

# ULVAC

A Community Magazine of ULVAC Group



No. **65**

**EXECUTIVE GUEST ● Production Technology to Realize Stable Product Supply Leads the Way to the World's Largest Market Share**  
— Murata Manufacturing Co., Ltd.

**LIVING & ULVAC ● Increased Freshness and Nutrition Through Vacuum Technology**  
— Tescom Denki Co., Ltd.

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— Standardization and High-Mix Low-Volume Production in the Rapidly Growing Module Business

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Cover Photo: “Jewel Beetle”  
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# Production Technology to Realize Stable Product Supply Leads the Way to the World's Largest Market Share

— Standardization and High-Mix Low-Volume Production in the Rapidly Growing Module Business



**Guest: Mr. Norio Sakai**

Fellow, Communication and Sensor Business Unit  
Murata Manufacturing Co., Ltd.

**Interviewer: Mr. Hisaharu Obinata**

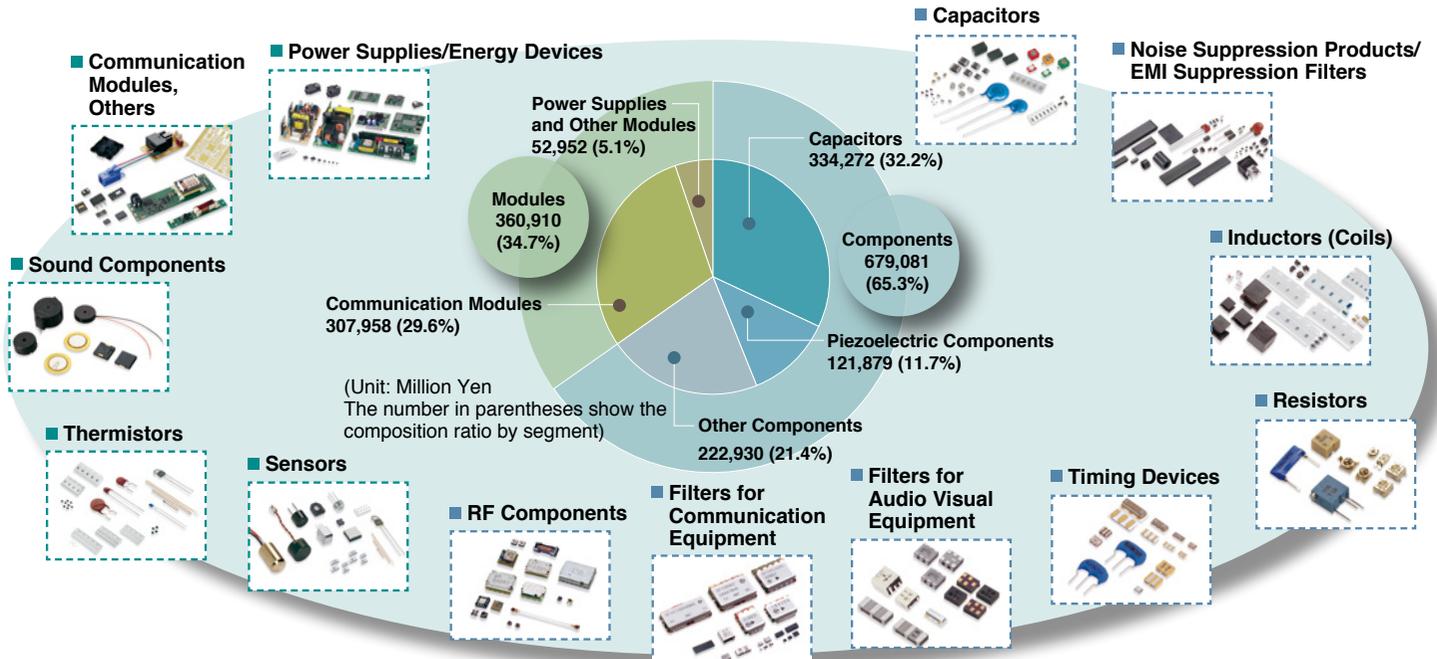
President and CEO, ULVAC, Inc.

Murata Manufacturing Co., Ltd. is one of the world's leading manufacturers specializing in electronic parts such as multilayer ceramic capacitors, communication modules, and sensors. It recorded its highest consolidated sales of over one trillion yen in FY2014. Its production technology and product development capabilities are the sources of its continued high-level business results. The production technology realizes low cost, high quality, and a stable product supply, while the product development capabilities allow advanced solutions to market needs to constantly be offered as well as the introduction of products matching such needs. The communication module business for smartphones is the most prominent example of their product development capabilities. For this issue's "Executive Guest" Hisaharu Obinata, President and CEO of ULVAC, Inc., visited Mr. Norio Sakai, Fellow, Communication and Sensor Business Unit, from Murata Manufacturing Co., Ltd. and asked him about the roles of production technology and process development as contributing factors for these good business results.

\*Personal changes on July 1, 2015

\*All product trademark notices are omitted in this document.

■ **Figure 1. Murata's product lineup and sales breakdown**  
(consolidated accounting period from April 1, 2014 to March 31, 2015)



## Production Engineering Division as a Part of the Research and Development Division

**Obinata:** Before we start, I would like to take this opportunity to express our sincere gratitude to Murata Manufacturing (“Murata”) for our long-term business partnership. Thank you.

Now, Murata is a manufacturer specialized in multilayer ceramic capacitors and piezoelectric materials. Many of your products dominate the global market. Meanwhile, your smartphone modules and fine electronic parts, using advanced materials technology, are further expanding your business.

Mr. Sakai, you are responsible for the module technology, so let me ask about the module-related process development and production technology. For our readers, Kazuya Saito (Executive Director and the head of the Research and Development Planning Department), Directing Manager of our Research and Development Department, is also joining us today.

Which divisions are involved in production?

**Sakai:** For the most part, the same divisions as in any other company—general administration divisions such as the Human Resources and Accounting Divisions, business divisions such as the Component, Device, and Module Divisions, the New Business Division in charge of new businesses, divisions in charge of new products, and the Sales Division.

What makes our production unique is the Research and Development Division. While most research and

development divisions focus on fundamental research on materials and such, ours has a Production Engineering Division. The Production Engineering Division has approximately 1,000 employees.

**Obinata:** That’s a lot! When did the Production Engineering Division become the part of the Research and Development Division?

**Sakai:** About 15 years ago.

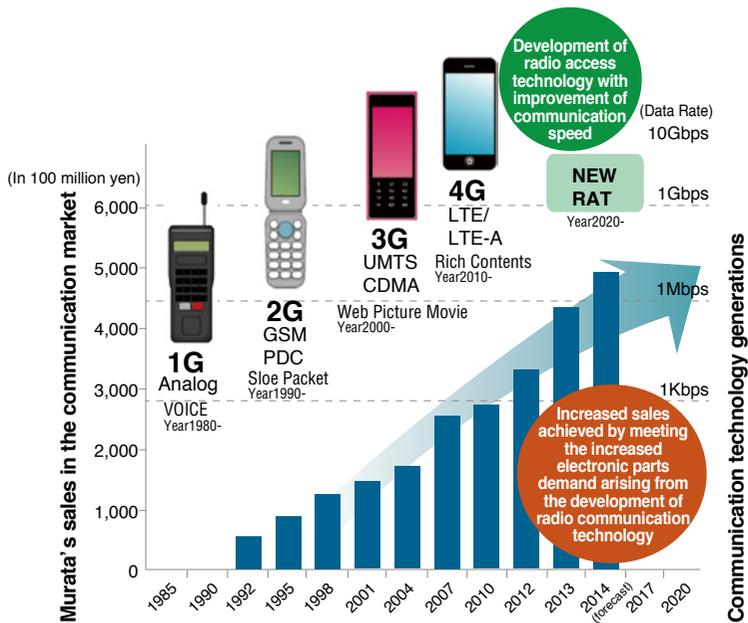
Murata is originally an electronic parts manufacturer that processes materials, so it used to place importance on electronics and chemistry but not as much on machinery. This changed when Akira Murata, the founder became the president. He placed the highest importance on production engineering and positioned it as a type of research and development. He said, “We are making our own materials now. In order to differentiate us from competitors, we should also make our own production equipment.” The production engineers now support production from the Yasu Office.

**Obinata:** Mr. Murata was far-sighted.

**Sakai:** Since the semiconductor business is a major business, many manufacturers like your company sell production equipment. While thin films are produced in the semiconductor business, we produce thick films. Since thick film production is such a small market, there was almost no production equipment on sale. A manufacturer in the Chukyo region used to produce it for a while, but the company was gone before we knew it.

What it came down to is that we had to make it ourselves. This is the background of in-house development as I know it.

■ Figure 2. Communication technology generations and sales in the communication market



The Production Engineering Division is now a part of the Research and Development Division, and we all understand that it is the combination of materials and production equipment that constitutes the essential part of manufacturing. This understanding drives Murata’s development.

### Emergence of Smartphones and Rapid Module Business Expansion

**Obinata:** As I said at the beginning, your sales are increasing in both the material and module businesses. Recent module sales are as high as the sales for multilayer capacitors, which are Murata’s signature products.

**Sakai:** Communication module sales are increasing rapidly with the spread of smartphone use. Capacitors account for 32.8% and communication modules account for 30.8% of recent sales.

We were always told that modules were not profitable and left the module business untouched for a long time. Around 2000, mobile phone motherboards were made with single-chip components known as discrete components. Modules were hardly used.

At one point an assembly manufacturer said to us, “We will not use your modules” and “We would go out of business if we used your modules.”

The situation changed as mobile phones became multifunctional and smartphones emerged. The use of modules started because discrete component designers could not meet the requests for super-fine, multifunctional, and highly functional single-chip components. Market needs for integrating these features into a module arose.

### The “Customer Needs First” Development Policy

**Obinata:** As represented by the corporate philosophy “Enhance technologies and skills, apply a scientific approach, and create innovative products and solutions,” Murata’s development is far-sighted and is based on the corporate spirit carried on since its foundation. Would you tell us what makes your development unique?

**Sakai:** As a ceramics manufacturer, we created new products through materials engineering. As time passed and our operation spread to electronic and communication technologies, however, we started to develop new products for these fields. Our strength is creation of new products through integration of all these technologies.

**Obinata:** And so you’re able to produce such successful products because the new products come into being when technology seeds meet technology needs. Whereas focusing only on the seeds tends to result in development that is nothing more than self-gratification.

**Saito:** I heard that you make technology roadmaps to develop products systematically. How does making these roadmaps translate into viable business?

**Sakai:** Development does not always go as planned. A few years ago, our current president Tsuneo Murata defined the most important business philosophy as “continued provision of value which leads to customer satisfaction.” What customers want is more important than what we want to provide. I believe that meeting customer needs is the key to the Development Division creating products that contribute to our business.

**Obinata:** I have been saying the same thing to my employees. I am now proposing regular technical exchanges with our customers to discover their needs.

**Sakai:** The purpose of a technical exchange is to understand customers’ concerns and learn new ways to do things instead of simply going over a technical roadmap with them. Face-to-face conversations should allow issues that did not get solved at events like an exhibition to be identified.

**Obinata:** That’s why it is so important to exchange opinions in person.

### The “Asobinin Kinsan” Team for a Free-Minded Search for Technology Seeds

**Saito:** Not only do we need to engage in short-term development to meet customer needs in 1 or 2 years, but we also have to prepare long-term development for product commercialization in 5 or 10 years. What is your company’s approach?

**Sakai:** Development designed to trigger innovation usually fails to produce the desired result, unfortunately. Our division has a team called “Asobinin Kinsan.” We used the



**Mr. Norio Sakai**

Fellow, Communication and Sensor Business Unit  
Murata Manufacturing Co., Ltd.

Born on March 1, 1958. Graduated with a Master's Degree from Kyoto University Graduate School of Engineering, Department of Mechanical Physical Engineering

- 1982 Joined the Production Engineering Division of Fukui Murata Manufacturing Co., Ltd. Developed manufacturing methods and equipment for multilayer ceramic capacitors and multilayer ceramic substrates.
- 1993 Joined the Yasu Division of Murata Manufacturing Co., Ltd.
- 2005 Took office as General Manager of the Package Engineering, Communication Business Unit.
- 2008 Also took office as General Manager of the 1st Manufacturing and Materials Engineering Division of the New Product Unit.
- 2012 Took office as a Research Fellow.
- 2014 Also took office as General Manager of the Functional Board Product Division of the Communication Business Unit and Director of the Engineering Group of the Communication Business Unit.

name “Kinsan” but it could be “Ginsan” or anything else for that matter. It is a team of selected employees—five from a group of 100 employees, for example. Those chosen are released from all of their work assignments. Whatever they have, they give it to other employees. Then, they use their free time to start something new. They can come up with anything and do anything. And it doesn't affect their work performance evaluation. After giving them some advice, we just wait until they submit a report. We never force them to do anything.

It is impossible to drive fundamental changes while working on regular assignments. Furthermore, speed is so important that we tend to only think of immediate

achievements. For this reason, I went so far as to create an assignment-free team. You need a team that spends the whole time playing around if you wish to have an innovative development.

**Obinata:** That sounds very encouraging to me. At ULVAC, we have come up with eight development themes for the employees to work on. This is a 3-year project, but I feel like we need more. Mr. Saito here and I have been discussing launching something like a future business project and a development team with a 10-year goal. The team would be free to come up with development themes and details with a 10-year vision.

**Sakai:** That sounds good. The important thing is who to choose. From my experience, I prefer someone who does not blend in to the organization much. Someone who thinks outside the box or wishes to win big money is good (laugh).

Someone who says “I don't want to do normal stuff” is a good candidate. Managers need to be able to identify these employees. You do not need to supervise them but need to check on them without pressuring them. It would be a disaster if you set them completely free. In any case, no one knows the future, so just wait and see what they do.

**Obinata:** I will keep that in mind.

## A Policy of Not Saying “No” and Fast Responses Expanded the Module Business

**Saito:** According to the data in a magazine that I read, your smartphone parts have high market shares; 60% for Wi-Fi modules, 35% for multilayer ceramic capacitors, and 40% for SAW filters. Other products also have very high shares. What is the secret?

**Sakai:** The secret is to get a hold of good materials before competitors. We had a high quality dielectric material called barium titanate (BaTiO<sub>3</sub>) for multilayer capacitors and lead zirconate titanate (PZT) for piezoelectric materials. We supplied them constantly, stably, and rapidly.

The same secret does not however apply to modules. Let me explain a little.

The first secret is never say “No” to the customers. This policy met a lot of internal resistance. Not saying “No” may be dangerous—there is a risk of us becoming the customer's slave. There is a fine line between becoming a slave and not. Another secret is speed. As I mentioned earlier, modules were not used much in mobile phones.

When smartphones became multifunctional and highly functional, discrete components could no longer meet the requirements. When the customers asked us for a solution, we immediately introduced our modules. We met our customer needs quickly and repeatedly, and this I believe led to the expansion of our module business. In the end, it may have been our speed.

## Authorizing Employees to Make Decisions is the Key to Fast Responses

**Obinata:** How did you get that speed?

**Sakai:** One of the reasons, I think, is our corporate culture that allows the employees to make decisions. An assistant manager or a team leader, instead of a general manager or manager, occasionally makes important decisions while meeting with the customers.

For example, we sent our best engineer to meet with a major mobile phone manufacturer in Northern Europe. You would think someone higher up like an executive officer or general manager would go, but in our case, an engineer who was not much of an English speaker went.

This made the engineers of the mobile phone company very happy. They respect the capabilities of the person instead of formality. They would say “You flew half way around the world all alone to meet us!? Let’s have a tech talk!”

Regardless of how big a company is or how important the project is, we send people who understand the product inside out. Important decisions are made without the presence of their bosses. This is where the speed comes from. Yet at the same time their bosses never say “I haven’t heard about it. No one reported.” I think we are good at communicating.

**Obinata:** English skills are definitely good to have, but successful communication with engineers relies on the level of technical knowledge. The engineers actively talk to the person with knowledge because they do not want to waste the opportunity to understand.

**Sakai:** At Murata, individual employees, irrespective of the organizational hierarchy, fully engage with the customers. This could be dangerous because important decisions are made without the knowledge of their bosses. But when you think about it, a manager with insufficient technical knowledge cannot make decisions on the spot until he/she talks to someone who understands. This is not efficient.

**Obinata:** I also believe authorizing employees to make decisions energizes a company. I want to build a corporate culture like yours quickly, but I do not have the guts you do.

## Work Environment with Open Communication and No Buck-Passing

**Saito:** Whether or not you can authorize the employees to make decisions depends on their skill levels. How do you educate them?

**Sakai:** Different types of customers appear in different business situations. They may be engineers, sales engineers, or cost managers. The level of staff communication determines if we can deal with them.

In my office, persons in charge of different divisions

work on the same floor and talk to each other freely. We have chosen not to be tucked away in an office, but we don’t schedule meetings either. Our thinking is that if you want to know or confirm something, you should do so on the spot. I believe that things go faster regardless of job titles if the staff members share necessary information. I would also like to emphasize that you should never blame someone else. Trying to locate the person ultimately responsible for a mistake intimidates the employees, prohibiting the company from improving. Managers must be most careful about any such accusations.

**Obinata:** Is this about your company? Or, is it only about your division?

**Sakai:** This is about my division. If this were a company-wide practice, our company would be a 10 trillion yen company by now (laugh).

## Unique Production Technology for Handling Large-Volume Orders

**Saito:** Recognizing the needs of major accounts early on is the key to increasing the market share. What is your approach?

**Sakai:** Identifying what the customer wants as fast as possible is the only strategy. Customers may not think too much about the price if you can successfully deliver what they want promptly. Being slow never works. Regardless of how great your products are, customer will not pay attention to them if you are slow. Generations change quickly particularly in the field of modules, and dual or triple sourcing occurs frequently. Therefore, you must always be the fastest one.

**Saito:** You are saying that you select who to send to customers based on their technical knowledge instead of job title to identify their needs as quickly as possible.

**Sakai:** That’s right.

When mobile phones were first released, they were



Hisaharu Obinata, President and CEO, ULVAC, Inc.

## Company Overview (as of March 31, 2015)

### Murata Manufacturing Co., Ltd.

Trade Name: Murata Manufacturing Co., Ltd.

Location of Head Office: 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto

Date of Incorporation: December 23, 1950

Common Stock: ¥69,377 million

President Statutory Representative Director: Tsuneo Murata

Murata Locations: Americas: 15, Europe: 14, Greater China and East Asia: 30,

Japan: 31 (except Murata Manufacturing Co., Ltd.),

Southeast Asia and South Asia: 15

Number of Employees: 51,794 (consolidated basis)

Function: Research, Production and Sales of Electronic Devices made from fine ceramics

Products: Monolithic Ceramic Capacitors, SAW Filters, Ceramic Resonators, Piezoelectric Sensors, Ceramic Filters, Piezoelectric Buzzers, Short-range Wireless Communication Modules (including Bluetooth® Modules), Multilayer Ceramic Devices, Connectors, Isolators, Power Supplies, Circuit Modules, EMI Suppression Filters, Inductor (coils), Sensors



manufactured by Motorola, and then manufacturers like Sony, Nokia, Samsung joined the competition along with several more Japanese manufacturers. Typically, production of a new product is dominated by one manufacturer at the beginning and later joined by others as the market expands. Accordingly, the order volume from each manufacturer decreases, allowing parts manufacturers to handle it without requiring a high production capacity. In the case of mobile phones, however, only a few manufacturers continued to dominate production despite the steady market expansion. It was the complete opposite of the typical pattern.

What happened was that the volume of a purchase order from a single manufacturer exceeded the capacity of parts manufacturers. Meanwhile, we had the manufacturing capability and production technology that met the manufacturers' needs. We also had reserves and were therefore able to start using production equipment that could handle the order volume. I believe that was an excellent decision our management made.

**Obinata:** So you were able to release the products at the right time, before anyone else, and provide a stable supply as a main supplier.

**Sakai:** We may not have grown this much if many parts manufacturers were involved and the purchase orders were smaller. I think we were able to demonstrate our potential because of the market dominance. The employees ourselves, including me, were surprised with what we were really capable of (laugh).

## Strict Standardization to Carry On High-Mix Low-Volume Production

**Obinata:** How long is the life cycle of a smartphone module?

**Sakai:** It's usually 18 months.

**Obinata:** Do you change the manufacturing equipment accordingly?

**Sakai:** We standardize the products to avoid equipment changes as much as possible. We do not change wafer processing equipment but make changes to the packaging equipment in order to meet customers' specifications.

**Saito:** You used the word "standardize." We at ULVAC often customize the products to meet customers' specifications but are not good at standardization. Would you tell us about your approach?

**Sakai:** It may sound like boasting, but I give lectures on standardization to the employees.

When I first joined the module business, I actually had a negative view of standardization. At one point, my boss scolded my group saying "Every time you develop a new technology, you cause confusion and lower productivity at the plant. Productivity would improve if you just didn't do anything." It is a bit strange that I am now an advocate for standardization.

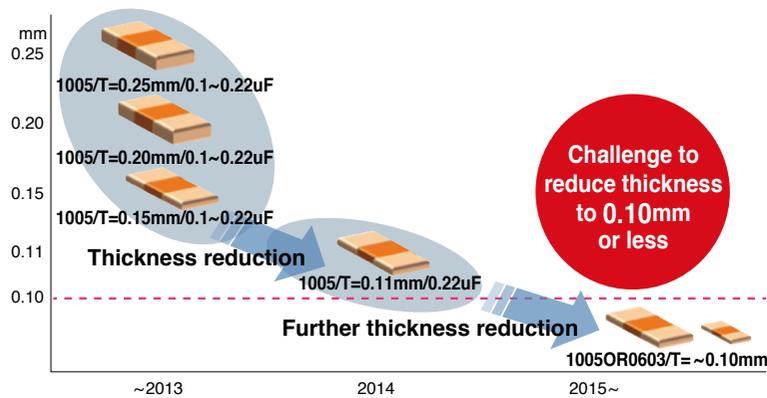
The reason why I changed was a big mistake that I made. Modules vary in size, and we used to produce them on a high-mix low-volume basis. When a few manufacturers dominated the mobile phone production, we received a large purchase order from one of the major manufacturers. You know, mass production gives production engineers a sense of achievement.

Blindly believing that we could mass produce mobile phone modules despite the general understanding that modules needed high-mix low-volume production, we built an exclusively designed mass production line. In a short while, however, the board shape and device changed as the mobile phone functions improved. The exclusive production line we built was no longer used. This bitter experience of wasting production equipment taught me that we must stick to high-mix low-volume production. That is how I started high-mix production with little changes to standardized equipment.

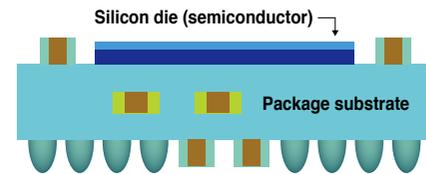
**Obinata:** You can implement far-sighted standardization because you are ahead of everyone else. If you were chasing after others and always trying to keep up with specification changes, you would naturally prioritize releasing products over standardization.

**Sakai:** I believe we should stick to high-mix low-volume production even when a small number of manufacturers dominate the market requiring mass production. We provide requested diversification and changes using peripheral

## ■ Figure 3. Miniaturization of embedded capacitors



## EXECUTIVE GUEST



- Contribution to downsizing of devices and improvement of the IC characteristics
- Use in smartphones, various types of ICs, and wearable devices
- Promotion of collaboration with IC manufacturers

technologies while keeping the core element standardized. We wait for 4 to 5 years before we make big changes to the equipment. We are patient until the time comes.

### Modules may be Further Integrated and Unified

**Obinata:** I was looking at 0.1 mm and 0.2 mm chips earlier in the lobby. While I was impressed, I was also thinking that if I sneezed I'd easily blow them all away. They are that small.

**Saito:** How much smaller do you think they will get?

**Sakai:** Someone will give up someday, but we must believe that humans have unlimited intelligence. Well, it'll stop somewhere though.

**Saito:** In the past, semiconductors were made on a large substrate and cut in small pieces. Now they are even smaller, and it is predicted that high-density packaging, in which a device is directly mounted on a substrate, will advance further in the future. How will miniaturization influence your products?

**Sakai:** Chips have been rectangular so far. In the future, "bending" or "odd shapes" may become the keywords. In terms of modules, we may receive a wide variety of requests from users who want to place them on an angled surface or in every available nook and cranny. The point of consideration will be how big a module should be to put together a selected range of functions.

**Obinata:** Sounds like we will need only one vendor in the future. It'll give you more of an advantage.

**Sakai:** It is impossible to pack all necessary functions into a module. Roughly speaking, current smartphones have four parts: a CPU as a brain, an LCD for showing images, communication elements for interaction, and a battery to provide power. Some of these parts are analog and some are digital, so they cannot be completely integrated. Functions may be integrated within these four areas, however. This leads to a dramatic decrease in the number of modules while at the same time requiring further chip miniaturization.

**Saito:** Miniaturization is our strength. We will be happy to help you in many more areas in the future (laugh).

### Speedy Responses to Promptly Meet Customer Needs

**Obinata:** Before finishing up, please let us know if you have any requests for us.

**Sakai:** That would be "speed." Only speed generates money. Our company grew because of it. We were able to demonstrate the value of speed, which is usually difficult to measure, by meeting our customers' requests. Speed makes a company better. Being fast is good.

**Obinata:** I completely agree. We must accelerate responses to customers as well as internal procedures.

**Sakai:** At Murata, requests for decisions are approved in as little as 2 to 3 days. This is a good result of delegating authority to make decisions to the employees.

It is like the company saying to the employees "Go ahead if you are in such a hurry!"

**Obinata:** One day I saw a document and was surprised with the number of seals of approvals. I made the employees halve the number of approvers. This tells me that we need a lot more improvement.

**Sakai:** Requests are checked more strictly when the economy is slow, of course. It is not that our employees are free to just do anything. I think it is that our executive officers doing a fine job of maintaining an exquisite balance between the two.

**Obinata:** We will use your stories as tips to accelerate our operations by giving employees more authority. We will continue learning from how Murata operates. Thank you for sharing these important stories and ideas.

**Obinata & Saito:** Thank you.



The photo shows (from right) ULVAC President Obinata, Fellow, Communication and Sensor Business Unit, Murata Manufacturing Co., Ltd. Sakai, and ULVAC Executive Officer Saito.

World  
First

LIVING & ULVAC

Tescom's Vacuum Blender

# Increased Freshness and Nutrition Through Vacuum Technology

— An Outstanding Product That Meets Customers' Needs and Promotes Health and Beauty  
Special thanks to: Tescom Denki Co., Ltd. ([www.tescom-japan.co.jp/english/](http://www.tescom-japan.co.jp/english/))



Long-lasting Sharpness!  
**Black  
Titanium-coated  
Blade**

Make 100%  
Real Fruit Juice!  
**Fresh  
Smoothies  
Made Using  
Whole Fruit**

Comes with  
**a Special  
Recipe Book**  
Developed with  
Food Professionals



#### Product specifications

Product number	TMV1100
Power supply	AC100V 50/60Hz
Power consumption	290W
Product dimensions (mm)	327 (H) × 148 (W) × 275 (D)
Product weight	Main body: 2.2 kg; blender bottle and bottle stand: approx. 1.5 kg; and smoothie bottle: 340 g
Color	S/Silver
Cord length	1.2m
Package dimensions (mm)	365 (H) × 480 (W) × 200 (D)
Package weight	Approx. 4.8 kg
POS code	4975302 883070
Accessories	Smoothie bottle (capacity: 780 ml), lid, brush with spatula, and recipe book

50<sup>th</sup>  
Anniversary  
TESCOM

# LIVING & ULVAC

Tescom, an electronics manufacturer that is celebrating its 50th anniversary this year, launched the first small-size blender in the world to leverage vacuum technology in June 2013. Highly regarded by consumers, this compact blender has proven to be a big hit. These days, consumer electronics manufacturers are competing fiercely for market share by offering a variety of blender models that cater to recent health-related trends. So, why is Tescom's vacuum blender so popular, and what benefits (features) does the use of vacuum technology provide? For this issue of Living & ULVAC, we interviewed the development staff of the manufacturer of this blender, Tescom Denki Co., Ltd. (headquartered in Shinagawa, Tokyo), to find out.

### Pursuing Greater Versatility and Sophistication in Home Appliances

Until a few years ago, many home appliances were made to be labor-saving, simple and convenient so that chores would be easier and life at home would be more comfortable. Recently, however, we have seen the launch of a succession of advanced home appliances that focus on delivering versatility and sophistication. Examples of such products include devices that allow you to make soft bread or rice cakes automatically by just adding unprocessed ingredients, robotic cleaners that move freely around the floor as they clean, and even electric fans that produce a comfortable breeze even though they have no blades. Such home appliances are gaining popularity not just because they are practical, but also because they employ ideas that surprise consumers, can be enjoyed and are user-friendly.

With most conventional home appliances, only mechanical features such as the motor were modified and improved, but modern home appliances combine a wide range of sensors (for detecting temperature, positioning, etc.) with computers while leveraging control technologies that are both complex and advanced. This has all been made possible by reductions in the size and price of electronic devices along with an increase in their sophistication. It's no wonder these types of products are also known as "smart home appliances."

The most appealing feature of Tescom's vacuum blender is that, thanks to the application of vacuum technology, it delivers almost everything that a conventional blender could not.

### Tescom Denki: The Market Leader for 10 Consecutive Years

Unlike manufacturers of general home appliances, Tescom Denki Co., Ltd. specializes in the manufacture of products for specific fields, such as beauty and kitchen appliances.

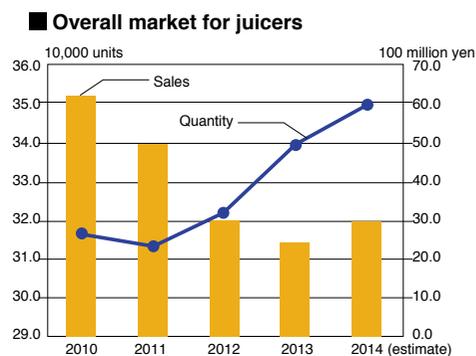
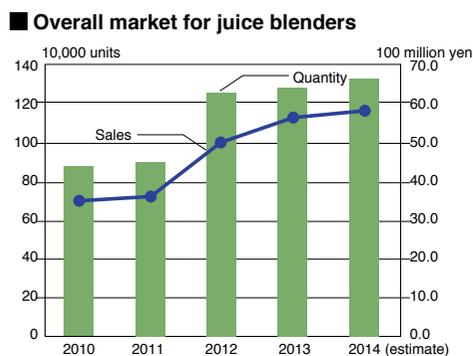
This blue-chip company started out 50 years ago as a manufacturer of hair dryers for hairdressers, barbers, and other hair professionals. Since then, Tescom has expanded its product lineup to include kitchen appliances, such as blenders, toasters, and food processors.

Having first begun selling blenders 30 years ago, Tescom has accomplished significant achievements in this field and led the Japanese blender market for 10 years in a row. The company has been at the top of the fiercely competitive home appliance industry for 10 years now thanks to its unmatched ability to develop products based on a precise understanding of consumers' needs. In fact, the company's development of the vacuum blender was begun in response to requests from users of its products.

### Leveraging Vacuum Technology to Take into Account Customer Feedback and Requests

Although the vacuum blender was launched in June 2013, Tescom actually began work on its development three years before that in 2010.

At that time, Tescom had received a lot of feedback and requests from purchasers of its blenders. Product users are always demanding, and the majority of requests were for a blend-



■ Fresh Juice Boom and Revitalization of the Market

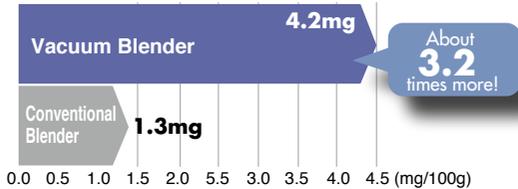
## ■ The Three Benefits of Vacuum Technology

### Benefit 1

#### Retains Nutrition for Longer!

Nutrients that are prone to oxidation can be effectively protected through the use of vacuum technology. For example, the vacuum blender slows the loss of polyphenols, which have antioxidant properties that prevent body cells from oxidizing, and vitamin C, which enhances beauty and resistance to stress. The blender also slows the loss of vitamin A, lycopene, enzymes and other nutrients.

Amount of polyphenols immediately after juice has been made\*\*



\*1 In-house conversion value; comparison of the remaining amount of polyphenols (chlorogenic acid) in a 100-g sample

Laboratory: Japan Food Research Laboratories; test certificate issue date: May 16, 2013; test result issue nos.: 13043953001-01 and 13043953002-01

### Benefit 2

#### Produces an Appetizing Color!

With conventional blenders, smoothies made from apples or bananas quickly discolor. By preventing oxidation, the vacuum blender produces juice with a clear color, which indicates that nutrition has been retained. Juices made with a vacuum blender keep their clear, fresh color for a long time.

Note: Except for the surface, as this is exposed to air.



### Benefit 3

#### Rich and Smooth: Even Dietary Fibers Taste Nice!

Conventional blenders degrade the taste of the juice by mixing in excessive amounts of air. Vacuum technology allows the rich taste of the ingredients themselves to be enjoyed. As less air attaches to the dietary fibers, the juice separates very little and remains smooth for a long time.



er that would eliminate discoloration of the ingredients, prevent the formation of bubbles (as these make it difficult to drink the juice), and keep the juice fresh. Part of a manufacturer's mission is, of course, to meet the needs of its customers, and such feedback also provides an opportunity for the company to differentiate its products from the rest. In fact, Tescom has long had a framework in place that allows such feedback to be quickly sent to its Development Department.

Mr. Hiroshi Akita (General Manager, Product Development Department, General Product Division), who has overall responsibility for the Development Department, had this to say as he recalled the events of that time: "Although some overseas manufacturers had already launched juicers that prevented discoloration and retained nutrients by slowly squeezing the ingredients, we felt that there was still a lot of room for improvement. Given this, we started a new round of product development to deliver a better blender."

It is the structure of conventional blenders that results in discoloration of the ingredients and the formation of bubbles. The reason this happens is because churning the ingredients in the air results in a large amount of air (oxygen) being fed into the mixture. In other words, the more the ingredients are mixed, the more discolored and oxidized the mixture becomes.

In explaining why Tescom decided to adopt vacuum technology, Ms. Rie Arai (Supervisor, Product Planning Section, Product Development Department, General Product Division) said: "We tried crushing apples slowly in a vise and other such tools and found that this method did not cause extreme discoloration. So, we [the Development Department] concluded that we should vacuumize the blender container to prevent the ingredi-

ents being exposed to air as they are mixed."

However, although vacuum technology could obviously be used in expensive large-scale industrial equipment, its use in home appliances seemed impractical when costs and technological issues were taken into consideration. Nevertheless, Tescom's development team rose to the challenge.

### Vacuum Technology Offers Surprising Benefits—

As this was uncharted territory for them, the development team constantly encountered new challenges in the early stages of development, such as how to achieve airtightness, what degree of vacuum would be required, what kind of vacuum pump should be used, how strong the glass container would need to be, and how big the main body of the blender should be. The team overcame this mountain of challenges by addressing them one by one. Another problem they faced was that they now had to find solutions to problems that could be ignored for mixing in air, but not for mixing in a vacuum.

After three years of trial and error, Tescom announced its development of the Vacuum Blender TMV-1000 to the media on June 20, 2013, and launched it the next day. Its price varies depending on the retailer (current market price: 29,800 yen), but the product includes the blender itself, a bottle that can store juice in a vacuum, a spatula with a brush, and a special recipe book.

Operating the blender is simple. All you have to do is push a button to vacuumize the container (about 0.3 atmospheres) and then blitz the ingredients. Because the ingredients are mixed in a vacuum, they do not discolor at all. In addition, no bubbles are formed, which means that the mixture leaves a smooth feeling

# LIVING & ULVAC

on the tongue. Another feature that has proven popular with customers is that it is no longer necessary to dispose of the highly nutritious marc—this can instead be used to make a smoothie. Tescom’s vacuum blender truly does meet almost every conceivable customer need.

The use of vacuum technology was also found to offer some surprising benefits.

In comparing the remaining polyphenol content in a 100-mg sample, Japan Food Research Laboratories found that the vacuum blender retains about 3.2 times more antioxidant polyphenols (4.2 mg) than a conventional blender does (1.3 mg). Furthermore, the difference in the preserving properties of these blenders was even more pronounced after 24 hours, with the vacuum blender retaining about 56.3 times more antioxidant polyphenols than a conventional blender. The vacuum blender also retained 15% more vitamin C, which is highly prone to oxidation.

The benefits of vacuum technology came as a double surprise, then, as this technology not only overcomes the disadvantages of conventional blenders (such as discoloration of ingredients and formation of bubbles), but also—as the analytical data shows—makes it possible for the nutrients of fruits and vegetables, which are prone to degradation, to be retained fresh until the juice is consumed and for the juice to be stored for later consumption.

## Development of a Strategy for Increasing Vacuum Blender Sales Based on the Collective Wisdom of Tescom’s Young Female Employees

Another challenge for home appliance manufacturers is that the success of a sales drive depends not just on how well the product performs, but also on how the product is marketed to consumers. Generally speaking, the blender tends to be the home appliance that is most often put away shortly after it has been purchased. To ensure that users can enjoy using the blender every day, the development team took into account usability, ease of storage, and design. They even created a recipe book in cooperation with food professionals to help users make the most use of the vacuum blender.

In charge of the product strategy, Ms. Yukako Morishita (Assistant Manager, Marketing Section, Product Strategy Department, General Product Division) explained: “The average user of this product is unfamiliar with vacuum technology, even though it’s the main feature we want to emphasize. Although our advertising budget was limited, we gave a lot of thought to how we could raise awareness of vacuum technology.”

In addition to the recipe book that comes with the blender, the team also used social media such as YouTube and Facebook to provide new recipes in real time using a variety of ingredients. Recipes that particularly stand out are those that use specialty products from Matsumoto City (Nagano Prefecture), where the company’s factory is located. They also used a character called



Tescom’s friendly Shinkuu character appears on its Facebook page.



<https://www.facebook.com/tescom.shinkuu>



The Development and Sales Promotion Team (Mr. Hiroshi Akita, General Manager, Product Development Department, General Product Division; Ms. Rie Arai, Product Planning Section, Product Development Department, General Product Division; and Ms. Yukako Morishita and Ms. Yukari Fukutomi, Marketing Section, Product Strategy Department, General Product Division)

“Shinkuu” (meaning “vacuum”) in social media to help familiarize consumers with the concept of vacuum technology.

Ms. Yukari Fukutomi (Marketing Section, Product Strategy Department, General Product Division), who works in the same section as Ms. Morishita, emphasized that the character was handmade, saying: “Ms. Morishita made the basic design for the character, and I bought the felt and other materials to make the original doll. We created everything, including the movies posted on social media sites.”

This demonstrates how all of the company’s employees have, since its launch, remained committed to increasing sales of the vacuum blender as a single team. The provision of recipes on social media sites offers the best customer service for users of the blender, and we hope that users will add their own unique recipes, too.

Part of Tescom Denki’s corporate slogan is “Lighting the Way to a Brighter Future by Growing Together,” and as the company enters the 50th anniversary of its founding, it aims to enrich people’s lives by continuing to evolve its vacuum blender through incorporating requests from not only users in Japan, but also new overseas users.

With a more than 90% share of the market for cryopumps in the flat panel display (FPD) field, ULVAC CRYOGENICS INCORPORATED (UCI) has—since its foundation in 1981—established itself as the leading player in the Asian cryopump market and continues to this day to provide support for the industry. Recently, though, UCI has begun proactively developing potential core businesses for the future by, for example, entering the cryocooler business in 2009 and took over the manufacturing and selling of cryogenic equipment from the Cryogenic Equipment Department of the Engineering Division at Iwatani Industrial Gases Corporation in 2014. In this issue’s “Visiting ULVAC”, we interviewed Mr. Masahiko Ishiguro, president of UCI, about the company’s current position and his vision for the future.



## ULVAC CRYOGENICS INCORPORATED

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# Targeting Asia to Become the Market Leader for Cryopumps and Cryogenic Equipment

—Expanding our Business in Line with Growth in the FPD Industry



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ULTRA CLEAN PRECISION TECHNOLOGIES CORP.
- **Singapore**  
ULVAC SINGAPORE PTE LTD
- **Philippine**  
ULVAC SINGAPORE PTE LTD, Philippines Branch
- **Vietnam**  
ULVAC SINGAPORE PTE LTD, Vietnam Representative Office
- **Malaysia**  
ULVAC MALAYSIA SDN. BHD.
- **Thailand**  
ULVAC (THAILAND) LTD.
- **India**  
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## Introduction

Founded in 1981 as a joint venture company based on joint investment and technical agreements between ULVAC (then ULVAC Japan, Ltd.) and the US company BROOKS AUTOMATION INC. (then the CTI Division of Helix Technology Corporation), UCI started out by renting office space in ULVAC's head office in Chigasaki City. Four years later in 1985, UCI realized a long-cherished dream when construction of its Chigasaki Head Office/Plant was completed in what is now Yabata, Chigasaki City, allowing the company to further expand its operations.

UCI has amassed more than 30 years' experience in selling semiconductor production equipment for LSIs; FPD production equipment for smartphones, PCs, LCD televisions and other such devices; optical film production equipment for glasses and digital cameras; and cryopumps for use in vacuum equipment such as a space chamber, which simulates the conditions of outer space.

UCI has been able to capture more than 90% of the FPD market in Asia thanks to the outstanding exhaust performance and low vibration of its products. Another of UCI's areas of strength is its range of large cryopumps with a length of 16 inches or more. UCI has a more than 90% share of this market, too.

UCI went on to found ULVAC CRYOGENICS KOREA INCORPORATED (UCK) in 2004, and stayed ahead of the competition by founding ULVAC CRYOGENICS (NINGBO) INCORPORATED (UCN) in 2005. Being the first company to establish sales channels and a service network for this line of business in China helped UCI to gain customers' trust.

As of June 2014, UCI had 79 employees working for it and the consolidated net sales for the ULVAC CRYOGENICS Group amounted to 4.5 billion yen.



ULVAC CRYOGENICS Offers an Extensive Lineup of Cryopumps, from Small and Medium Through to Supersized Models.

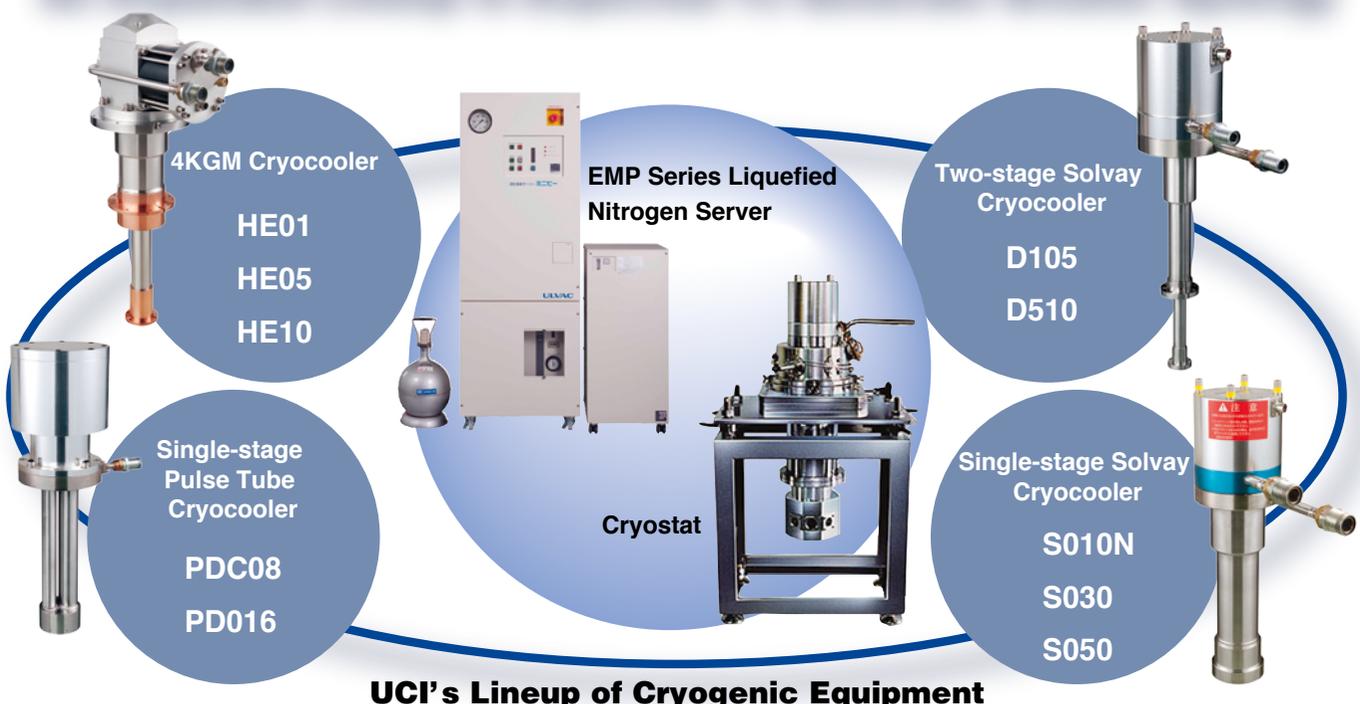
## Targeting Further Growth in the Cryogenic Equipment Field

In 2009, UCI entered into the business of cryocoolers used in the fields of superconductivity, medical equipment, measuring instrument, and laboratory cryostat by leveraging its cryogenic technology, a core technology platform for the manufacture of cryopumps.

In 2014, UCI began selling cryogenic equipment, after UCI took over the manufacturing and selling of cryogenic equipment from Cryogenic Equipment Department of Engineering Division from Iwatani Industrial Gases Corporation.

The technologies used by Iwatani Industrial Gases to manufacture its cryogenic equipment were highly regarded, particularly those found in the cryogenic chillers (cryostats) and refrigerators used for research and development. The synergy between these technologies and conventional cryopump technologies has allowed UCI to proactively pursue even greater technological innovation. Going forward, these technologies are expected to help UCI enter new markets, including the rapidly growing field of high-temperature superconductors and the medical field. (For further details, refer to page 21 of ULVAC News.)

## An Expanded Lineup Is Expected To Generate Greater Synergy



## Greater Collaboration and Close Cooperation with Group Companies in Korea and China



**Masahiko Ishiguro**  
President, UCI

Having positioned Asia, which is currently undergoing dramatic industrial development, as its priority region, UCI is working to realize even greater service integration through cooperation with ULVAC KOREA, Ltd. and UCK in Korea together with ULVAC (Shanghai) Trading Co., Ltd. and UCN in China.

UCI's efforts are particularly focused on increasing sales of cryopumps—one of their core businesses—over the next five years in the semiconductor market and the market for organic electroluminescence (EL) products, an area that has received a lot of attention in recent years. To establish its cryogenic device business as another of its core businesses, the entire UCI group is also committed to further developing its range of cryogenic equipment with a view to boosting sales of these products to the same level as those of cryopumps.

**Based on its “Salespersons Wearing Work Uniforms” Strategy, UCI’s Unique Sales System Allows Client Requests to be Dealt with Quickly**

UCI has a unique overseas sales strategy.

UCI does not have an independent department dedicated to overseas sales. Instead, such work is handled by the company's Service Technology Department, which is also responsible for quickly dealing with customer requests and consistently providing services from delivery and repairs through to maintenance.

President Ishiguro, UCI's president, refers to employees in the Service Technology Department that are responsible for overseas sales as “salespersons wearing work uniforms.”

Another of UCI's distinctive features is its standardization of machine tools between Korea, China, and Japan. This allows the company to deliver the same level of quality in all three countries. UCI also provides its engineers in these three countries with rigorous training so that they can exchange personnel to meet workload requirements.

**Facilitating Company Events for Smoother Communication by Attending Encouraging all Employees to**

UCI has hosted annual barbecues at its plant over the last few years, and these events have been attended by all of its employees. The company makes an effort to host such events in order to facilitate smoother communication between its employees and create a “family feel” in the workplace. Mr. Ishiguro says that they are close to realizing this goal because, having participated in a number of events now, almost all of the employees and their family members have gotten to know each other.

UCI is also proactive in interacting with other companies in the ULVAC Group. It has, for example, rented a fishing boat with ULVAC TECHNO, Ltd. (which is also headquartered in Chigasaki City) to hold a fishing event.



UCI's end-of-year party



UCK's ceremony for the new fiscal year



Plant tour



Fishing competition



Group photograph of UCN employees in the new fiscal year

**Agreed to the Transfer of Iwatani Gas's Cryogenic Equipment Business to UCI**  
 — **ULVAC CRYOGENICS INCORPORATED**

In May 2014, ULVAC CRYOGENICS INCORPORATED (hereinafter, UCI) took over the manufacturing and selling of cryogenic equipment from the Cryogenic Equipment Department of the Engineering Division at Iwatani Industrial Gases Corporation (hereinafter, Iwatani Gas) and started manufacturing and selling the equipment.

UCI is a manufacturer specializing in cryopumps used for vacuum devices and equipment—such as chip making equipment, flat panel display production equipment and optical film production equipment—and has been supplying many cryopumps in Japan and Asia for many years. In 2009, UCI began manufacturing and selling cryogenic freezers used in the superconductor, medical equipment, measuring instruments and laboratory cryostats sectors.

As a major manufacturer of cryogenic equipment (mainly cryostats and cryogenic freezers), Iwatani Gas developed products used for R&D in the cryogenic field, but discontinued selling those products at the end of 2013.

By taking over Iwatani Gas's business of manufacturing and selling cryogenic equipment, UCI has added cryostats to its product lineup and has acquired cryogenic element technologies.



**Various cryostats**

This has generated synergy that has led to positive technical innovations; and it facilitates entry into the rapidly growing superconductor and medical equipment sectors.

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**Liquid nitrogen server**

**Renamed to ADVANCE RIKO with the Transfer of Shares to CHINO**  
 — **ULVAC, Inc.**

In November 2014, a decision was made to transfer all shares of ULVAC-RIKO, Inc., a consolidated subsidiary of ULVAC, Inc. to CHINO Corporation. On December 25, 2014, ULVAC-RIKO, Inc. left the ULVAC Group and made a new start under the name of ADVANCE RIKO, Inc. as part of the CHINO Group.

Since its founding under the name of SHINKU-RIKO Inc. in 1962, ULVAC-RIKO, Inc. has developed its business as a manufacturer specializing in infrared heaters, thermal analysis and thermal property measuring instruments and other types of thermal analysis equipment.

The transferee, CHINO Corporation, is a manufacturer specializing in temperature and other measuring devices and controls, and provides integrated solutions—from measuring temperature to regulating temperature—as its main business. It is anticipated that combining CHINO Corporation's technologies with ULVAC-RIKO, Inc.'s thermal technologies will generate synergy.

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**New Products**

\* Please visit our website for further information.

**ULVAC, Inc.**

**Sales Debut of New HELIOT 900 Series Leak Detectors, Improved Evacuation Capability and Usability for Faster Testing**

ULVAC, Inc. has begun selling new leak detectors "HELIOT 900 Series".

Leak detectors are test equipment designed to measure the amount of leakage and locate leaks during helium leak testing, a method of testing leaks using helium gas. Helium leak testing provides higher sensitivity than any other leak test method and enables fast and accurate testing, even for minor leaks. Due to these advantages, helium leak testing is used in a wide range of industries that require leak testing, including production lines for various piping components, electronic devices, air-conditioners/chillers, and automobiles, as well as food/drug packaging and medical equipment.

ULVAC has been selling leak detectors since the 1960s, and after 1995, the name of these products has been the HELIOT Series. We have fully upgraded our time-tested HELIOT 710 Series products to launch the brand-new HELIOT 900 Series.

The market size of leak testing is expanding year by year, with the global trend regarding



product quality improvements. HELIOT 900 Series are compatible with the expansion of new applications for leak testing and the inspection requirements that continue to get stricter.

**Main Features**

- (1) The products provide a helium pumping speed of 5 L/sec, which is two to three times higher than competing models in the same class.  
 To meet today's ever-demanding helium leak testing requirements, such as shorter test times and higher responsiveness, stability and detection sensitivity, we have dramatically improved helium evacuation capability while increasing the sensitivity of the detection unit.
- (2) Tablet-type controller as a standard feature  
 The display is no longer fixed to the detec-

tor body, eliminating operational constraints and greatly improving usability. The 7-inch capacitance touch panel allows operators to work with the detector more intuitively and promptly while holding it in hand. The controller comes standard with wireless remote connection to enable remote control operation. The display supports seven languages.

- (3) Advanced mobile cart  
 To ensure safe movement — even through narrow passages — the cart embodies numerous features requested by professionals in laboratories, such as a compact body, large wheels, a flat panel cover, and the ease of moving and placing.
- (4) Improved user serviceability  
 The service panel can be removed without tools. The internal structure provides good serviceability.  
 Maintenance can be performed in accordance with a step-by-step video that can be displayed on the controller.
- (5) The products are interchangeable with existing models to enable a smooth transition.

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**Crystal Oscillator System for Regulating Frequency Won "the Business Award" at "The Kanagawa Industrial Technology Development Grand Prize Competition"**

— **SHOWA SHINKU CO., LTD.**



SHOWA SHINKU CO., LTD. received "The Business Award" at "The 31st Kanagawa Industrial Technology Development Grand Prize Competition" for its system for adjusting crystal oscillator frequencies, SFE-B03. Kanagawa Prefecture and the Kanagawa Newspaper jointly sponsor this competition to recognize excellent industrial technologies and products developed by small- and medium-sized companies in Kanagawa Prefecture, thereby encouraging their efforts for improving their capabilities developing technologies.

This is the third time that SHOWA SHINKU has received an award (it was previously awarded "The Grand Prize" and "The Encouragement Award" (in the 1st and 11th competitions respectively).

This system continuously measures and monitors the oscillation frequency of a crystal oscillator and etches the electrode film on the surface of the crystal oscillator with an argon ion beam to adjust the frequency to the target value. The Business Award was granted for capabilities of SFE-B03 to adjust and process smaller and higher-precision crystal oscillators at high productivity.

It is expected that using this system will contribute to further downsizing and increasing the efficiency of various types of electronic equipment.

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**Received its Seventh Straight "AUO Best Equipment Supplier Award" for Cooperating to Make Proposals for Improving the IGZO Process and Reducing the Lead Time of Sputtering Systems**

— **ULVAC TAIWAN INC.**

ULVAC TAIWAN INC. (hereinafter, UTI),



an overseas subsidiary of ULVAC, Inc. in Taiwan, received "The 2013 Best Equipment Supplier Award" from AU Optronics Corp. (hereinafter, AUO), which is a major panel manufacturer in Taiwan. This is the seventh straight year UTI has received the award.

The awards ceremony was held at the Head Office of AUO in Hsinchu, Taiwan and Masasuke Matsudai, the Director and Managing Executive Officer of ULVAC, Inc., received the shield from Mr. Xie, the Deputy General Manager of AUO.

UTI received this award for the improvements it made to AUO's large-scale mass-production line by making proposals for the IGZO process and reducing the lead time of sputtering systems.

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**New Products**

\* Please visit our website for further information.

**ULVAC, Inc.**

**Sales Debut of New Ceramic Ball Bearing Molecular Pump UTM300B, Compact Size with Integrated Controller Design and Free Mounting Orientation**



ULVAC, Inc. has begun selling new ceramic ball bearing type turbo molecular pump, UTM300B with 280L/s pumping speed. Turbo molecular pump is utilized to make high and ultra high vacuum environment in various markets from R&D or mass production line. ULVAC launches the ceramic ball bearing turbo molecular pump, UTM300B, in addition to the existing line-up, small size pivot bearing type, medium and large size magnetic levitation turbo molecular pumps, to meet to the requirements such as free mounting orientation, more compact design, smaller size backing pump, etc in the trend of diversified applications of turbo molecular pumps.

The UTM300B is the ceramic ball bearing turbo molecular pump with 280L/s pumping

speed. The size of this new pump is compact by integrated controller design. There is no limitation in mounting orientation. Excellent high backing pressure performance allows you to select smaller backing pumps.

The UTM300B is ideal and affordable solution for use in the small-size equipment for academic research and R&D, compared with conventional magnetic levitation type pumps.

**Main Features**

- (1) No limitation in the mounting direction.
- (2) Integrated controller to the pump body reduces cable length and downsize pumping system.
- (3) Advanced mobile cart.  
High compression ratio made it possible to run the pump at high backing pressure and downsize its backing pump.
- (4) Inlet port flange is selectable from VG100, ICF152, and ISO100-K.
- (5) Noise level at the no load is 50dB or less (with ISO-100K flange).
- (6) Applicable standard CE and NRTL.

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**ULVAC, Inc.**

**System for Integrating the Photonics Crystal Process is Developed and Launched**

Through collaborative research with MARUBUN CORPORATION, TOKYO OHKA KOGYO CO., LTD., TOSHIBA MACHINE CO., LTD., the National Institute of Advanced Industrial Science and Technology and the Institute of Physical and Chemical Research, ULVAC, Inc. developed and launched a system of integrating the photonic crystal process, which can significantly improve the light-extraction efficiency in LED production processes.

Used in an LED manufacturing process, this system forms a uniquely patterned photonic crystal layer—through nanoimprinting and dry etching—on a sapphire substrate layer. This helps make an LED with significantly improved energy efficiency, as part of the light that would otherwise go back into the device and change to heat energy can also be extracted from the sapphire substrate layer.

Photonic crystals are structures that can scatter and transmit light. By using this photonic crystal layer, in place of the conventional PSS method, light-extraction efficiency can be

Received the Special Contribution Award from CSOT in Shenzhen for Making Tremendous Contributions to Reliable Mass Production by Providing Services Promptly and Establishing a Well-Organized System for Supplying Parts

— ULVAC (Shanghai) Trading Co., Ltd.



China Star Optoelectronics Technology (hereinafter, CSOT), which is affiliated with TCL Corporation, a major general home electric appliances manufacturer in China, held a groundbreaking ceremony on September 16, 2014 in Wuhan, Hubei to celebrate the start of construction of a G6 LTPS panel production line funded by a new investment by CSOT.

At the global vendor convention held on the same day, awards were presented to excellent vendors. Hisaharu Obinata, the President and Chief Executive Officer of ULVAC, Inc., received the Special Contribution Award from Mr. Li Dongsheng, the Chairman of TCL Corporation. The ULVAC Group was commended for making great contributions to a

**ULVAC, Inc.**  
**JCSS Calibration Service**  
**Expanded its Scope**

ULVAC, Inc. is an MRA\*1/JCSS\*2 accredited calibration laboratory for vacuum gauges. Recently the range of calibration pressure has been expanded and ULVAC, Inc. is allowed to calibrate all vacuum gauges (whether they are made by ULVAC, Inc. or not). ULVAC, Inc. will continue to provide its customers with calibration services for their vacuum gauges, whether they are made by ULVAC, Inc. or other manufacturers, by using JCSS secondary standard gauges and working reference standard gauges, and issue JCSS sealed certificates.



- \*1 MRA (Mutual Recognition Agreement)  
International agreement for recognizing one another's conformity assessments
- \*2 JCSS (Japan Calibration Service System)  
Calibration laboratory registration system under the Measurement Act

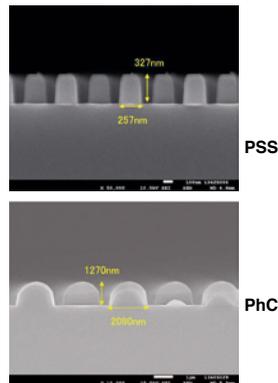
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reliable G8.5 mass production line in Shenzhen by establishing a service center near the factory, getting it up and running in a short time, providing services promptly, and establishing a well-organized system for supplying parts.

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Upper panel: Conventional PSS method (enlarged 10,000 times)  
Lower panel: Photonic crystal method (enlarged 50,000 times)

increased to a maximum of about 80% from about 30% achieved by PSS. In addition, the pattern depth can be reduced to about one-fifth of that of PSS, resulting in less dry etching time and, in turn, significantly reducing manufacturing costs.

As a general distributor of this system in Japan, MARUBUN CORPORATION provides sales support collectively for collaborative research licensing and the systems and materials of each company. ULVAC, Inc. and TOSHIBA

MACHINE CO., LTD. are in charge of nanoimprint systems that form photonic crystal layers. In particular, ULVAC, Inc. is in charge of final shaping to the designed pattern after dry etching, by using the two-layer resist method.

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- ULVAC KIKO, Inc.
- ULVAC EQUIPMENT SALES, Inc.
- ULVAC CRYOGENICS INCORPORATED
- ULVAC-PHI, Inc.
- TIGOLD CORPORATION
- ULVAC COATING CORPORATION
- Nisshin Seigyo Co., LTD
- ULVAC Human Relations, Ltd.
- SHINKU CERAMICS CO., LTD.
- FINE SURFACE TECHNOLOGY CO., LTD.
- Reliance Electric Limited
- SHOWA SHINKU CO., LTD.

■ **China**

- ULVAC (China) Holding Co., Ltd.
- ULVAC (NINGBO) Co., Ltd.
- ULVAC (SUZHOU) CO. LTD.
- ULVAC Orient (Chengdu) Co., Ltd.
- ULVAC Automation Technology (Shanghai) Corporation
- ULVAC Tianma Electric (Jingjiang) Co., Ltd.
- ULVAC Vacuum Furnace (Shenyang) Co., Ltd.
- ULVAC (Shanghai) Trading Co., Ltd.
- ULVAC Materials (Suzhou) CO., LTD
- ULVAC Opto-electronics Thin Film Technology (Shenzhen) Co., Ltd.
- ULVAC CRYOGENICS (NINGBO) INCORPORATED
- ULVAC NONFERROUS METALS (NINGBO) CO., LTD.
- ULVAC Research Center SUZHOU Co., Ltd.
- Luoyang Xinyou Magnesium Co., LTD
- Hong Kong ULVAC Co., Ltd.
- ULVAC VACUUM EQUIPMENT (SHANGHAI) CO.,LTD.

■ **Taiwan**

- ULVAC TAIWAN INC.
- ULTRA CLEAN PRECISION TECHNOLOGIES CORP.
- ULCOAT TAIWAN, Inc.
- ULVAC AUTOMATION TAIWAN Inc.
- ULVAC SOFTWARE CREATIVE TECHNOLOGY, CO.,LTD.
- ULVAC Materials Taiwan, Inc.

■ **South Korea**

- ULVAC KOREA, Ltd.
- Ulvac Korea Precision, Ltd.
- Pure Surface Technology, Ltd.
- ULVAC CRYOGENICS KOREA INCORPORATED
- ULVAC Materials Korea, Ltd.
- UF TECH, Ltd.

■ **Southeast Asia**

- ULVAC SINGAPORE PTE LTD
- ULVAC MALAYSIA SDN. BHD.
- ULVAC (THAILAND) LTD.

■ **North America**

- ULVAC Technologies, Inc.
- Physical Electronics USA, Inc.

■ **Europe**

- ULVAC GmbH

ULVAC WEB SITE:

<http://www.ulvac.co.jp/en/>

# Innovation begins in a Vacuum.

# ULVAC's Vacuum technology.

Tablet displays that we use may be taken for granted, but the display would not work, without the Vacuum technology applied by ULVAC. The Vacuum technologies that we have created over the past 60 years have been applied to a wide range of areas, including semiconductors, electronic devices, flat-screen TVs, solar cells, automobiles, pharmaceuticals, and food products.

"Ultimate in Vacuum Technology"

We will further develop the ULVAC brand by pursuing the development of new technologies that complement vacuum technologies.