

# OKI's Effort at Achieving the World's No.1 Mechatronics Factory

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OKI's mechatronics factories\*1) have been based in Japan (Tomioka Factory) and China (Oki Electric Industry (Shenzhen) Co., Ltd., herein after referred to as OSZ) to take into account the concept of local production for local delivery as well as production quantity. These two factories produce mechatronic products developed by OKI's Systems Hardware Business Division such as automated teller machines (ATMs)/cash processing machines, bank branch systems, and automated ticketing machines/check-in terminals found in train stations and airports.

Taking on the role as the mother factory, the Tomioka Factory (Tomioka, Gunma Prefecture) handles high-mix, low-volume/intermittent production while responding to the Japanese market requirements. Main products include ATMs for banks and convenience stores, cash processing machines such as teller machines, and automated ticketing machines/check-in terminals in train stations and airports.

On the other hand, OSZ (Shenzhen, Guangdong Province, China) is the production base for global market products with primary focus on the Chinese market. The factory continuously produces, medium-volume (not large volume) products. Main product is an ATM for the global market (product name: ATM-Recycler G7 (**Photo 1**)).



Photo 1. ATM-Recycler G7 in use overseas

## Production Bases for Mechatronic Products

Although production is based on the concept of local production for local delivery and performed close to the

intended market, OKI carries out production utilizing the strengths of the two bases.

The high-mix, low-volume/intermittent production at the Tomioka Factory (**Photo 2**) strives for high precision, high-quality products with increased added value while flexibly adjusting the production according to order situation. At OSZ (**Photo 3**), inexpensive labor is utilized as an advantage to produce continuous, medium-volume products with quality equivalent to the Tomioka Factory.

Leveraging the features of both the Japanese and Chinese productions, OKI aims to achieve the "world's No.1 mechatronics factory."



Photo 2. Tomioka Factory



Photo 3. Oki Electric Industry (Shenzhen) Co., Ltd. (OSZ)

## Features of Tomioka Factory

Previously, parts manufacturing was carried out at the Tomioka Factory while product assembly and testing was performed at the Honjo Factory (Honjo, Saitama Prefecture). In 2011, the processing steps from parts manufacturing to product assembly and testing and on

\*1) Mechatronics factory is a term used by OKI to refer to a facility that manufactures mechatronic products.

through to staging work have been consolidated at the Tomioka Factory to achieve integrated production.

This enabled flexible response to customer requirements including the shortening of production lead-time.

Furthermore, to produce high precision, high-quality products with increased added value in a high-mix, low-volume/intermittent production environment, general-purpose sheet metal processing technology was enhanced to surpass dedicated sheet metal processing. In product assembly and testing, human-robot integration and in-house production of core parts were expanded. As a result, capacity increased 1.5 times over a three-year period.

### Enhancement of General-purpose Sheet Metal Processing Technology

As mentioned previously, there are two methods for processing sheet metal, dedicated processing and general-purpose processing. For high-mix, low-volume/intermittent production, general-purpose sheet metal processing is the suitable method. In this method, a laser is used to cut the contour and bending is performed with a general-purpose mold eliminating the need for a dedicated mold.

While general-purpose sheet metal processing has

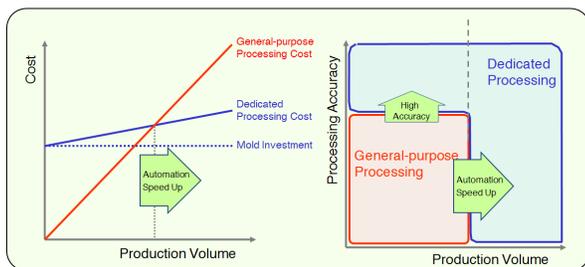


Figure 1. Overcoming the Disadvantage of General-purpose Sheet Metal Processing

the flexibility to meet the requirements of each customer, its disadvantage is the inability to attain the accuracy, cost and speed that are possible with dedicated sheet metal processing.

Therefore, OKI has made self-improvements to the processing equipment to overcome the disadvantage of the general-purpose sheet metal processing (Figure 1).

Specifically, the laser cutting equipment was tuned to provide higher speed and accuracy in the cutting process, and automated bending equipment was customized to increase accuracy and improve operation during the bending process.

Additionally, an information integrated management system (Figure 2) of workers and processing equipment was implemented to enable nonstop 24-hour manufacturing of parts.



Photo 4. Contour Cutting using a Laser



Photo 5. Automation of Bending Process

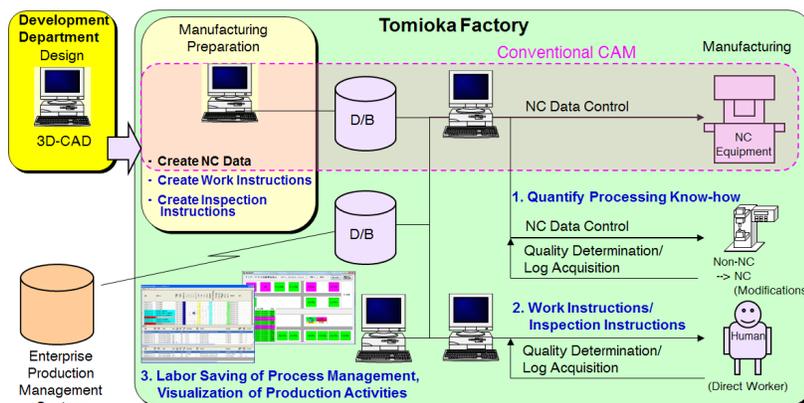


Figure 2. Information Integrated Management System

## Development and Implementation of Management System

For a long time, parts processing relied on the techniques of skilled workers. However, with the mass retirement of the baby boomers, the inheritance of technical skills has become a challenge.

Adjustment of processing equipment, processing work and measuring of part dimensions, all of which previously relied on skilled workers, are now automatically instructed on the display of the processing equipment. This allows less experienced workers to operate without resorting to skilled workers.

IT has also been adopted for visualization of production progress/productivity and work traceability management to improve productivity and quality stabilization.

The Tomioka Factory's management system has been improved and translated into Chinese for implementation in OSZ's parts receiving process (described later).

## Product Assembly and Testing with Human-robot Integration

Large-scale automation using dedicated robots is not practical in a high-mix, low-volume/intermittent production environment.

Therefore, based on human tasks such as setting parts, "autonomation" using robots was carried out on tasks that were labor intensive and prone to human errors and variations. This led to reduction in labor and helped to stabilize quality.

In addition, adopting a single high-mix, low-volume/intermittent production line to eliminate the need to change production line for each product has reduced the production cost and lead times.

However, realization of such a production requires the worker to carry out various tasks alone. Since it is time-consuming to build up work proficiency and a heavy burden on the worker, a navigation system introduced for assembly helps the worker.



Photo 6. Human-robot Integration

## Navigation System for Assembly Work

The navigation system guides the assembly by lighting up the parts in the order to be assembled and simultaneously, the instructions are automatically displayed on a monitor.

Thus, there is no need for the worker to memorize the order of assembly, and burden on the worker is reduced.

Furthermore, it became possible to collect performance data automatically for use in work analysis and quality traceability. Both hardware and software of this navigation system were developed and manufactured in-house.



Photo 7. Navigation System for Assembly Work

## Features of OSZ

Recently, labor cost is rising in China, but it is still less expensive than in Japan. The abundant inexpensive labor is utilized to produce products with the same level of quality as the Tomioka Factory.

Assembly of mechatronic products, which include numerous parts, demands worker skill.

However, unlike in Japan, the labor turnover is very high in China making it difficult to maintain quality relying solely on an individual's skill. Therefore, OKI has established a mechanism suitable for China that avoids passing defective products from one process to the next and prevents production of defective products.

To prevent the flow of defective products to the successive process, a thorough inspection of the entire lot is conducted when the parts are received using a system reflected with a proven quality record. The system is a Chinese version of the previously mentioned management system developed for the Tomioka Factory.

Measures to prevent production of defective products include 1) TEISU kitting to avoid missing components; 2) equipment/tooling devised to eliminate sensory work. These measures also stabilize quality. Furthermore,

taking advantage of the continuous medium-volume production, a dedicated production line was built for each product to ensure production efficiency and quality.



Photo 8. Final Inspection of ATM-Recycler G7

## Becoming the World's No.1 Mechatronics Factory

As mentioned above, OKI has taken full advantage of the characteristics that both the Japanese and Chinese productions offer to provide “product quality,” “product cost” and “product delivery” that satisfy the customers of the Japanese, Chinese and global markets.

Working toward further expansion of the global market, OKI will continue reforms to supply products with quality and price that will convince customers all over the world and aim to achieve the “world's No.1 mechatronics factory.”

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## TiPO [Glossary]

### Staging

Task of setting up individual configuration for installation at customer premise. Setting up the individual configuration within the factory greatly reduces setup time.

### Dedicated sheet metal processing

Presswork performed using a special mold fabricated for each part. Used for mass production of parts.

### General-purpose sheet metal processing technology

Sheet metal processing method using machine tools such as a turret punch press, laser processing machine and press brakes instead of a special press mold. Used for prototyping and low-volume production.

### Autonomation

Not a simple automation, but automation with human-like intelligence such as automatically stopping the machine when a defect is detected to prevent defective production to continue.

### Mixed flow production

Production method for reducing the setup change time by producing multiple products on a single production line.

### TEISU kitting

Parts servicing worker sets the parts required for each process in a special tray before supplying them to the assembly worker. At OSZ, parts are set and supplied to five units. This ensures the correct number of parts is supplied to the assembly worker. After assembly is completed, the assembly worker checks the special tray to confirm no parts are remaining, thus prevent products with missing parts.