaluation Scales. Scales are simple linear graphs that show how a particular diamond performs in relation to the entire performance range.

Using the BrillianceScope, GemEx was able to determine how any diamond rates against the best diamonds in the world. There are currently about 160 BrillianceScopes out in the field, located in facilities where the diamonds are being cut and the quality level of the gems is being established and maintained. Many of them are located in such exotic places as China, Romania, Israel and Bombay. While GemEx retains ownership of the machines, the cutting facilities perform the actual analysis, which are incorporated into a report that are sent to some of the largest diamond retailers in the United States. These reports – which are the actual product that GemEx sells – help retailers maintain standards of their benchmark diamonds. For instance, Kay Jewelers uses the reports for its well-known Leo Diamond®, ensuring that all of the Leo Diamonds it sells match up to the quality standards that had been set long ago.

After cutting and polishing the diamonds, the diamond cutters place the gems on the BrillianceScope for analysis. If the quality level is acceptable for that particular diamond brand, it is packaged up and sent to the retailer; if it isn't, the diamond is reworked until the standards have been achieved.

That bodes well for anyone who is considering the purchase of a diamond. In fact, thanks to the BrillianceScope – and its accurate measurement, courtesy of HKP products– customers can expect another "C" upon purchase: contentment. ■