

**One Stop Shopping for Mission Critical Quartzware and Consumables  
for the Semiconductor Manufacturing Industry!**

Introducing Quartz Unlimited's

# Hub & Spoke

Operational Methodology

**This is how we get things done!**



[www.quartzunlimited.com](http://www.quartzunlimited.com)




Quartz Unlimited, LLC, using a Hub and Spoke business model, brings you not only one-stop shopping for Mission Critical Quartzware and Consumables, but ensures:






- **SECURITY, CONFIDENTIALITY & DOCUMENTATION CONTROL**  
Once the NDA is executed, project drawings and documentation are reviewed by QU engineering, broken into operation-specific modules, redrawn, encoded, and shared with our partners on a need-to-know basis. No confidential information ever reaches our partners—not your name, not your part number, not your full product specifications.
- **FLUID PRODUCTION CAPACITY**  
Because we've made it our business to partner with the very best in each manufacturing process, QU is very agile. Workloads can be easily divided between multiple, qualified partners. Thus, we are able to quickly expand or contract manufacturing operations, readily adjusting our manufacturing capacity to meet changing market demands.
- **STRICT QUALITY CONTROL**  
Quartz Unlimited QC engineers oversee and control quality at each stage of the production process. They are poised for immediate response to quality or manufacturing problems, providing solutions before cost overruns and delivery delays occur.
- **TIGHT COST MANAGEMENT**  
Traditionally, cost estimates are a hazy combination of experiential data, optimism, and wishful thinking. QU estimates are extremely accurate, as each of our partners estimates costs for their particular operation. These specialists know their manufacturing costs; know their business.
- **JUST IN TIME DELIVERY**  
Since each of our partners performs a very specific operation, delivery scheduling is accurate and easily managed.

Take a closer look at our process and capabilities.



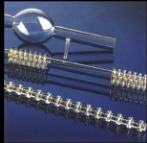


Process	General Capabilities	Core Competency & Differentiating Unique Capabilities	Materials Processed
<p>Engineering</p> 	<p>A talented and experienced group of engineers, with diverse experience, provides consulting, engineering, and design services. We employ only the most up-to-date, reliable, and sophisticated computer technology throughout our engineering group.</p>	<p>Broad range of knowledge and experience turns concepts and/or drawings into viable, operation-specific, security-encoded parts and specifications. Capable of handling fast-tracked prototypes and evaluation parts.</p>	<p>All</p>
<p>Drafting</p> 	<p>Our highly-educated and experienced team provides drafting services, utilizing the latest engineering and designing software. We operate around the clock, in three shifts.</p>	<p>Super fast creation of pinpoint accurate 2D and 3D drawings in any format.</p>	<p>All</p>
<p>Materials</p> 	<p>Materials for each and every part are purchased only through authorized, qualified distributors.</p>	<p>GE, TOSOH, ShinEtsu, Corning, Schott Glass, SaintGobain &amp; others.</p>	<p>All</p>


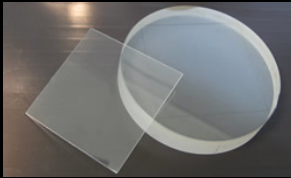



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<p>Laser machining</p> 	<p>Laser drilling, cutting, marking engraving and contouring. Digitally-controlled CO<sub>2</sub> lasers in a multi-axis motion system for drilling and cutting. Laser and scanning optics for micromachining and engraving. Capabilities also include annealing and ultrasonic cleaning.</p>	<p>Laser Micromachining for patterns and channels in substrates. Proprietary Laser Polishing technology enhances the mechanical resilience of quartz wafers edges. Large volume capacity with absolute repeatability to meet "Copy Exact" requirements.</p>	<p>Fused Quartz Fused Silica</p>
<p>Machining</p> 	<p>Diamond machining a variety of features into quartz and other hard to process materials. Located in a 12,000 square feet facility, this partner employs multiple shifts, as needed.</p>	<p>Experienced work force processes parts with zero tolerance and JIT delivery for major industries, as well as government, and defense contracts. Extremely sophisticated processes and quality control instrumentation.</p>	<p>Fused Quartz Fused Silica Pyrex, Borofloat Borosilcate SodaLime BK7, B270</p>
<p>Machining</p> 	<p>Diamond machining for fragile and exotic materials, as well as various grades of glasses. Operating in an 110,000 square feet facility with employees working in multiple shifts.</p>	<p>Over twenty five years of experience of working with quartz and similar materials. This partner is a high volume producer.</p>	<p>Fused Quartz Fused Silica Pyrex, Borofloat Borosilcate SodaLime BK7, B270 Sapphire Silicon</p>





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<p>Water jet cutting</p> 	<p>Precision cutting for a variety of materials, including glass and similar hard-to-cut materials. The Water Jet process cuts with unprecedented precision and speed.</p>	<p>Unique five-axis cutting head moves from straight-line to angle cuts with precision and ease.</p>	<p>Fused Quartz Fused Silica Pyrex, Borofloat Borosilcate SodaLime BK7, B270 Sapphire Silicon</p>
<p>Slicing</p> 	<p>Single crystal SAW wafers and other crystalline products.</p>	<p>Able to produce wafers as thin as a few thousands of an inch with extremely smooth surfaces. Equipped to diamond wire cut quartz and other exotic materials when quality is critical.</p>	<p>Quartz Silicon Sapphire Ruby Lithium Lithium Niobates Tantalate Langasite</p>
<p>Glass blowing</p> 	<p>Glass blowing, design, engineering and production.</p>	<p>Computer-controlled glass blowing capabilities for ultra-precision glassware.</p>	<p>Quartz Borosilicate + more</p>



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<p><b>Polishing</b></p> 	<p>Cutting, machining, grinding, single- and double-sided lapping and polishing. This partner facility (over 35000 square feet) houses the latest sophisticated equipment and maintains a work force operating in multiple shifts. Highly-organized infrastructure with advance communication and e-commerce capabilities.</p>	<p>Accommodates large diameter plates up to 1250 mm x 630 mm and surface finishes to 0.5 <math>\mu\text{m}</math>. Equipped with advanced, sophisticated instrumentation for process and quality control. Employs traditional instrumentation and an Interferometer, an Autocollimator and a Spectrophotometer in their arsenal to ensure the quality of their product.</p>	<p>Fused Quartz Fused Silica Pyrex, Borofloat Borosilicate SodaLime BK7, B270 Calcium Fluoride <math>\text{CaF}_2</math></p>
<p><b>Surface Finishing</b></p> 	<p>Near-perfect surfaces are produced using a technology that has been fine-tuned to the nanometer.</p>	<p>This technology produces super smooth surfaces, with an attainable surface flatness of approximately 6 nm, peak-to-valley, or <math>\lambda/100</math>.</p>	<p>Quartz Pyrex Fused Silica SodaLime Borofloat BK7, B270 Calcium Fluoride <math>\text{CaF}_2</math></p>
<p><b>Sputtering</b></p> 	<p>Process capability includes DC and RF magnetron sputtering. Wafers and other substrate materials up to 12 inches in diameter are coated under tight controls in a clean room environment.</p>	<p>Equipped to cooperate in fast-tracked process development. Prototype and small production capability.</p>	<p>Silicon Alumina Quartz Aluminum Nitride Beryllium Oxide</p>



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<p>Parts Cleaning</p> 	<p>With years of industry experience behind them, our partner provides cleaning, reclaiming, and packaging service to SEMI Class100 &lt; 10 level for parts used by the semiconductor industry.</p>	<p>Fully-qualified, SEMI grade cleaning of parts for the semiconductor industry.</p>	<p>Quartz Silicon</p>
<p>QC &amp; Certification</p> 	<p>Digitizing, first article inspection, 2D and 3D contour and statistical analysis, fixture inspection and verification.</p>	<p>This partner team supports quality control at every imaginable level.</p>	<p>Any that fit into a 6 ft x 6 ft cube.</p>

## THE WAY WE DO BUSINESS

Quartz Unlimited, LLC's organizational and operational model is based on the Hub & Spoke business model, now employed worldwide by leading organizations, such as FedEx. Our objective is to eliminate problems that naturally arise in a traditional subcontracting arrangement. When a subcontractor hires other subcontractors, the management of material and information flow can become very complex. That complexity often is the source of price, quality, and on-time-delivery problems. Our Hub & Spoke operational methodology allows us to establish a One-on-One working relationship with each of the contributing partners. This eliminates complex interactions between subs and inherently negates communication, cost-overrun, quality, and delivery problems.

Every single process in each multi-phase manufacturing process is handled by QU (the Hub) and one of our partners (the Spokes). It is simple and straight forward. Consequently, higher demands on production capacity and expanded diversity in product lines increase *only* the volume, and not the complexity, of our processes.

In practice, each of our partners (directed by members of the QU team) simply performs: each in their area of specialty, each to the best of their considerable ability. When the finished product ultimately emerges, it is the sum of the best efforts of all of the participants. The model is a sound foundation for dynamic and manageable operation and growth.

The key factor to the successful execution of the Hub & Spoke model is a Hub company that employs people with up-to-date knowledge and broad experience in related industries. The founders of QU, Ferenc & Adam Ledniczky, have over twenty-five years of industry-wide experience in engineering, manufacturing, and management. Their forwardlooking mindset keeps them current with the latest computer and communications technologies.

Their combined knowledge and experience give them the understanding and abilities need to manage a sophisticated, modern infrastructure in a worldwide arena. And that infrastructure securely provides Quartz Unlimited customers with the highest-quality products: in the volumes they need, just in time to meet production requirements.

