APPLICATION STORY

Digitalization transformation solution

Building corporate resilience with comprehensive digital transformation in manufacturing and environment

The majority of enterprises recognize the need for digitalization and have implemented it gradually across a variety of industries. In introducing digitalization, enterprises have developed to begin to gradually adopt the standard, advancing from manual data collection to automatic data collection across various environments/elements, including production, equipment, testing, and personnel systems across the manufacturing enterprise. For manufacturers, the current challenge is not insufficient data, but rather how to efficiently collect low-cost data to help improve production efficiency, strengthen corporate resilience, and achieve advanced smart manufacturing.

Project challenges/goals

Semiconductor wafer manufacturers own the most advanced wafer manufacturing equipment in the world. The core manufacturing equipment is digitized with built-in connectivity to the company's internal MES/ERP database. However, in addition to the core equipment, other process-related peripheral equipment such as dry vacuum pumps, scrubbers, chillers, HVAC, and other environmental control-related equipment have yet to be digitized. Although inconvenient, the customer's operation and maintenance of these non-essential peripheral devices were previously recorded and organized manually on paper without digitalization.

As the COVID-19 epidemic spread in 2019, the isolation restrictions for confirmed cases made it difficult to control the attendance of factory and outsourcer personnel. The semiconductor industry products were in short supply despite factories' full-speed efforts. The industry could not keep up with the demand. When peripheral equipment required operation and maintenance, scheduling personnel became extremely difficult, and this dilemma directly affected the customer's production progress, yield, and capacity.

After the encounter with the epidemic, the customer has a profound understanding that along with the main production equipment, peripheral equipment must be digitized to ensure the stable operation of the overall production equipment, the improvement of production efficiency, the assurance of production quality, and thus enhance the resilience of the enterprise to face the unknown next need.

Project key challenges:

- Integrate 12 different brands of dry vacuum pumps
- Incorporate peripheral equipment: Scrubber, chiller, gas cylinder cabinet, heating, ventilation, and air conditioning (HVAC), environmental control (temperature/humidity), and other equipment
- After collecting the above types of equipment data, convert it into SECS communication protocol
- Convert the collected peripheral equipment data into SECS communication protocol
- Use SECS and OPC UA communication protocols to connect to the MES/ERP database
- Provide enterprise-specific wireless network equipment

Solution overview

The connection between Beijer Electronics' X2 HMI panels/ BoX2 IoT Gateway and the controller is not restricted by the controller brand or device type. Users can make the connection as long as the communication protocol is supported. There are as many as 12 brands of dry vacuum pumps in the customer's factory, and they were installed in a staggered way. Traditionally, when establishing communication for dry vacuum pumps of different brands, the setup process is complicated. The equipment control is difficult, the cost is high, and future maintenance is also tricky.

Using Beijer Electronics' X2 HMI panels /BoX2 IoT gateway allowed a single gateway to connect the 12 different brands of dry vacuum pumps, eliminating the need for customized software. The customer only needed to be familiar with one software and learn the SOP to start the installation. Beijer's software allows rapid setup (of the same software and hardware configurations), offering easy equipment management and monitoring while reducing setup and maintenance costs.

The same setup model can also be applied to peripheral equipment such as scrubbers, chillers, gas cylinder cabinets, HVAC, and environmental controls (temperature/humidity). Installers can use the same set of X2 HMI panels or BoX2 IoT Gateways to communicate with different basic equipment types.

Beijer Electronics' X2 HMI panels/BoX2 IoT Gateway can play the roles of both Server and Client. Semiconductor factories often occupy vast areas and have strict security mechanisms. The transportation of any software or spare parts is time-consuming and complicated. Therefore, equipment management and monitoring are critical and usually partitioned systematically to form a simple hierarchical structure. The role (Server or Client) can be set by checking the desired box within the system interface. This adaptable role interchange function provides customers with more flexible installation options, reducing the number of spare parts. Customers can save hardware and labor costs and shorten installation and problem-solving time.

Beijer Electronics' X2 HMI panels/BoX2 IoT Gateway supports the SECS communication protocol, which can convert basic device information into the SECS communication protocol and then communicate with the backend MES/ERP. The semiconductor manufacturing process is exact, and the allowable error range is minimal, so the semiconductor industry has its dedicated communication protocol: SECS/GEM. There are two traditional methods. The first method is to purchase a dedicated gateway, which is expensive and has limited communication support for the controller. The customer may need to mix and match gateways of varied brands. The second method uses a general gateway to collect data and send it to an intermediary server to convert it into SECS communication. For this solution, the customer must purchase high-end X86/Windows hardware and SECS/GEM software solutions and solve the gateway problem themselves—communication to the intermediary server. No matter which method is used, customers must have engineers familiar with the SECS/GEM communication protocol to complete the connection.

However, the SECS communication driver developed by Beijer Electronics can be loaded using Beijer Electronics' X2 HMI panels/BoX2 IoT Gateway. The customer only needs to clearly define the communication content to automatically convert controller data into SECS communication. There is no need to purchase additional software and hardware or hire a full-time engineer to establish SECS communication.

Beijer Electronics also provides industrial-grade network switches and 5G routers. The manufacturing industry's digital transformation also relies on integrating on-site IoT gateways and network communication equipment. The customer used Beijer Electronics' industrial-grade network switch JetNet and industrial-grade JetWave 2512 5G router to monitor on-site process equipment information processed by the BoX2 IoT Gateway and then sent the information to the customer's MES/ERP backend management system. This process has achieved production and supply chain visualization management and improved production capacity while managing real-time predictive maintenance of production equipment.

Utilizing comprehensive digitization of manufacturing environments can build solid corporate resilience. Compared with other industries, the production yield rates of semiconductors are already outstanding. However, pursuing better yield rates is still an ongoing goal because the unit price of wafers is high, and even a meager defective rate can still add up to a large sum of loss.

After comprehensively monitoring the operating information of peripheral equipment, the customer was able to use mathematical algorithms to combine manufacturing and environmental data (the original operating details of the equipment, such as temperature, humidity, rotation speed, horsepower, rated current, rated voltage, etc.) to program data, compare correlations, and monitor the stability of the production process. The system for real-time reporting of abnormalities allows customers to respond to the production line quality issues, reducing unnecessary losses.

Equipment data can improve production efficiency and maximize utilization rates. The customer can also use equipment data for predictive maintenance to avoid unnecessary downtime, perform regular annual repairs, and arrange inspections before equipment abnormalities occur.

Digital transformation is imperative. Beijer Electronics products help customers complete digitalization in a modular, systematic, and cost-effective manner with minimal changes to existing equipment. Beijer Electronics products apply mathematical algorithms to your companies' accurate manufacturing and environmental data, resulting in improved production efficiency and stronger corporate resilience to face the challenges of the rapidly changing market.

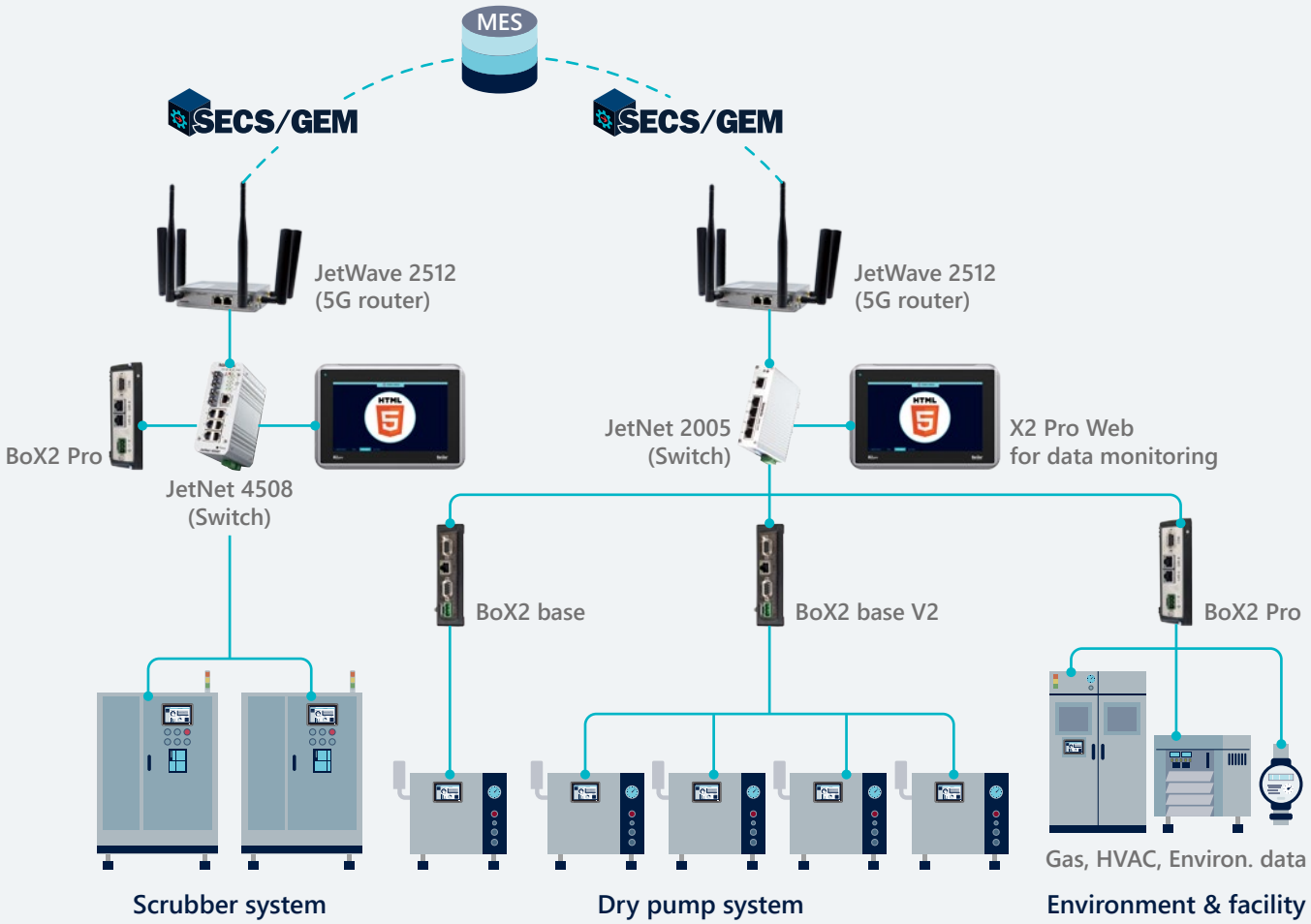

Figure 1

Why Beijer Electronics

- Beijer Electronics' X2 HMI panels and IoT Gateway support a variety of controllers. The production data can be collected quickly without replacing or changing the controller program.
- Beijer Electronics' X2 HMI panels and IoT Gateway can play the roles of Server & Client at the same time, providing higher flexibility.
- Beijer Electronics' X2 HMI panels and IoT Gateway support the semiconductor's unique SECS/GEM communication protocol and can directly communicate with semiconductor MES/ERP.
- Beijer Electronics also provides industrial-grade network switches and 5G routers.

About Beijer Electronics

Beijer Electronics is a multinational, cross-industry innovator that connects people and technologies to optimize processes for business-critical applications. Our offer includes operator communication, automation solutions, digitalization, display solutions and support. As experts in user-friendly software, hardware and services for the Industrial Internet of Things, we empower you to meet your challenges through leading-edge solutions.

Beijer Electronics is an Ependion company. Ependion (formerly Beijer Group) is listed on the NASDAQ OMX Nordic Stockholm MidCap list under the ticker EPEN. www.ependion.com

CHINA
Shanghai

DENMARK
Roskilde

FRANCE
Paris

GERMANY
Nürtingen

NORWAY
Drammen

SOUTH KOREA
Seoul

SWEDEN
Göteborg
Jönköping
Malmö
Stockholm

TAIWAN
Taipei

TURKEY
Istanbul

UNITED KINGDOM
Nottingham

USA
Salt Lake City

Beijer ELECTRONICS

APAC Head Office | Taiwan
Beijer Electronics Corp.
14F., No.215, Sec. 3, Beixin Rd., Xindian Dist.,
New Taipei City 23143, Taiwan
info.tw@beijerelectronics.com
www.beijerelectronics.tw | +886 2 2218 3600