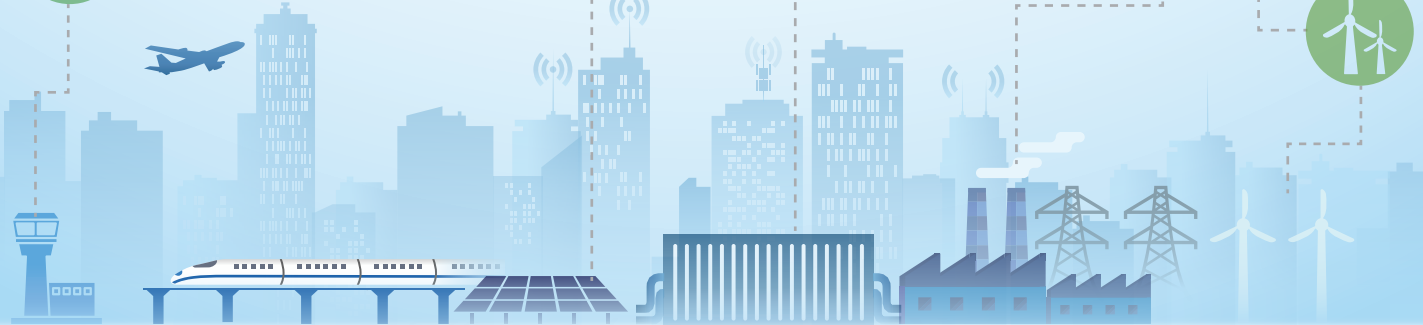


# Energy and Environment Case Studies Collection

- ／ Power and Energy
- ／ Environmental Monitoring
- ／ Equipment Operation and Maintenance



**ADVANTECH**

*Enabling an Intelligent Planet*

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

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As the development of sensing, data acquisition, and wireless technology evolves, more and more industrial IoT practices are coming on-line. In the near future, there will be billions of connected devices performing an array of functions: collecting data, monitoring facilities, and executing remote control. Advantech is devoted to offering top-tier computing, communication, and sensing capabilities to power and energy, environmental monitoring, and equipment operation and maintenance markets, all of which can be referred to as "Energy & Environment" applications.

01



## Power and Energy

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## Environmental Monitoring

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## Equipment Operation and Maintenance

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# Intelligent PV Plant Monitoring Solution Enhances Operation Management Efficiency



Location: **China**

## Background

Beijing's air quality is infamous for its lack of breathability. In order to improve public health, the government is encouraging the installation of solar PV (photovoltaic) systems. However, with a growing number and variety of PV installations, centralized management and information integration of each station is increasingly difficult to manage.

BOE Technology Group has gradually completed 20 key PV construction projects in the Beijing area. As more and more PV plants come on-line, more manpower and resources are required for regular maintenance and operation management. The company urgently needed real-time monitoring and a unified management platform.

## System Requirements

In order to implement real-time 24/7 monitoring, the new PV plant management solution needed to provide comprehensive intelligent remote control and management. This included: collecting data from front-end instruments and devices; properly configuring network systems based on site conditions and transmission distance; utilizing data gateways to completely record and protect data; and providing a feature-rich user-friendly management platform.

In addition to comprehensive functionality, the software needed to allow users to design their own human machine interface (HMI) applications. Due to the cold northern climate and the challenging environment around the power plant, related hardware products needed to have rugged and durable characteristics capable of withstanding harsh conditions.

## Project Implementation



### ADAM-4117

Robust 8-ch Analog Input Module with Modbus



### UNO-2372G-J

Fanless Industrial Computer with Advantech WebAccess/SCADA (5000 tags)



### EKI-6333AC

10/100T (X) to Single-Mode SC Type Fiber Optic Industrial Media Converter



### EKI-9628G

Industrial 24GE+4G Combo Layer 3 Managed Ethernet Switch

## System Description

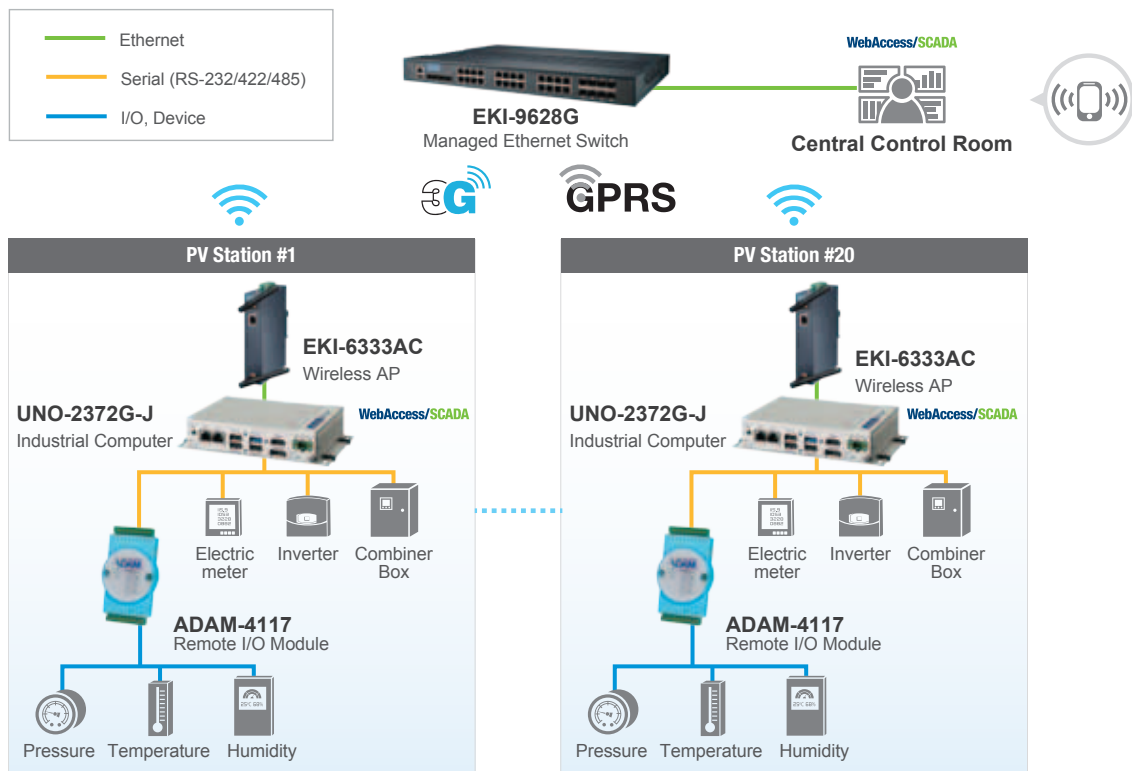
For photovoltaic applications, Advantech proposed web browser-based intelligent software equipped with industrial-grade hardware. The Solar Power Management System (SPMS) solution is a multi-layer architecture for data acquisition, network transmission, and systems management.

In terms of hardware, the project employed several Advantech devices, including a fanless industrial computer, remote I/O module, industrial wireless AP, and a Managed Ethernet switch. With compact, durable, and reliable features, the UNO-2372G-J provided excellent computing power balanced with low power consumption. The fanless design, extended

temperature range, and IP40 protection were paired with rich I/O interfaces to easily connect a variety of peripheral devices.

The ADAM-4117, an 8-channel analog input module with high and low temperature resistance, anti-noise, and anti-surge characteristics, is responsible for collecting environmental and weather information through the Modbus RTU protocol to transfer data to the computer. Since the PV plants are categorized as outdoor and remote applications, for network configuration Advantech utilized the EKI-6333AC to transfer data between the stations and the control center through 3G and GPRS.

## System Diagram



## Why Advantech?

Implementing Advantech's intelligent PV plant monitoring solution, owners like BOE Group do not need to worry about compatibility between products and peripheral devices during the project building phase, and can enjoy stable and reliable system performance through our high degree of seamless integration. After completion, this remotely centralized management platform - with visible, manageable and controllable features - not only saved manpower and resources but also significantly enhanced the operation and maintenance effectiveness of plant operation via real-time monitoring and unified management.

# Advantech Wind Turbine Monitoring and PHM Solution Enhances Remote Management for Offshore Wind Farms



Location: **China**

## Background

Although offshore wind farms rely on remote monitoring systems for managing Operations & Maintenance (O&M), many systems can only monitor the status of wind turbines and transmit alerts when anomalies occur. Lacking systems for prognostic and health management (PHM), operators must send personnel for repairs after they receive alerts.

Advantech developed an integrated software and hardware Solution Ready Package (SRP) specifically for wind farm O&M management that offers comprehensive wind turbine monitoring and PHM solutions.

## System Requirements

A Chinese electric group hoped to incorporate an O&M management system to reduce the O&M cost of wind power generation. CyberInsight, a systems integrator focusing on industrial big data analysis, was charged with developing the cloud-based system for this project. CyberInsight purchased a set of middleware providing related software and hardware for both the edge computing layer and the cloud-based PaaS layer. The solution met the following criteria:

1. The edge computing layer: A hardware platform collected wind turbine information and performed data pre-processing and data format conversion before connecting to the IIoT cloud.
2. The cloud PaaS layer: An open PaaS layer IoT cloud platform offered convenient access to wind turbine information for software. A data visualization tool allowed the user to design dashboards.

## Project Implementation



WebAccess/MCM

### SRP-PHM420

- MIC-1810: Data Acquisition Platform with Built-in Intel® Core™ i3/Celeron® Processor
- WebAccess/MCM: Machine Condition Monitoring (MCM) Software



### WISE-PaaS

Industrial IoT Cloud Platform

## System Description

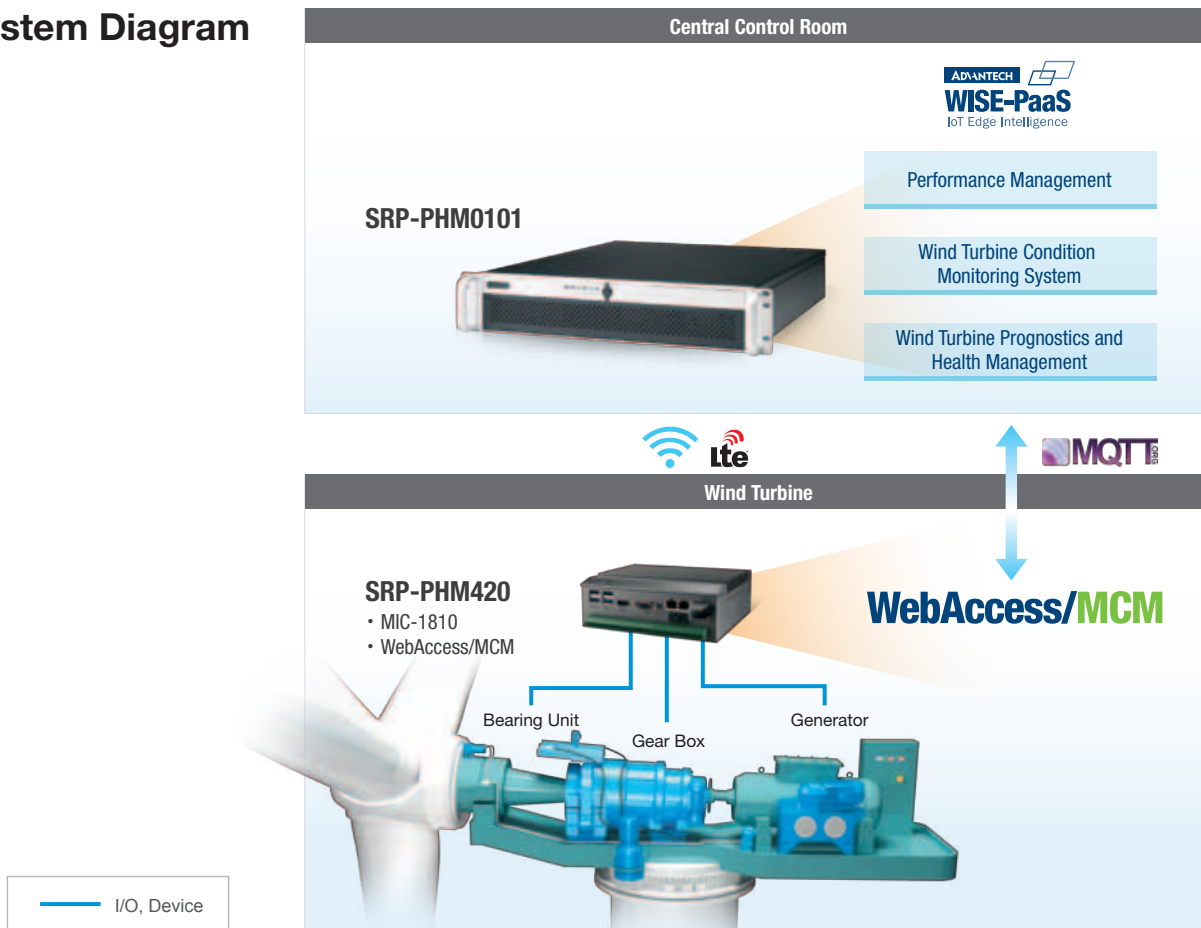
The MIC-1810, installed in large-scale wind turbine, collects data from the bearings, gear boxes, and generators. The built-in WebAccess/MCM optimized and pre-processes analog signals before converting them into the MQTT format for upload to the SQL database in the WISE-PaaS industrial IoT cloud platform. CyberInsight's three sets of applications at the top of the cloud provide easy access to the necessary wind turbine data from the database.

In the edge computing layer, Advantech provides the integrated software and hardware solution SRP-PHM420 (including MIC-1810 and WebAccess/MCM).

The MIC-1810 is an extremely compact embedded computer to provide multiple I/O channels that satisfied the project's requirements for collecting vibration, current and temperature. The WebAccess/MCM installed in the MIC-1810 can be used to define data collection criteria, extract meaningful information on characteristics and transfer information through Ethernet.

In the cloud PaaS layer, WISE-PaaS is an indispensable cloud platform for building both public and private clouds. It provides a development environment for app developers on the SaaS layer.

## System Diagram



## Why Advantech?

For CyberInsight, Advantech's cost-effective wind turbine monitoring and PHM solution provided a smooth connection between the equipment layer and the applications layer, allowing the systems integrator to focus on the development of AI algorithms and smart apps to complete projects in less time with less effort. Following the successful completion of the offshore wind farm project, Advantech and CyberInsight continued their "co-creation" efforts to help expand their real-time equipment monitoring and PHM solutions to a range of new applications.



# Advantech's Power Automation Computer Optimizes Substation Power Equipment Operation Management



Location: **Brazil**

## Background

With the new technological innovations in the field of power equipment, traditional substations are rapidly applying information technology for enhancing operation management efficiency.

To implement a SCADA system to replace the traditional manual operation management, the system needed to process massive amounts of information. Additionally, the diversity of equipment within a substation complicated system development and challenged the integration process. Therefore, it was vital that system integrators select power automation platforms suitable for substations when implementing SCADA systems.

## System Requirements

A leading Brazilian system integrator specializing in power monitoring solutions for substations wanted to overhaul its power equipment operations and maintenance management system. The company used SCADA software developed by Brazil's Elipse Software to implement a distributed control and centralized management system. To ensure the system didn't lag from overloading, the company proposed the following hardware requirements:

1. A sturdy and durable industrial computer complying with the IEC 61850-3 power standard;
2. Sufficient computing performance for executing a range of SCADA functions;
3. A variety of I/O interfaces and flexible expansion options to connect with base-layer power equipment and devices;
4. An RTU capable of carrying out data collection and control for non-networked devices.

## Project Implementation



### ECU-4784

IEC 61850-3 Certified  
Power Automation Computer



### ADAM-3600

Wireless Intelligent RTU with 8x AI, 8x DI,  
4x DO and 4-Slots Expansion



## System Description

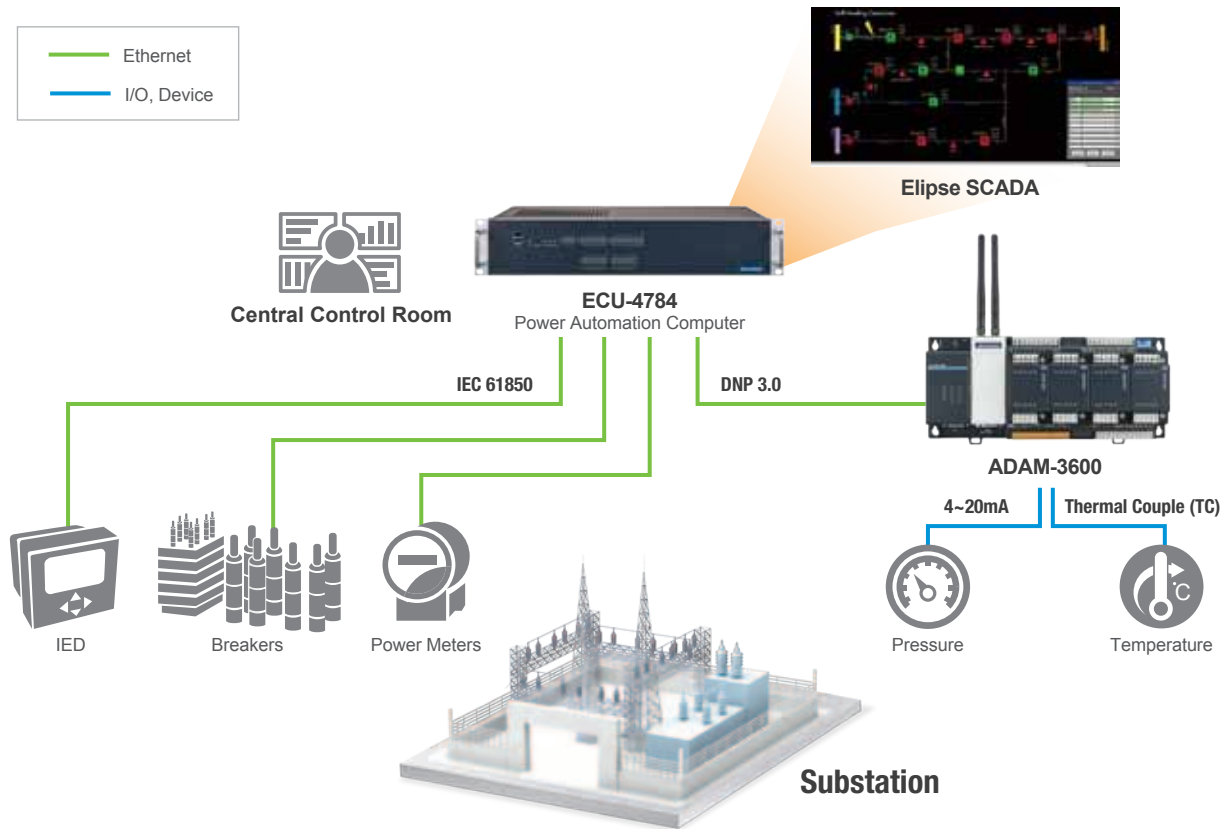
The solutions provided by Advantech – ECU-4784, an IEC 61850-3 certified power automation computer dedicated to power and energy, and ADAM-3600, a multi-channel intelligent remote terminal unit – integrated with the Elipse SCADA software as specified by the power system integrator and met the hardware specification requirements.

Substations consisted of two categories of power equipment and devices: those that supported the IEC 61850 communication protocol network signals and those that didn't. Advantech obtains the information by connecting devices that didn't support the protocol through the ECU-4784 network port to the monitoring center. ADAM-3600, installed on-site,

collected device information which didn't provide network signals, and converted the data into DNP3.0 communication protocol network signals before uploading to the ECU-4784.

The ECU-4784, installed with Elipse SCADA software, collected data and performed system administration. When an abnormal incident occurred in a substation, the IED automatically shut down and the ECU-4784 received a signal immediately, helping users carry out rapid emergency response. To dispatch power during peak periods, users issued start and stop commands directly from power equipment and devices through the ECU-4784.

## System Diagram



## Why Advantech?

Advantech's ECU-4784 complied with the IEC 61850-3 power certification required for the project while providing high-performance processing power. From SCADA software companies looking for a suitable hardware platform to implement complete solutions, to system integrators developing power monitoring systems, the ECU-4784 is an ideal platform for integrating power equipment and SCADA software.

# Intelligent Power Distribution Cabinet Solution Optimizes Remote Device Operation and Maintenance



Location: **China**

## Background

Low-voltage power distribution cabinets are the basic equipment in power transmission and distribution projects. Unexpected shutdown or abnormal operation may result in huge economic losses. In China, many power distribution devices are located in remote areas where, as a result, maintenance and usage safety cannot be effectively guaranteed.

In the face of such problems, intelligent control is the only way to improve the safety of critical operating equipment, enabling users to quickly understand equipment usage status and efficiently manage equipment lifecycle.

## System Requirements

As a leading company in China's low-voltage electrical industry, Zhejiang Tengen Electric Co., LTD. is committed to offering customers intelligent solutions. In recent years, Tengen noticed market demand had changed from a previous emphasis on pure products into a growing need for overall solutions. The solutions often required additional integration for large amounts of equipment which were not easily connected. As a

result, the cost for the intelligentization of power distribution cabinets was high, making it difficult to gain popularity.

In the process of upgrading and connecting the products to the network, Tengen required industrial-grade wireless gateways that could coexist with MQTT and power standard protocols. Although similar products were offered in China, stability was difficult to guarantee.

## Project Implementation



**ECU-1251TL**

TI Cortex A8 Industrial Communication Gateway with 2x LAN, 4x COM Ports

**WISE-PaaS/EdgeLink**

**WISE-PaaS/EdgeLink**

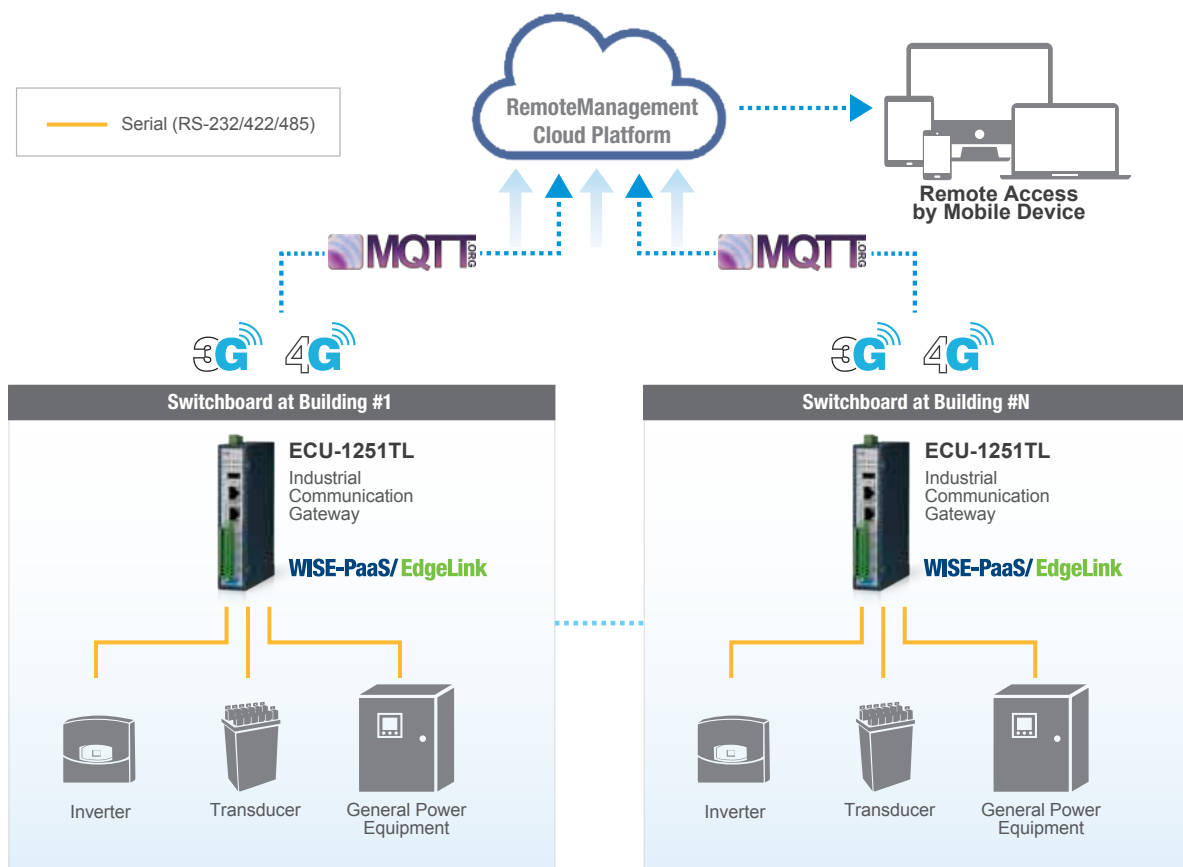
Machine-to-Intelligence Edge Engine

## System Description

In response to Tengen's requirements, Advantech's technical team developed a system plan: Install an ECU-1251TL edge industrial communication gateway on each low-voltage power distribution cabinet; use the communication interface of ECU-1251TL to collect data on the operating status data of the cabinet; directly transmit the data, via the built-in wireless LTE communication module, to the cloud platform; and then gather the collected data into a report so users could see the real-time status of the power distribution cabinet and predict potential abnormalities.

The ECU-1251TL is a RISC-based edge intelligent gateway that supports Ethernet communication, WI-FI, and GPRS/3G/4G wireless communications. Each serial port has isolation measures to ensure stable and accurate data. The built-in WISE-PaaS/EdgeLink software allows the user to set up the device without having to write code. Moreover, support for the power industry's general communication protocols - IEC 60870, DL\_645, and the IoT-specific lightweight MQTT - allows the ECU-1251TL edge intelligent gateway to collect widely deployed switchboard and equipment operation data.

## System Diagram



## Why Advantech?

Advantech's intelligent power distribution cabinet solution reduces manual detection errors, allowing users to understand and master the status of the equipment during use, quickly discover faults and receive early warnings, and manage the entire lifecycle of equipment through Internet and cloud platform technologies. Advantech's ECU-1251TL industrial communication gateway offers the best choice for smarter, more efficient energy management.

# Advantech Communication Management Computer Connects Energy Systems in Beijing Daxing International Airport



Location: **China**

## Background

The volume of energy consumption in an airport is astounding. However, a significant proportion of the energy is wasted due to inadequate control and management. This has prompted many airports worldwide to adopt intelligent operation and maintenance (O&M) platforms and use automated controls to prevent unnecessary waste, improve efficiency, and reduce overall energy consumption.

Beijing Daxing International Airport has positioned itself as a large-scale international aviation hub committed to setting a new paradigm for green airports in China. High-level energy conservation and environmental protection standards were incorporated into the plans during the initial design period.

## System Requirements

A system integrator was appointed to establish an unmanned energy and equipment O&M platform for managing 26 substations, 60 transformers, 9 backup power generator facilities, and 258 electrical rooms. Computers were installed in each electrical rooms as data gateways to collect and convert data from various communication protocol formats to the IEC 61850-9 format before uploading to the integrated O&M platform. The platform was designed for comprehensive monitoring of the air-conditioning, lighting, water supply, heating, elevators, other equip-

ment with high energy consumption, as well as related instrumentation. The computers had to meet the following criteria:

1. Industrial-grade computer with signal isolation and anti-interference design that meets IEC 61850-3;
2. Adoption of the RT-Linux real-time operating system for instantaneous control;
3. Wider range of operating temperature to ensure stable operation in harsh environments;
4. Multiple RS-485/232 serial and LAN ports for equipment connecting and data transmission.

## Project Implementation



### ECU-4553

TI Cortex4 A8 Communication Management Computer with 4x LAN, 16x COM Ports

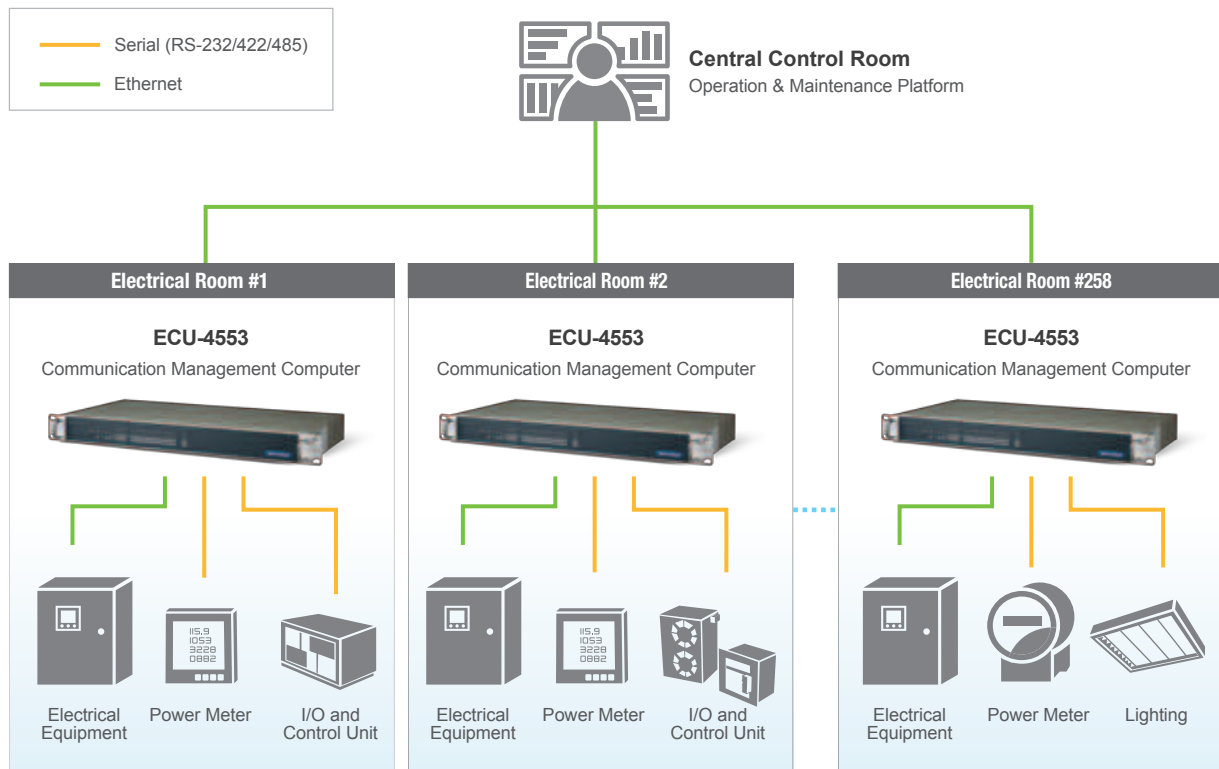


## System Description

Beijing Daxing International airport has 258 electrical rooms, each of which is to be equipped with an Advantech ECU-4553 communication management computer as the data gateway. This unit was selected because it can connect a high number and wide variety of bottom-layer equipment to the upper-level management system. The serial ports on the ECU-4553 will also provide connectivity to small-scale relays, high-voltage/low-voltage power instrumentation, onsite I/O devices, onsite controllers, and other devices while allowing for high-speed data conversion. The data will then be transmitted to the management system in the control center via Ethernet switches.

The ECU-4553, which has a built-in TI Cortex A8 processor, is a high-performance industrial-grade computer that meets the IEC 61850 standard. It is equipped with the RT-Linux operating system, which facilitates real-time communication and increases the accuracy and efficiency of the energy consumption monitoring system. With regard to achieving seamless connectivity, the ECU-4553 provides 4 LAN ports and 16 RS-232/485 serial ports and it can easily connect to equipment that uses different protocols.

## System Diagram



## Why Advantech?

Communication gateways are a core component in energy consumption monitoring systems. Advantech's ECU-4553 has passed rigorous 2-year tests for electromagnetic compatibility, hardware reliability, and software/hardware compatibility. Therefore, the system integrator has stated that they shall continue to use the ECU-4553 in new airports and upgrades to existing airports in China. They also plan to use the ECU-4553 in other large-scale public buildings, commercial offices, smart cities, and other high energy consumption settings in order to establish a smart energy consumption management system that saves operating costs and optimizes management efficiency.

# CEMS Solution for Flue Gas Emission Meets National Environmental Requirements



Location: **China**

## Background

Industrial development has brought considerable economic prosperity but also raised serious pollution issues around the world. China's Environmental Protection Agency (EPA) has implemented new environmental protection standards and regulations that require companies to upload their environmental data to an EPA database.

To meet the new standards, manufacturing companies keep track of pollutant emission rates by using Continuous Emission Monitoring Systems (CEMS) which can gather emissions data for environmental compliance and optimization.

## System Requirements

This project was mainly aimed at monitoring flue gas emissions in iron, steel, and chemical manufacturing plants. In the past, monitoring of pollutant emissions in China was focused on their concentrations. However, the monitoring frequency was very low, and the results seemed random given that they were based on estimates. Advantech's ADAM remote I/O modules and fanless host computers were thus ideal for independent data analysis and storage.

An automatic flue gas monitoring system was designed to target gas pollutants and particulate matter in the atmosphere by continuously monitoring their concentration and total emissions. The data was then transmitted to the relevant authority. This monitoring system comprised subsystems for monitoring gaseous pollutants, particulate matter, and flue gas parameters, as well as subsystems for data processing and transmission.

## Project Implementation



**ADAM-4055**

16-ch Isolated Digital I/O  
Module with Modbus



**ADAM-4117**

Robust 8-ch Analog Input  
Module with Modbus



**TPC-1251T**

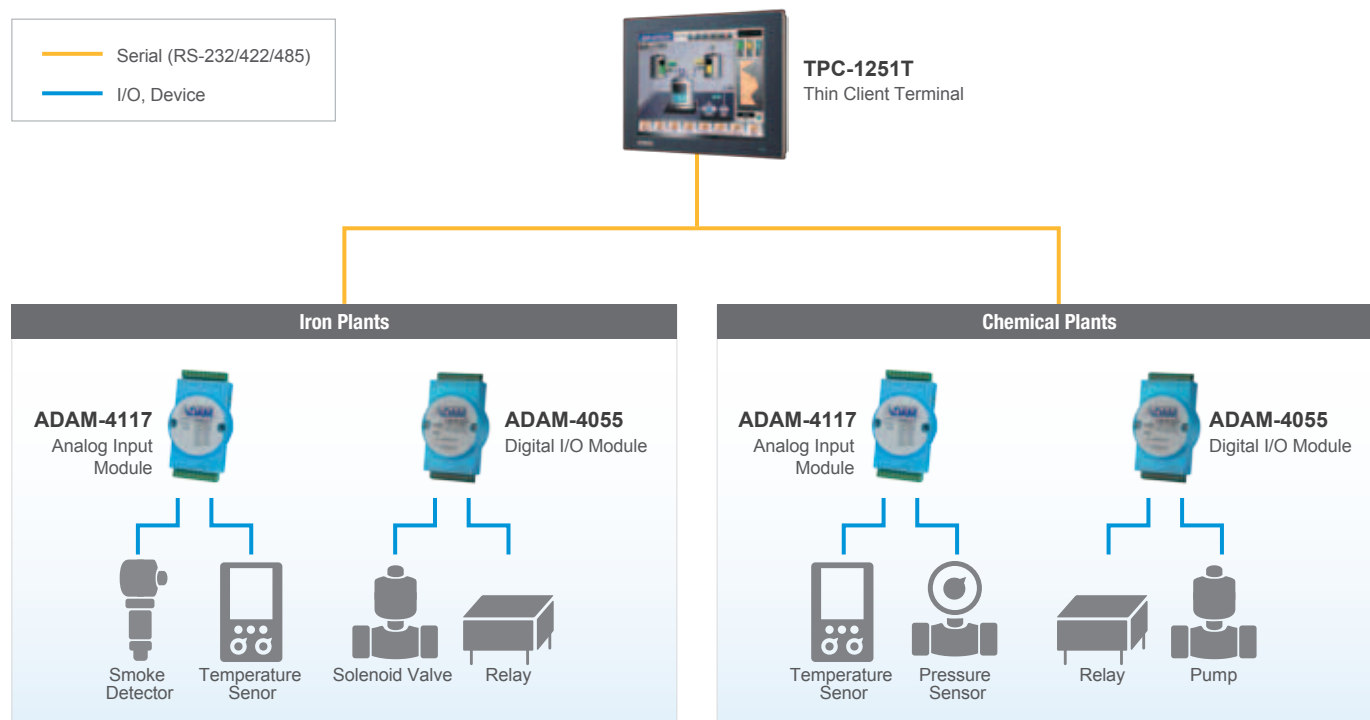
12.1" TFT LED LCD Intel®  
Atom™ Thin Client Terminal

## System Description

Given the significance of both data collection and transmission in this project, Advantech offered a total CEMS solution that brought system performance in line with national environmental regulations. It proved to be a cost-effective solution that satisfied the client's demands. ADAM-4000 series remote I/O modules were employed to acquire data from dust meters and flue gas parameters as well as other devices for measuring

pollutant concentrations (including SO<sub>2</sub>, NO<sub>x</sub>, HCL, CO, CO<sub>2</sub>, etc.) . The data could then be directly uploaded to a TPC-1251T thin client terminal host computer for analysis. Based on this solution, the customer can optimize their system structure with a single RS-485 cable while thereby avoiding complex wiring. This enabled the customer to take quick actions to improve overall air quality.

## System Diagram



## Why Advantech?

Advantech can offer total hardware solutions that improve system automation, stability, and reliability. ADAM-4000 series modules are compact, versatile sensor-to-computer interface units designed specifically for reliable operation in harsh environments. Thus, Advantech's brand awareness and high-quality services give customers peace of mind in using complex system. Advantech's solution reduced costs for this customer while meeting national environment requirements.

# Wastewater Monitoring System Connects Discharge Data to Multiple Cloud Platforms



Location: **Taiwan**

## Background

To prevent environmental pollution from industrial and domestic sewage, Taiwan's government require factories and industrial park to install automated wastewater monitoring system.

Advantech's ADAM-3600 Edge Sensing Device-to-Cloud Solution provides data collection, preprocessing, and transmission forwarding that enables system integrators to efficiently develop an automated wastewater monitoring system that complies with both factory system and government requirements.

## System Requirements

According to the requirements of Taiwan's EPA (Environment Protection Administration), data must be transferred to the local environmental conservation authority's monitoring center at specific intervals. The system also had to be linked to the EPA's public platform in order to provide real-time data on water quality. In contrast to the customary multi-layer structured automated monitor system, a Taiwanese system integrator introduced cloud IoT technology and, with the currently market-preferred

device-to-cloud solution, set the system to transmit data with the MQTT format from nearly 20 types of water quality sensors at various test stations to a unified management Microsoft Azure cloud platform. Data filtering and multi-point transmission features were implemented on the cloud platform to meet the information publication requirements of various governing authorities.

## Project Implementation



### ADAM-3600

Wireless Intelligent RTU with 8x AI, 8x DI, 4x DO and 4-Slots Expansion

### WISE-PaaS/EdgeLink

### WISE-PaaS/EdgeLink

Machine-to-Intelligence Edge Engine



## System Description

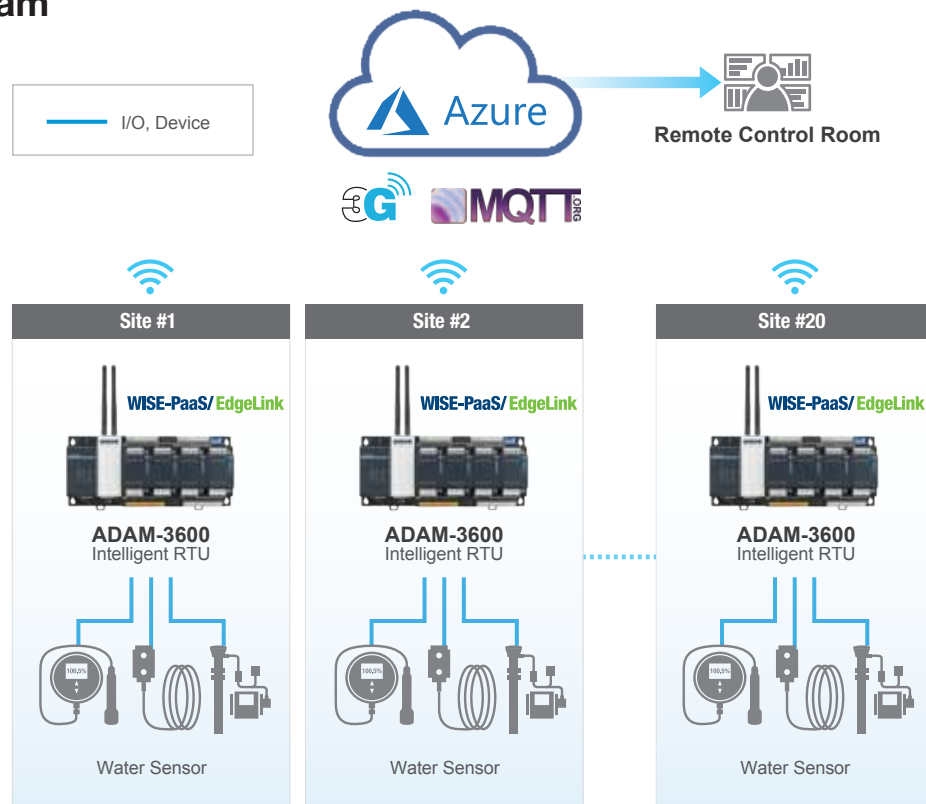
With only the ADAM-3600 intelligent RTU, which comes with built-in WISE-PaaS/EdgeLink intelligent IoT technology, Advantech was able to meet the system requirements for continuous automated monitoring and cloud management. Water quality data was collected from various sensor brands at different measuring points, linked by the ADAM-3600, and then summarized, averaged, resized, or otherwise preprocessed through WISE-PaaS/EdgeLink. Finally, the processed key data was transmitted together via MQTT to the Azure cloud platform at the designated interval.

ADAM-3600 supports a wide temperature range (-40 to 70 °C) and has 20 analog and digital I/O channels onboard. The flexibility of two Ethernet

ports and two Wi-Fi/3G/GPRS/Zigbee-compatible wireless communication mini PCIe slots enabled users to select the most suitable transmission method for device-to-cloud connections.

WISE-PaaS/EdgeLink played a key role in this application. It supported multiple communications protocols (e.g., Modbus, DNP3, RESTful, MQTT) to connect with currently installed PLCs and the various sensors employed for physical signal collection. In addition, before sending data to the cloud platform, it preprocessed data according to user settings, thus reducing the data transmission volumes.

## System Diagram



## Why Advantech?

Advantech's ADAM-3600 with WISE-PaaS/EdgeLink is a leading device in the field of environmental conservation and can satisfy the needs of environmental monitoring. System integrators may achieve device-to-cloud connectivity with simple settings on this compact RTU and shorten program development times. The RTU also handles many configurations of hardware products and thus simplifies maintenance work. For data transmission, the breakpoint resume function ensures data accuracy and completeness. Multiple interface and modularization designs provide users with expansion options according to the intended application.

# Advantech LoRa Wireless Sensor Node Assures Effective Monitoring of Wastewater Discharge



Location: **Taiwan & China**

## Background

Most factories generally undergo routine inspections to record or verify the data from outfall discharge. For large companies that operate many plants, this method requires both a significant commitment of time and human resources.

To overcome the drawbacks of traditional approaches, Advantech helps manufacturers record and manage their wastewater discharge monitoring more efficiently with the WISE-4610 LoRa wireless sensor node.

## System Requirements

A Taiwanese company with more than 10 plants in Taiwan and China consumes an overwhelming amount of water annually. In order to meet effluent environmental regulations, the high-tech company decided to install wastewater monitoring systems. Given the considerable scale of operations, coupled with privacy issues, the operator required the installation of a private network for small quantities of data with long range transmission. Such a system allowed discharge data to be uploaded to the monitoring system through a wireless network.

Software and hardware required for the system included:

1. Field site: A device capable of receiving analog, digital, and RS-485/RS-232 data.
2. Middle: A wireless LoRa gateway supporting the Modbus protocol for upper system connection.
3. Top: Remote monitoring SCADA software that regularly updated effluent detection results.

## Project Implementation



**WISE-4610-S614**

LoRa Wireless Sensor Node providing 4 AI and 4 DI Channels



**WISE-4610-S672**

LoRa Wireless Sensor Node providing 6 DI and 2 COM Ports



**WISE-3610**

Wireless Private LoRa Gateway



**WebAccess/SCADA**

Browser Based SCADA Remote Monitoring Software

## System Description

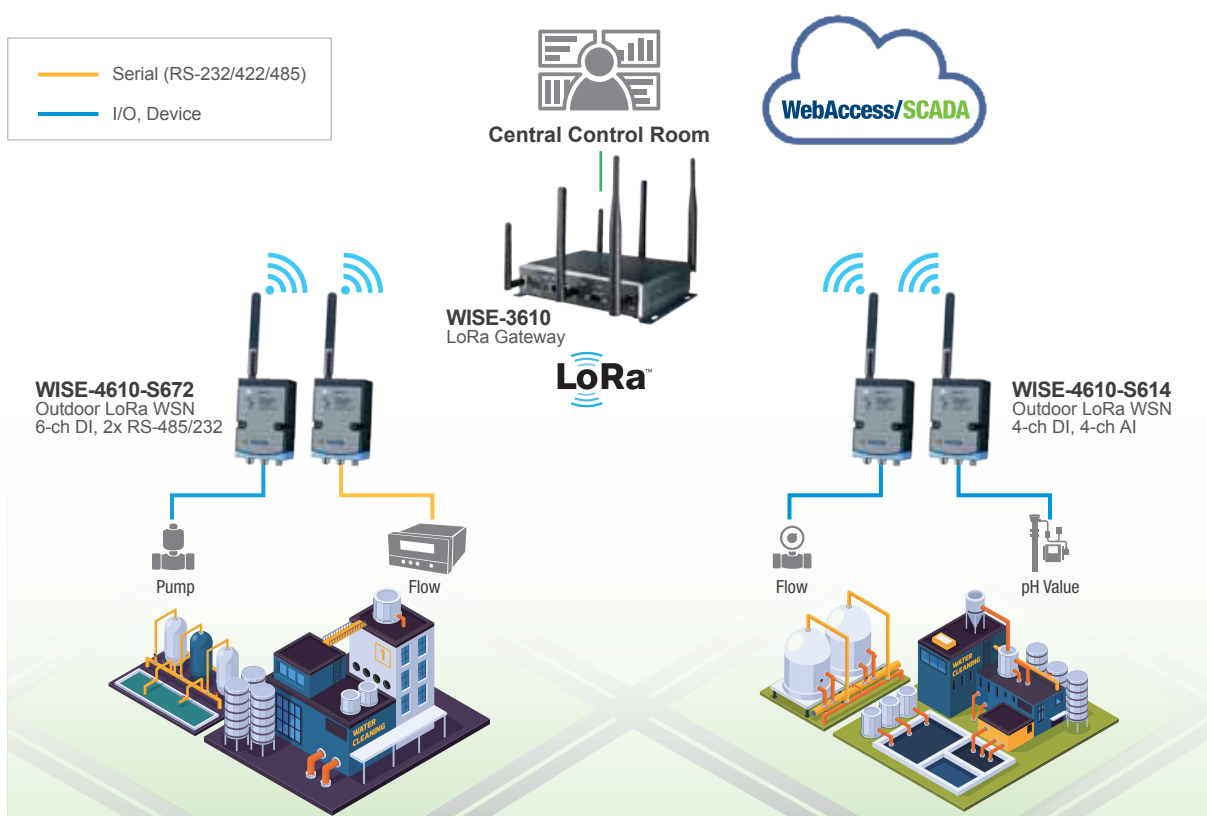
By applying low-power wide-area network (LPWAN) technology, Advantech provided this high-tech company with a hardware and software solution for its wastewater discharge monitoring. The solution, simple in structure and covering a radius of 5 km, included: WebAccess/SCADA remote monitoring software, the WISE-3610 wireless LoRa network gateway and the WISE-4610 LoRa wireless sensor node.

As the wastewater contained different pollutants in different production stages, the company relied on a diverse range of wastewater treating equipment. Advantech specifically provided two products, WISE-4610-S672 and WISE-4610-S614, with 6 digital input channels,

2 RS-485/RS-232 serial ports, 4 analog, and 4 digital input channels, respectively, to connect different types of devices such as water quality sensors, meters, alarms, and counters.

Data collected by WISE-4610 sensor nodes installed throughout the site was transmitted, via the LoRa network, to the WISE-3610 and then forwarded to the wastewater monitoring system developed with WebAccess/SCADA. Effluent measurement results were displayed animatedly and straightforwardly on the central control dashboard and automatically updated on user-set times.

## System Diagram



## Why Advantech?

Advantech's LoRa wireless wide area private network solution requires only two WISE products to integrate directly with SCADA software or private clouds. No computer or router installation is required on site. Additional features - including easy arrangement, easy installation, low power consumption, and solar power supply - make the system structure concise and practical, with low installation and maintenance costs. The time-saving approach helps companies fulfill environmental protection commitments by ensuring maximum performance of pollution prevention systems.

# City Flood Control Systems Get a Powerful IoT Solution



Location: **United Arab Emirates**

## Background

City flood prevention systems exist primarily to address the problems of heavy rain. The function of the pump station needs to be combined with a water forecasting system for scheduling key tasks.

Local authorities in Al Ain, UAE started installing storm water management systems in 2012. The project aimed to improve the operation of storm water networks and pumping stations. This was designed as a two phase project. The first phase was completed in 2012 and the second phase looked at phase one to evaluate its efficacy.

## System Requirements

The project of phase one faced a key issue: too many integration points that made troubleshooting, maintenance and installation expensive and difficult to manage especially since it could only be carried out from a single location. The lack of coordination caused a problem of having too many licenses for administrators to manage and development was not user friendly. Phase two of the project included 13 storm water pumping stations where

each of them required controllers and SCADA node gateways with 3G/4G modem. It was also essential that these 13 pumping stations could be managed centrally from a single web-based SCADA system via a 3G/4G data network that would include historical and current alarms, a detailed reporting system, a configurable dashboard, and integration with third party CCTV systems.

## Project Implementation



**APAX-5580**

Intel® Core™ i7/i3/Celeron  
DIN-Rail IPC w/ 2 x GbE,  
2 x mPCIe, VGA



**UNO-2484G**

Intel® Core™ i7/i5/i3 Regular-Size  
Modular Box Platform with 4 x GbE,  
1 x mPCIe, HDMI, DP

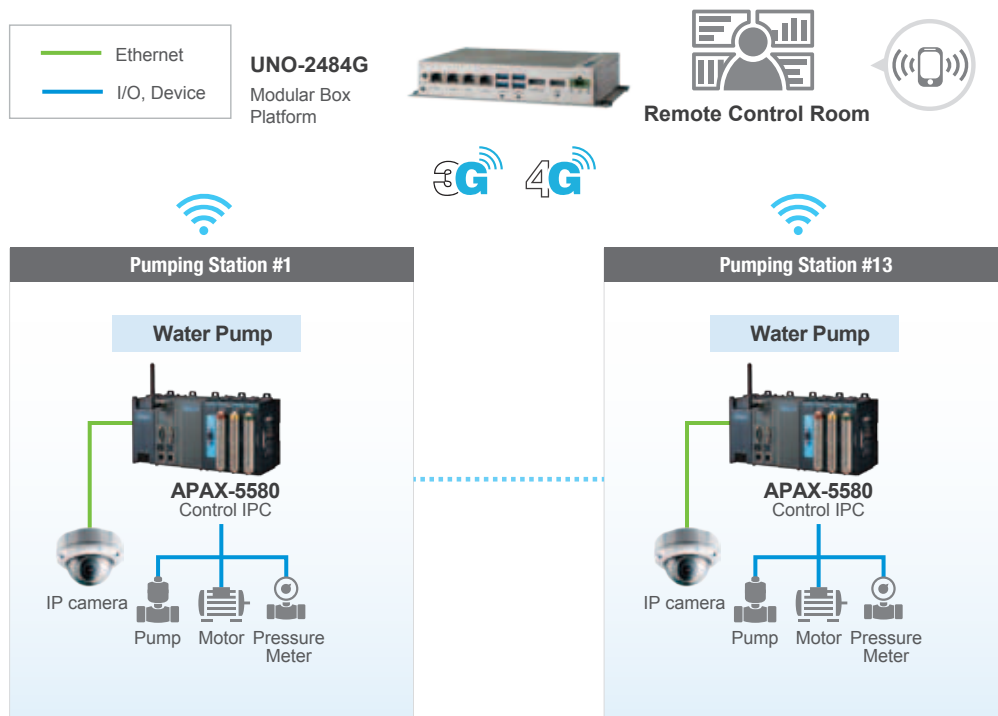


## System Description

At each pumping station the following solution was proposed: An APAX-5580 collected data from pump, motor and pressure meter. Collected data was then sent to UNO-2484G by 3G/4G. Each site installed a third-party CCTV camera where information such as emergencies, and unauthorized access from this feed was collected by APAX-5580 and sent to an UNO-2484G embedded modular box platform. To manage this data, watch the CCTV camera feed in real-time and configure the pumping stations from anywhere, Advantech WebAccess/SCADA System 5000 I/O tags were installed on each of the gateways.

There are many advantages of WebAccess over the existing SCADA system. By having a centralized system that is able to view, control and configure any of the pumps remotely over the Intranet or Internet from any web-browser and mobile operating system, maintenance costs are significantly reduced. Since these 13 sites are spread over a wide area it's incredibly useful if the engineers in the central control room see exactly where the pumps are located. Fortunately, the WebAccess/SCADA includes access to Google maps to the exact location and operating details of the pump can be seen without having to drill down any further.

## System Diagram



## Why Advantech?

By using Advantech's cost effective solution, our customer, ETEK, was able to provide a system that was easy to develop at a much more efficient level than in phase one. With considerably less operating and maintenance costs, this total solution enabled engineers to access all of the system's pumps from any location. Not only is Advantech's hardware easy to install and maintain, but with Advantech's WebAccess SCADA solution, it can be fully managed from any location. With hundreds of pre-installed drivers available for third party devices, the ability for WebAccess to manage legacy systems is unparalleled and makes future expansion considerably less expensive. ETEK's success in this project and their satisfaction with Advantech's solution meant that it was a win-win solution for all concerned parties and the successful bidding of future of projects is all the more likely.

# Advantech NB-IoT Wireless Sensor Node Brings IoT to Legacy Water Pumps



Location: **China**

## Background

Pumps that operate for extensive periods of time are subject to structural damage as well as wear and tear of components. These issues can cause urban flooding after torrential rain, water outages in industrial zones, and other major incidents.

To identify issues and perform repair as quickly as possible, IoT technologies can be implemented to introduce remote monitoring and operation and management (O&M) systems to give complete control over the operating status of distributed pumps.

## System Requirements

A water pump manufacturer established more than twenty branches and service outlets, but struggled with providing timely repairs and maintenance to its customers. As most pumping stations are located in remote regions, basements, building corners, and underground, the adopted remote monitoring and O&M system required wireless network technology with wide coverage and a strong signal to ensure stable data transmission.

For cloud management, because the company's engineers were mostly skilled in mechanical equipment instead of information technologies, the company's first choice was a public cloud supplier that could provide platform-as-a-service (PaaS) and software-as-a-service (SaaS) as well as customized apps and software.

## Project Implementation



**WISE-4471**

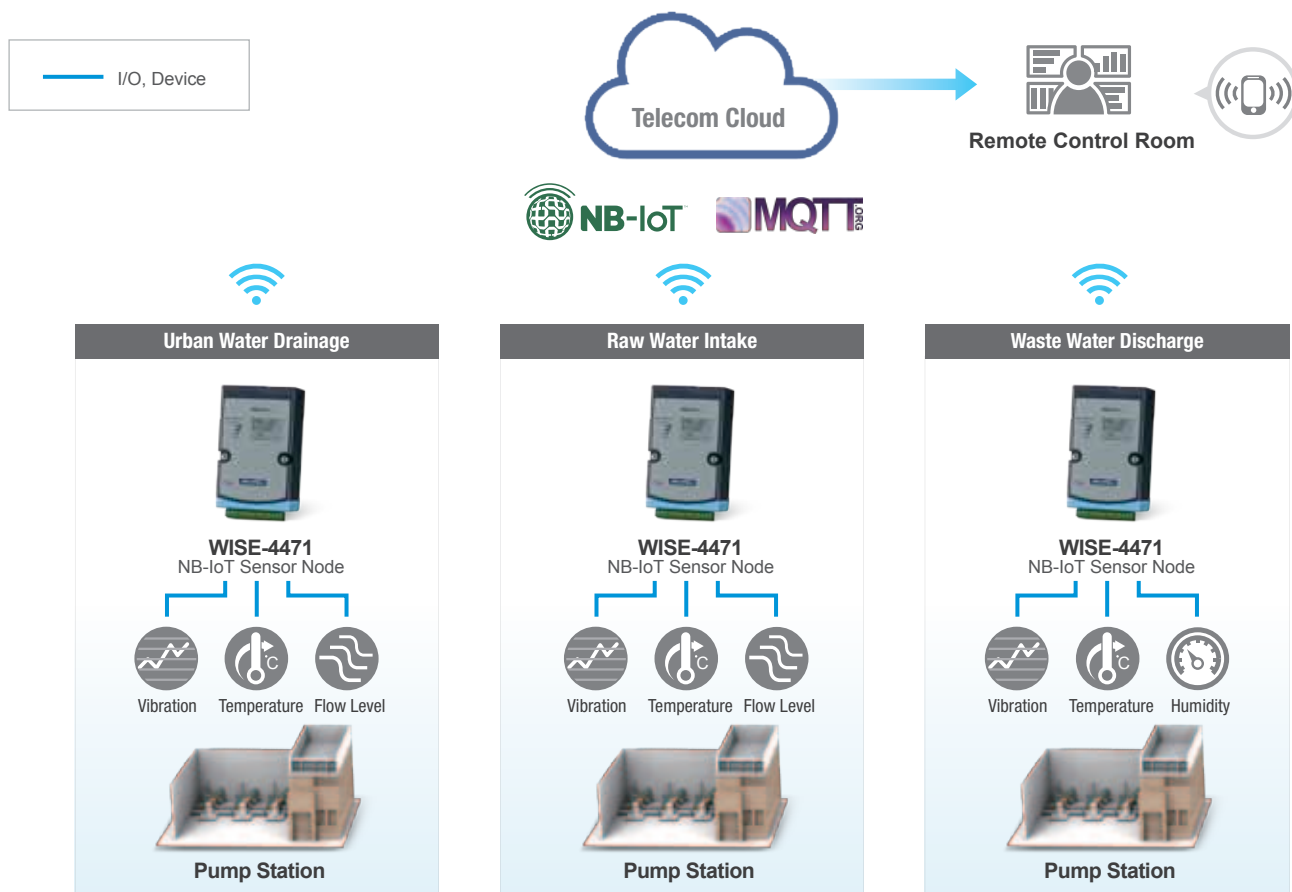
NB-IoT / eMTC  
IoT Wireless Sensor Node

## System Description

Operations started with the installation of the WISE-4471 IoT wireless sensor node in the control cabinet of the water pumps. The modules were connected via RS-485 serial ports to PLCs in the water pumps, thus enabling data collection (e.g., temperature, humidity, voltage, vibration, water levels, and noise levels). The module pre-processes and converts data into MQTT format for uploading once or twice daily to the remote monitoring and O&M system on the public cloud platform via a wide area wireless network provided by China Telecom's NB-IoT SIM card.

This cloud platform with customized apps allows management to observe the starts, stops, and operating status of all pumping stations. In terms of hardware, the WISE-4471 supports narrowband IoT (NB-IoT) radio technology, requiring that the user need only purchase a SIM card from telecom that provides NB-IoT network services. Additionally, it supports MQTT and can be easily integrated with private or public cloud platforms to provide convenient management of pumping stations where monitoring is required.

## System Diagram



## Why Advantech?

Advantech, China Telecom, and the public cloud platform have built an integrated NB-IoT device-to-cloud solution that only requires the installation of the WISE-4471 IoT wireless sensor node. The water pump manufacturer successfully upgraded its business model and has eliminated the need to send staff to inspect pumping stations manually. Given the vast distribution of stations across provinces and cities, the benefits of this centralized remote monitoring and management system are evident. The manufacturer has improved customer satisfaction and established an excellent reputation for high-quality services in the market.

# Industrial Ethernet Solution Enhances Electric Generators Remote Asset Management System



Location: **Germany**

## Background

In after-sales service of power generators, the conventional routine patrol method is often adopted. This method requires incurs large labor costs for the vendor in order to maintain generator units over a wide area. In the event of an error that cannot be resolved in time, equipment can suffer substantial damage.

By remotely monitoring the operational status of each generator via a cloud management system, suppliers can respond immediately, boosting their clients' confidence in the vendor's products and services.

## System Requirements

To avoid the need for software development and minimize the cost of hardware installation, a power generator supplier sought to adopt Microsoft Azure Cloud Services as its management platform. They planned to install a add-on system at the power generator in order to add device-to-cloud equipment management capability. To simplify system installation, maintenance, and expansion, the required power generator docking system required a compact structure.

This docking system had to be able to collect various generator signals for real-time monitoring, to provide control features for immediate reporting, and to be capable of implementing emergency procedures when an anomalous situation occurred. In addition, since power generators were widely distributed, all uploading and downloading of data had to be transmitted via a 3G wireless cellular network.

## Project Implementation



**ADAM-6017**

8-ch Isolated Analog Input and 2-ch Digital Output Modbus TCP Module



**ADAM-6050**

18-ch Isolated Digital I/O Modbus TCP Module



**ADAM-6266**

4-ch Relay Output and 4-ch Digital Input Modbus TCP Module



**SmartFlex**

Advanced 3G/4G Cellular Router



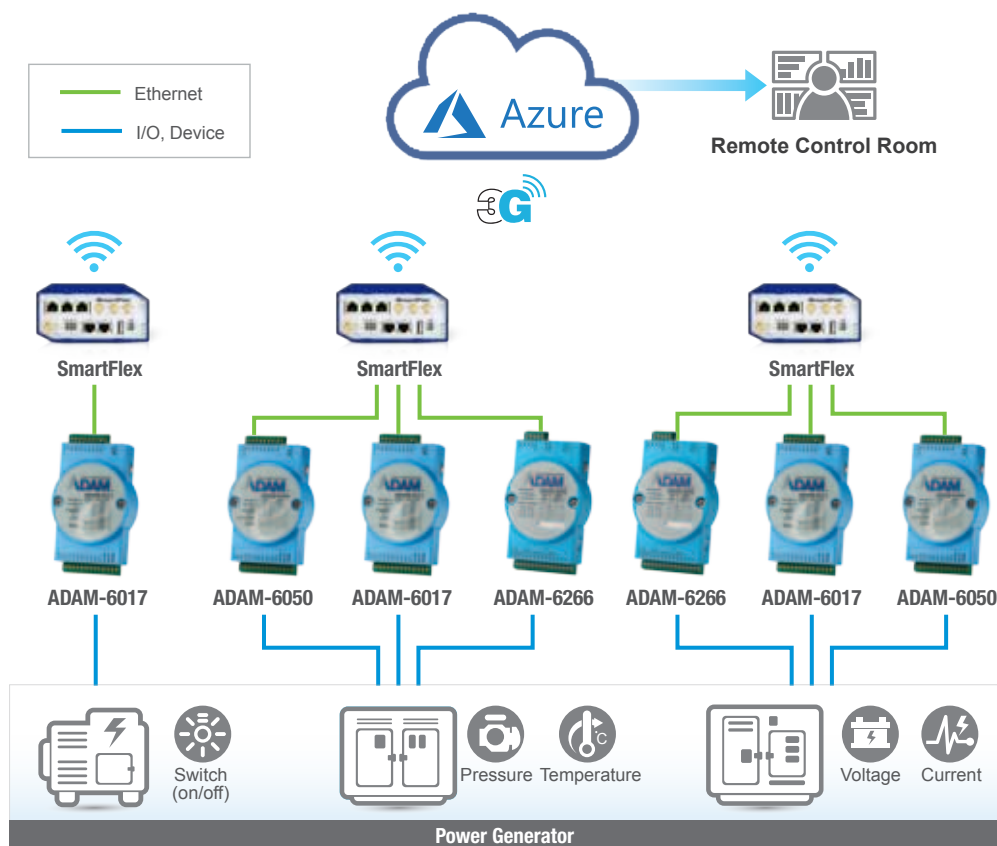


## System Description

Advantech utilized three industrial Ethernet remote I/O modules, namely the ADAM-6017, ADAM-6050, and ADAM-6266, as well as a SmartFlex 3G/4G cellular router. All products were installed in a case beside the generator unit. The ADAM-6017 was utilized to collect operation temperature and power signals from the generator unit; the ADAM-6050 was employed to control on-site switch signals and warning lights; and the ADAM-6266 was adopted to trigger the motor's emergency switch.

Following data encryption, conversion, and processing by the micro-controller unit in the ADAM modules, power generator status data was transmitted via the 3G router to Microsoft's Azure Cloud Service, which is compatible with the ADAM modules, and data could then be visualized in real time through the Power BI visualization tool powered by Azure. This output could then be applied for condition monitoring and preventive maintenance.

## System Diagram



## Why Advantech?

Convenient and innovative applications related to increasingly ubiquitous IoT equipment are changing conventional practices in many industries. However, to simplify the compliance of device-to-cloud data connection, reduce system installation costs, and shorten system implementation times, choosing a compact device-to-cloud structure that can connect with public cloud services is key to ensuring efficient remote management of critical equipment such as power generators, water pumps, air conditioner units, and elevators. Advantech's ADAM solution helped the supplier complete its remote monitoring management system quickly and saved them a substantial amount on software and hardware costs.

# Intelligent RTU for Central AC Remote Monitoring System in Office Buildings



Location: **Korea**

## Background

Central air conditioning (AC) systems are some of the most power-intensive equipment within office buildings. By relying on outdoor main units for producing both hot and cold air, these units then provide HVAC to the subsystems in all sections of the building.

Traditional AC systems are typically serviced through manual labor. Due to the difficulty of keeping up with usage in all sections, a single lapse in attention can lead to a serious human error resulting in excessive electricity bills. This situation prompts many building operators to set up remote monitoring systems for buildings' central AC.

## System Requirements

A renowned South Korean AC equipment manufacturer is dedicated to developing AC systems and peripheral products capable of automated monitoring. Recently, this AC equipment manufacturer embraced cloud computing technology to design auxiliary equipment for central AC systems in office buildings. By incorporating a cloud solution, the company hoped to enhance efficiency, analysis, and prediction by gathering comprehensive data from dispersed subsystems.

To develop a central AC remote monitoring system on their privately built cloud platform, the company required remote terminal units (RTUs), I/O modules, and software tools necessary for uploading information about the AC's main unit and over 100 subsystems to the cloud. The company was also responsible for receiving all commands sent down from the system; giving building managers and users the capacity to monitor multiple indoor units online.

## Project Implementation



**ADAM-3600**

Wireless Intelligent RTU with 8x AI, 8x DI, 4x DO and 4-Slots Expansion



**ADAM-3624**

4-ch Analog Output  
ADAM-3600 Extension  
Module



**ADAM-4018**

8-ch Thermocouple  
Input Module



**ADAM-4053**

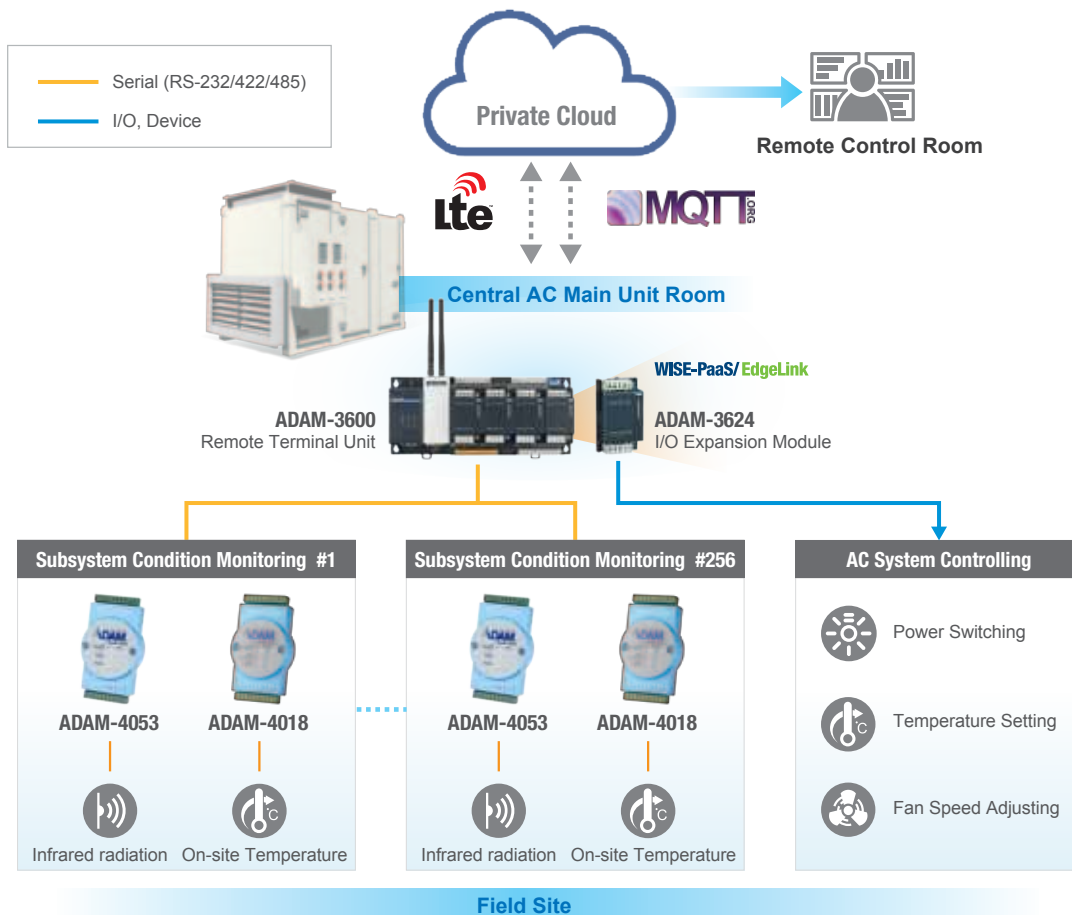
16-ch Digital  
Input Module

## System Description

The project required three functional areas: data collection, pre-processing, and transmission. To meet the project needs, Advantech provided a comprehensive solution including the ADAM-3600 remote terminal unit, WISE-PaaS/EdgeLink edge intelligence core software, the ADAM-3624 analog output module, custom Advantech RS-485 communication modules, the ADAM-4018 temperature measurement module, and the ADAM-4053 digital input module. Each floor's ADAM-4018 and ADAM-4053 were responsible for collecting data from over 200 AC subsystems throughout the entire building and sending the data to the ADAM-3600.

The ADAM-3600 - installed in the central AC main unit room - performed data collection from the main AC unit. All data was sent into the WISE-PaaS/EdgeLink, built-in with the ADAM-3600, for communication protocol conversion, before being sent to a remote monitoring system in private cloud via a wireless network. From there, the system gathered data according to the API format defined by Advantech. Additionally, the digital output channel with built-in ADAM-3600 and the analog output provided by the expansion module ADAM-3624, ran commands sent from the system.

## System Diagram



## Why Advantech?

Advantech provides complete solutions with the ADAM-3600 and ADAM-4000 series products; integrating wireless communication, data acquisition, data conversion, and logic control functions. In doing so, Advantech helps AC equipment manufacturers quickly design and implement central AC remote monitoring systems while assisting end users in carrying out optimized analysis of AC operations.

## Regional Service & Customization Centers

<b>China</b>	Kunshan 86-512-5777-5666	<b>Taiwan</b>	Taipei 886-2-2792-7818	<b>Netherlands</b>	Eindhoven 31-40-267-7000	<b>Poland</b>	Warsaw 00800-2426-8080	<b>USA</b>	Milpitas, CA 1-408-519-3898
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## Worldwide Offices

### Greater China

#### China

Toll Free	800-810-0345
Beijing	86-10-6298-4346
Shanghai	86-21-3632-1616
Shenzhen	86-755-8212-4222
Chengdu	86-28-8545-0198
Hong Kong	852-2720-5118

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Taipei & IoT Campus	886-2-2792-7818
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Israel	072-2410527
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#### Malaysia

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Penang	60-4-537-9188

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#### Indonesia

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Düsseldorf	49-2103-97-855-0

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St. Petersburg	8-800-555-81-20

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Irvine	1-949-420-2500
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São Paulo	55-11-5592-5367

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Mexico City	52-55-6275-2727

# ADVANTECH

Enabling an Intelligent Planet

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

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