PACTECH

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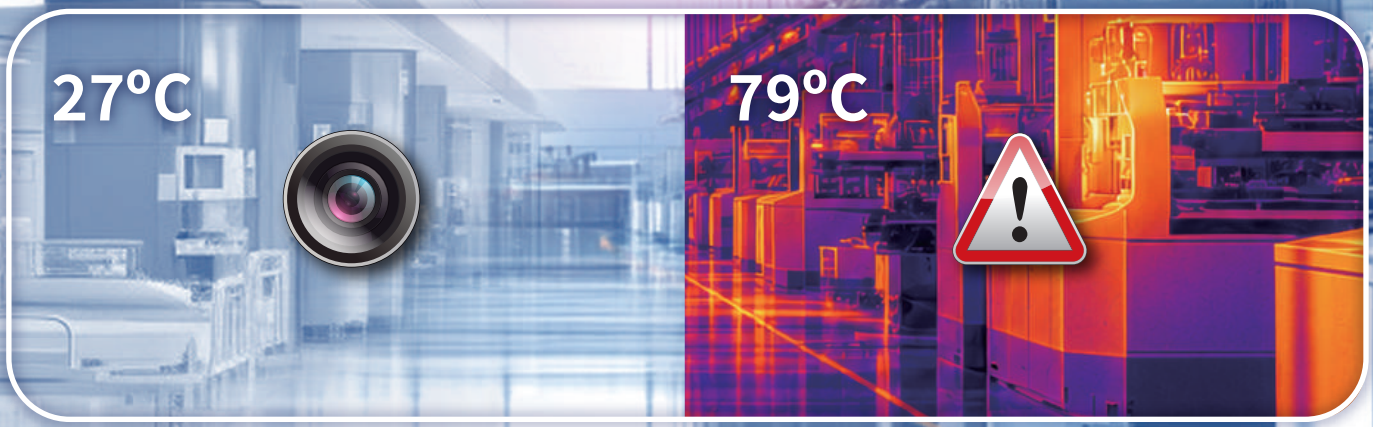
From Medical to Industrial: The Versatile Applications of Infrared Thermometry



Application Story

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New Products

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ICP DAS CO., LTD.

COMPUTEX 2026: ICP DAS AI Predictive Maintenance & Energy Management for Smart Factories

By Editorial Team (Translated by Lynn Tang)

As manufacturers prioritize smart factories and ESG, ICP DAS will showcase AI- and ESG-driven solutions at COMPUTEX 2026—highlighting predictive maintenance and energy optimization. A complementary Hsinchu seminar this July will demonstrate practical applications to strengthen enterprise resilience and competitiveness.

Focusing on AI Empowerment and ESG Energy Management, the exhibition features predictive maintenance, thermal anomaly detection, energy analytics, and HVAC control. These solutions merge edge computing and cloud platforms to accelerate smart factory decision-making.

From Equipment to Energy: The Core of Smart Factory Decisions

For AI applications, ICP DAS presents a PET-AR401 edge AI vibration monitoring solution. Combined with the iMotor Utility platform and ITRI's PHM technology, it detects real-time equipment abnormalities—shifting from reactive to predictive maintenance to cut unexpected downtime.

To enhance safety in power distribution and renewable energy applications, ICP DAS also showcases an infrared thermal imaging solution that combines the iSN-813-MTCP infrared temperature sensor with a WISE edge controller. Using thermal and visible-light image fusion technology, the system detects abnormal temperature rises in real time and provides image-based alarm notifications to improve monitoring efficiency.

As robotics, advanced packaging, and semiconductor production demand greater precision and speed, EtherCAT has become key for motion control. ICP DAS will demonstrate high-speed synchronized control solutions meeting the real-time and stability requirements of precision equipment.

For ESG initiatives, ICP DAS integrates PM-3133/PM-4324AP smart meters, PMC-2841M concentrators, and the IoTstar platform into an energy management solution—providing analytics, demand forecasting, and load control to cut energy costs and support carbon inventory.

For energy-intensive HVACs, ICP DAS integrates its ECO controller with the UA-7231M IIoT Server and SC-6104-W5 Module—

using real-time monitoring and automated control to boost chiller and cooling tower efficiency for significant energy savings.

IIoT Architecture: Bridging the Last Mile to Smart Factories

ICP DAS also showcases air quality monitoring, wireless, and Remote I/O solutions—building a complete IIoT architecture that links sensing, communication, and control into a closed-loop data system.

Hsinchu Seminar: Powering Precision Control & Smart Manufacturing

To help enterprises accelerate AIoT adoption and evaluate practical benefits, ICP DAS will host the "Smart Edge, Sustainable Factory: AIoT Total Solution Seminar" on July 23 at the Sheraton Hsinchu Hotel.

Besides AI and ESG applications, the seminar will focus on motion control technologies. Topics include high-speed synchronized control based on EtherCAT, real-world implementation cases, predictive maintenance, energy optimization, and industrial safety.

To meet rising precision demands in robotics, advanced packaging, and semiconductors, this seminar shares real-world strategies to maximize equipment reliability and efficiency. Register early as seating is limited.

To drive future competitiveness through equipment reliability, control accuracy, and energy efficiency, ICP DAS's COMPUTEX exhibit and seminar will demonstrate how AIoT elevates equipment monitoring to advanced control and smart factory decision-making.

Exhibition Information

Exhibition: COMPUTEX Taipei

Date: June 2–5, 2026

Booth: K1121a, Hall 1, Taipei Nangang Exhibition Center

ICP DAS is committed to promoting sustainable manufacturing and warmly welcomes industry professionals to visit its booth and explore new opportunities in smart manufacturing and energy transformation.

Redefining Tea Egg Quality Through Data

In food manufacturing, product consistency and safety are fundamental requirements. As production expands, achieving real-time monitoring and energy transparency without replacing existing equipment becomes a key challenge. ICP DAS addresses this need with a practical IIoT upgrade approach.

By Andrew Wu (Translated by Eva Lee)

From Normal Food, See Process Management on Site

Take tea egg production as an example. From cooling, braising, to sterilizing, every step affects quality. As production grows, manual management becomes increasingly inefficient.

Digitalization is no longer simply an efficiency improvement tool; it is now a necessity, yet many factories still face long-standing operational issues.

Challenges in Production Management

Pre-implementation problems typically mirror traditional manufacturing challenges:

Limited Visibility of Cold Chain

Over ten cooling rooms lack real-time monitoring. Cooling consumes 45% of daily power; unmonitored anomalies during off-hours risk severe material loss.

Lack of Energy Transparency

High-energy equipment like boilers lack precise measurement, obscuring energy costs. Management cannot gauge regional usage or identify savings.

Manual Data Collection

Production data was mainly recorded on

paper or Excel, resulting in low efficiency, higher errors, and delayed progress tracking.

These issues are common among traditional manufacturing facilities pursuing digital transformation.

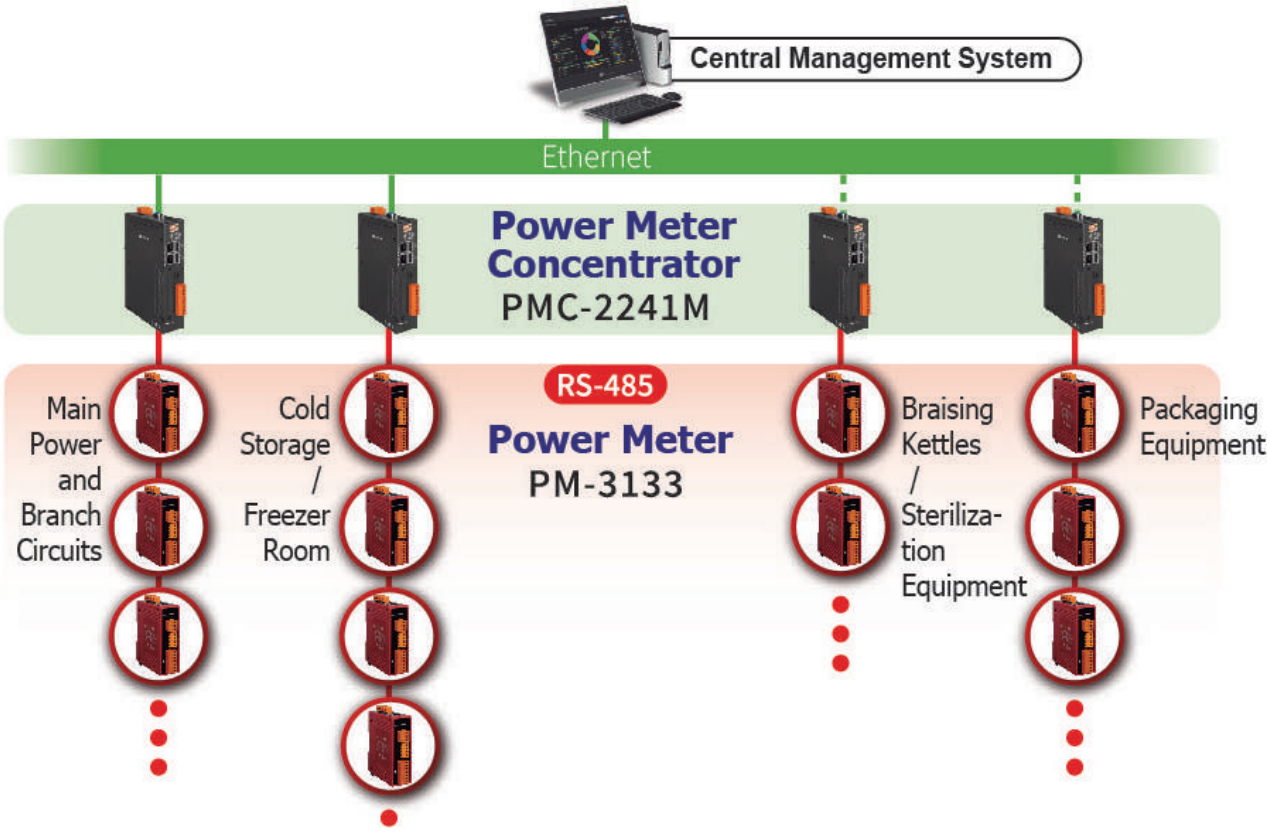
Equipment-Free Upgrade Solutions

ICP DAS provides a low-barrier, fast-integration IIoT architecture, enabling digital upgrades without existing equipment changes.

The field-to-cloud architecture includes:

- Full Power Sensing: PM-3133 meters measure real-time power parameters at regional panels, building a solid data foundation.
- Centralized Data Management: PMC-2241M/ PMC-2841M power concentrators aggregate, store, and transmit data, forming a reliable backbone.
- Real-Time Event Response: Built-in IF-Then-Else logic triggers instant LINE alerts upon anomalies, reducing reaction time.
- Visual Decision Platform: AVEVA Edge SCADA converts complex data into intuitive charts for real-time and trend analysis.

This architecture unifies energy management and production monitoring into one optimizable system.



▲ Fig. 1 | System Architecture
Integrate power meters (PM-3133) and concentrators (PMC-2241M) via Ethernet and RS-485 for power data real-time transmission and central management.

Core Technologies: Stable, Accurate, and Scalable

PM-3133 Series Power Meters | The Frontline of Precision Measurement

The PM-3133 delivers high accuracy (<0.5%, PF=1) three-phase power measurement and supports split-core CTs (up to 400 A). They offer flexible installation, relay outputs for on-site alerts, and broad 10-500 VAC compatibility for rapid deployment.

PMC-2241M / PMC-2841M | Data Hub and Management Core

The PMC series integrate data collection, demand management, and alerts via a Web UI. They support protocols like Modbus, MQTT, and SNMP for seamless integration, ensuring secure access with VPN, HTTPS, and SFTP.

AVEVA Edge | Visual Decision-Making Platform

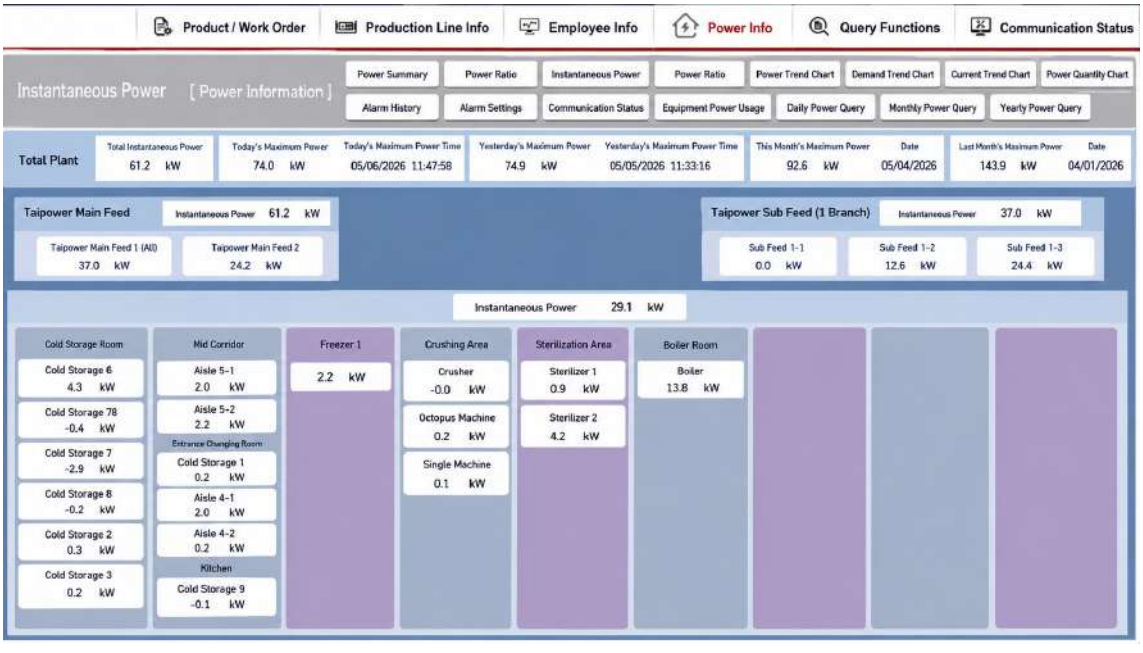
AVEVA Edge provides a cross-platform SCADA/HMI solution for multi-device connectivity and quick deployment. It features trend analysis, alarms, reports, and database functions. It supports over 250 drivers to connect various PLCs and equipment easily.

From Monitoring to Prediction: A Shift in Management Models

The ICP DAS solution goes beyond simply “displaying data”, it enables intelligent decision-making.

Using IF-Then-Else logic, the system sends LINE alerts for low currents or downtime. Managers grasp situations instantly, even off-hours, minimizing risks.

Data are not only passive records but also an active management tool.



▲ Fig. 2 | Central power monitoring system showing factory-wide usage and equipment distribution for energy and anomaly management.

Comprehensive cybersecurity mechanisms (including VPN, HTTPS, and SNMP v3) further safeguard data transmission and remote access.

Implement Benefits: Using Data for Decision-Making

The system fosters a data-oriented model:

- Cold Chain Monitoring: 24/7 monitoring and alerts drastically cut anomaly-induced losses.
- Smooth Processes: Mobile forms replace paper, syncing data instantly to boost efficiency and accuracy.
- Concrete Energy Use: Clear power structures empower managers to craft data-backed saving strategies.

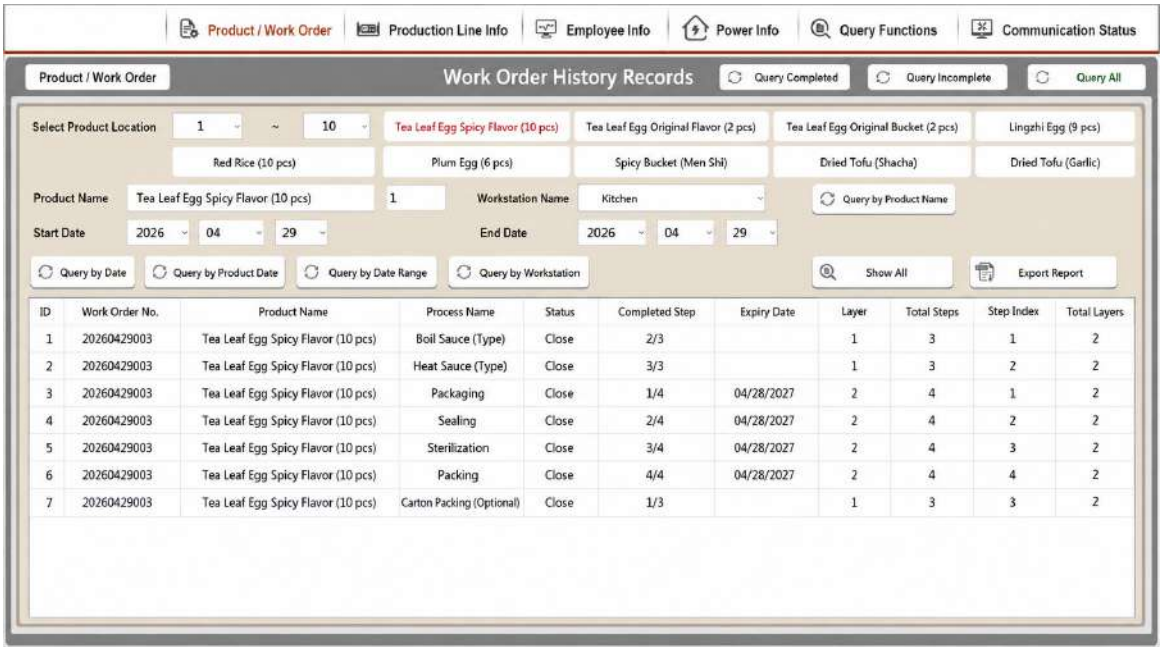
Realizing Digital Transformation

For most food factories, the key is "painless adoption and gradual expansion," not just advanced tech.

ICP DAS uses modular architectures to upgrade existing foundations securely, shifting factories from passive to proactive.

With instant data and risk warnings, quality and efficiency become verifiable, optimizable capabilities.

Starting with a tea egg, traditional production lines can move toward a resilient future.



▲ Fig. 3 | Production Management System (Tablet) for real-time data entry and queries, enhancing efficiency.

How Can Existing Equipment Be Integrated into Digital Systems? A Case Study on Energy Monitoring Transformation in an Electronics Plant

Integrating legacy equipment is a key challenge in manufacturing digitalization. In long-established electronics plants, mixed-generation equipment and diverse communication protocols often hinder centralized monitoring. This case shows how communication integration and data conversion can build a visualized energy monitoring system without replacing existing equipment.

By Andrew Wu (Translated by Eva Lee)

Many electronics plants still rely on indicator lights for equipment status and manual recording for energy data, reflecting the limitations of earlier industrial infrastructures.

As plants expand, network-ready equipment coexists with older assets that cannot directly connect to management systems. The result is fragmented data and increasingly complex system management.

Thus, the core challenge for enterprises is not acquiring new equipment, but integrating existing assets into digital systems.

Making Dispersed Data Visible

The electronics plant in this case faced complex wiring, disconnected communications with substations, and manually recorded energy data, limiting operational visibility.

The first step was integrating scattered information to establish monitoring capabilities:

- Convert RS-485 meters and thermostat to Ethernet for network integration.
- Collect protection relay and key equipment data to monitor system statuses.
- Centralize data in the control room for unified management of power and breaker status across substations.

Integration Without Equipment Replacement

Although full replacement is straightforward, it is often costly and disruptive to production.

Therefore, for this case: The existing equipment was retained and integrated into the digital system through protocol conversion and signal capture.

The on-site multi-brand meters mostly supported Modbus RTU but had various settings that were hard for direct integration. So, using I-7514U to aggregate RS-485 signals and tGW-715i to convert them to Ethernet (Modbus TCP) enabled unified data collection.

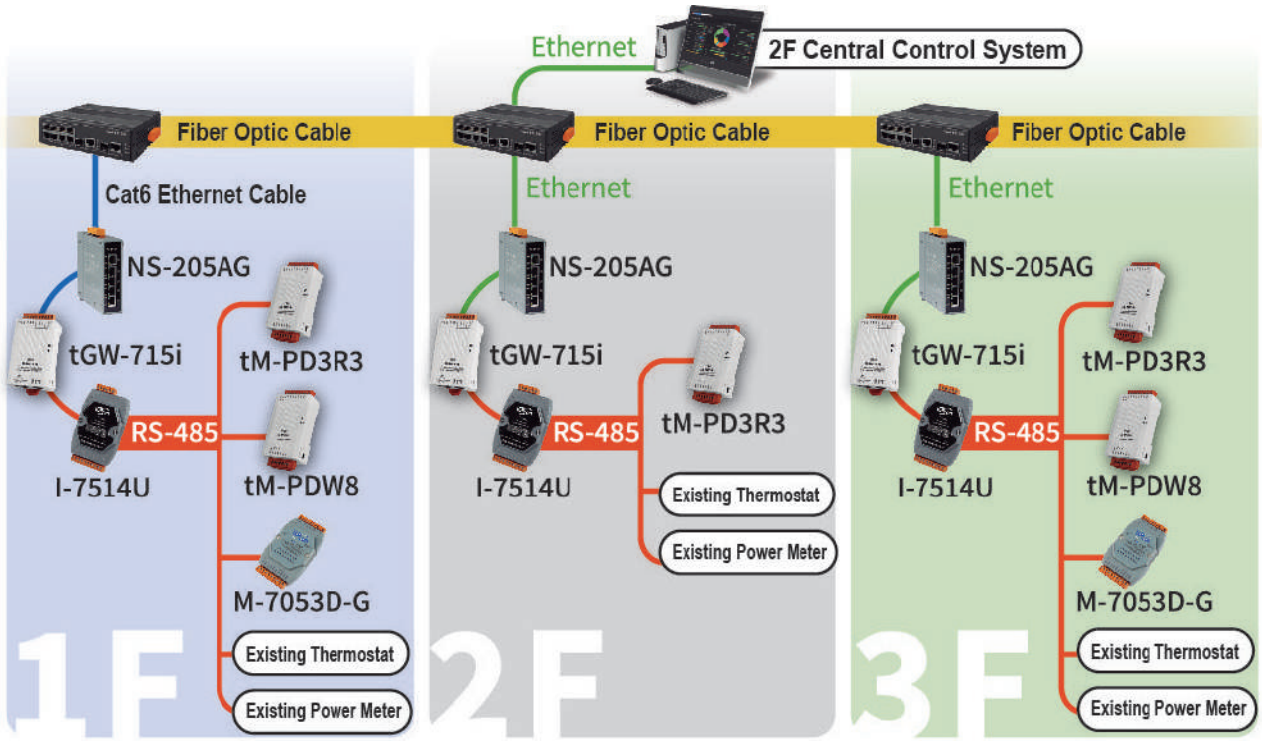
For non-communicating devices, tM and M-7000 series RS-485 I/O modules were deployed to capture their digital and analog signals (e.g., switch status, temperature changes). This allowed non-networked devices to connect through conversion.

In short, even “non-communicative devices” can be “translated” into system-readable data.

Stable Communication in Complex Environments

Because devices were scattered across different zones, long wiring distances and industrial interference made communication reliability a key concern.

Using the I-7514U for signal splitting and concentration optimized multi-device, long-distance RS-485 communication. Combined with the tGW-715i for network data conversion, it enhanced communication quality, ensured stable



▲ Fig. 1 | Existing Equipment Communication Integration Architecture
Integrating existing RS-485 devices into Ethernet network via I-7514U and tGW-715i for centralized monitoring.

operation, and provided future scalability.

From Manual Records to Real-Time Management

After integration, energy data was collected automatically and equipment status became centrally visible, enabling faster issue detection.

Furthermore, data-driven decisions replaced experience-based management in energy saving, maintenance, and production optimization.

Project Highlights

1. Digital Integration Without Replacement
   Centralized RS-485 signals using I-7514U and converted them to Ethernet (Modbus TCP) via tGW-715i, integrating existing meters and thermostats without replacement.
2. Real-Time Energy and Equipment Monitoring
   Deployed tM and M-7000 series I/O modules to capture equipment signals, centralizing dispersed power and device data to improve management visibility.

3. Enhancing Communication Stability for Long-Term Operation
   Utilized I-7514U for signal splitting and isolation to optimize long-distance, multi-device networks, securing stable data transmission and scalability.

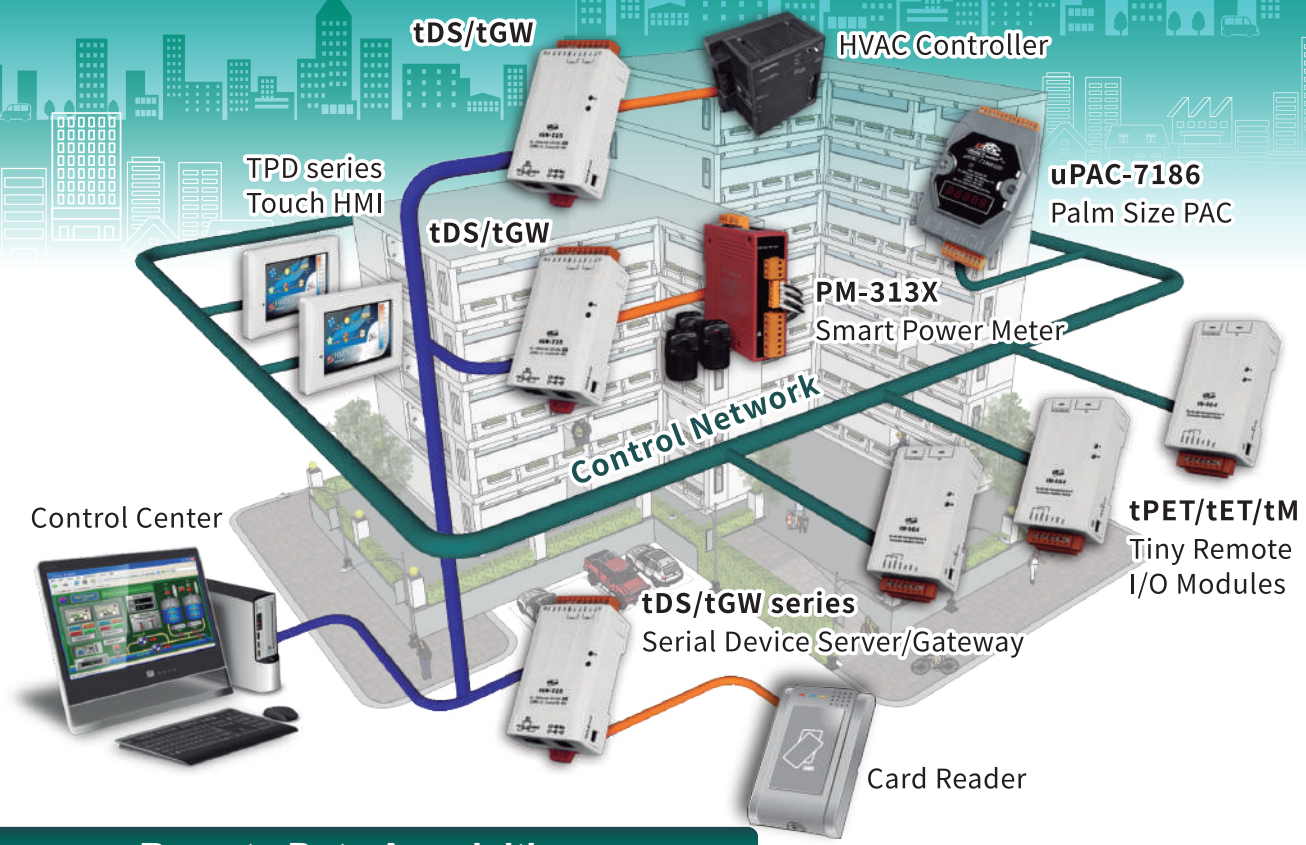
Digital Transformation Doesn't Require Total Replacement

This case demonstrates that digitalization does not require full equipment replacement. Existing equipment can be integrated step by step.

Connecting previously scattered data clarifies overall factory operations, transforming management style from experience-driven to data-backed.

When data becomes visible, continuous optimization becomes possible.

Industrial Communication



Remote Data Acquisition

tPET Series

Tiny PoE Remote I/O

- Modbus TCP/UDP, MQTT
- IPv4/IPv6, SNMP v2c
- 32-bit Counters (DI)
- Pair-Connection

ET-2200 Series

Ethernet Remote I/O

- 2-port switch: Daisy Chain
- Modbus TCP/UDP, MQTT
- IPv4/IPv6, SNMP v2c
- 32-bit Counters (DI)
- Pair-Connection

tM Series

RS-485 I/O Module

- Industrial RS-485 multi-drop network
- Protocols: DCON, Modbus RTU/ASCII
- Pair-connection

Accessories

Serial to Ethernet Device Server

tDS Series

- Virtual COM PORT technology
- TCP/IP connectivity
- Pair-connection

Serial Devices

Modbus TCP to Modbus RTU/ASCII

tGW Series

- Modbus Read-Cache
- IPv4/IPv6 Dual-Stack
- SNMP v2c network management
- Pair-connection

Modbus Devices

E-Catalog
tGW-700 Series
Tiny Gateway

E-Catalog
tDS-700 Series
Serial-to-Ethernet Device Server

E-Catalog
Industrial
Remoto I/O

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Industrial Computer Products and Data Acquisition Systems

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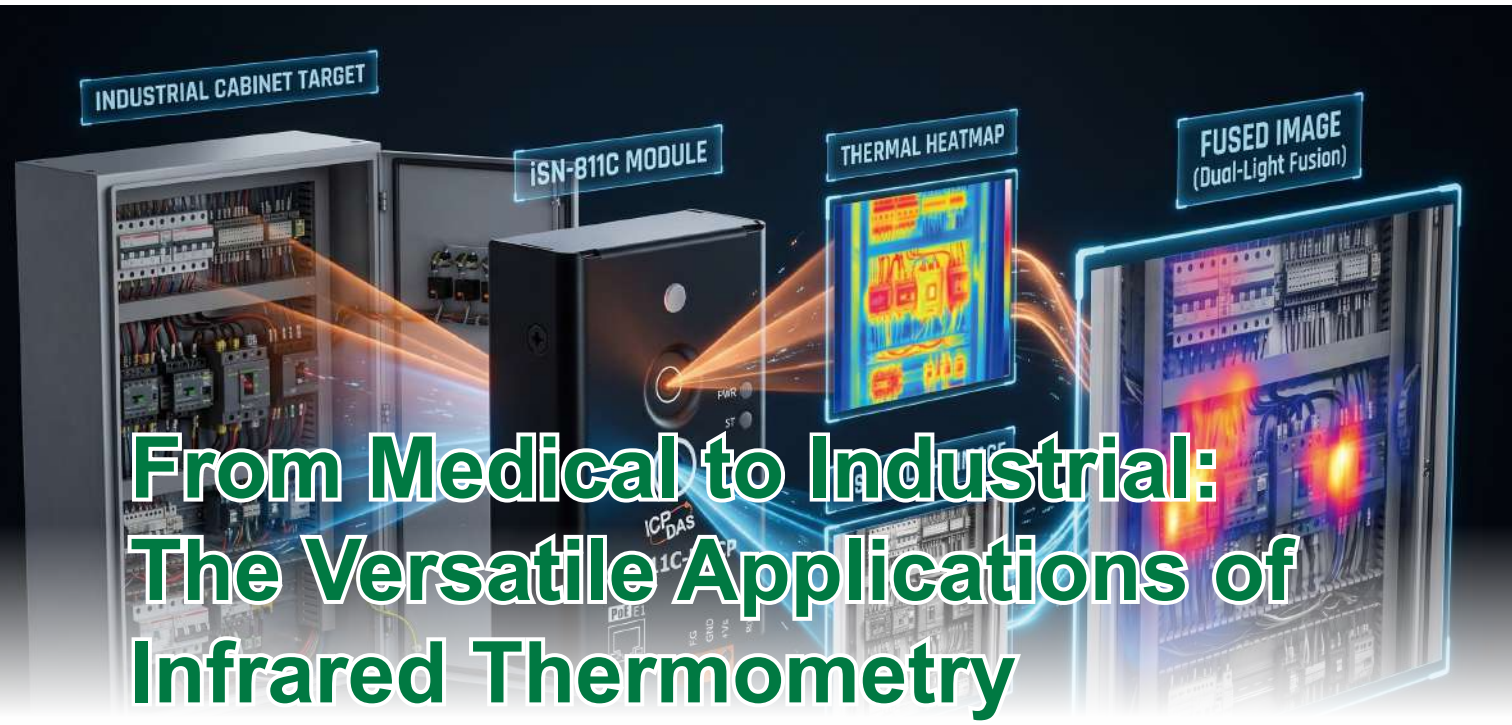


From Medical to Industrial: The Versatile Applications of Infrared Thermometry

Temperature is a critical metric for system health. Evolving from medical single-point diagnostics, infrared thermometry now drives industrial broad-area monitoring and predictive maintenance. This article explores how iSN-81x thermal modules utilize edge computing, dual-light fusion, and IoT to help businesses shift from reactive to proactive maintenance.

By Adam Tsai (Translated by Carol Hsu)

Tech Crossover: Medical to Industrial Thermal Imaging

In the medical field, infrared thermometry (like ear and forehead thermometers) centers on 'microscopic absolute accuracy.' Designed for the human body's extremely narrow temperature fluctuations, it demands a clinical precision of ±0.1°C.

The shift from clinical settings to factory floors has fundamentally changed the focus of this technology. In high-risk industrial environments with extreme temperature fluctuations, measuring “absolute temperature” at a single point is no longer sufficient. Instead, maintenance operations must rely on detecting “relatively abnormal temperature rises” at multiple points to understand the spatial distribution and long-term temperature trends.

As a result, industrial thermal imaging is shifting from precision measurement to visual monitoring and predictive analytics.

Industrial Challenges & Limitations of Traditional Thermometry

Many traditional industries still rely on 'periodic inspections' or 'reactive maintenance'. While highly accurate, conventional contact thermometry's slow response makes it impractical for high-risk applications like high-voltage or high-

speed equipment.

To overcome these issues, many factories use handheld thermal cameras for manual inspections. However, structural problems remain:

1. Long Blind Spots: Monthly or quarterly checks cannot prevent sudden equipment degradation.
2. High safety risks: Approaching high-voltage gear risks electric shock or arc flashes.
3. Data Silos: Manual records are hard to integrate with SCADA/ERP systems for long-term trend analysis.

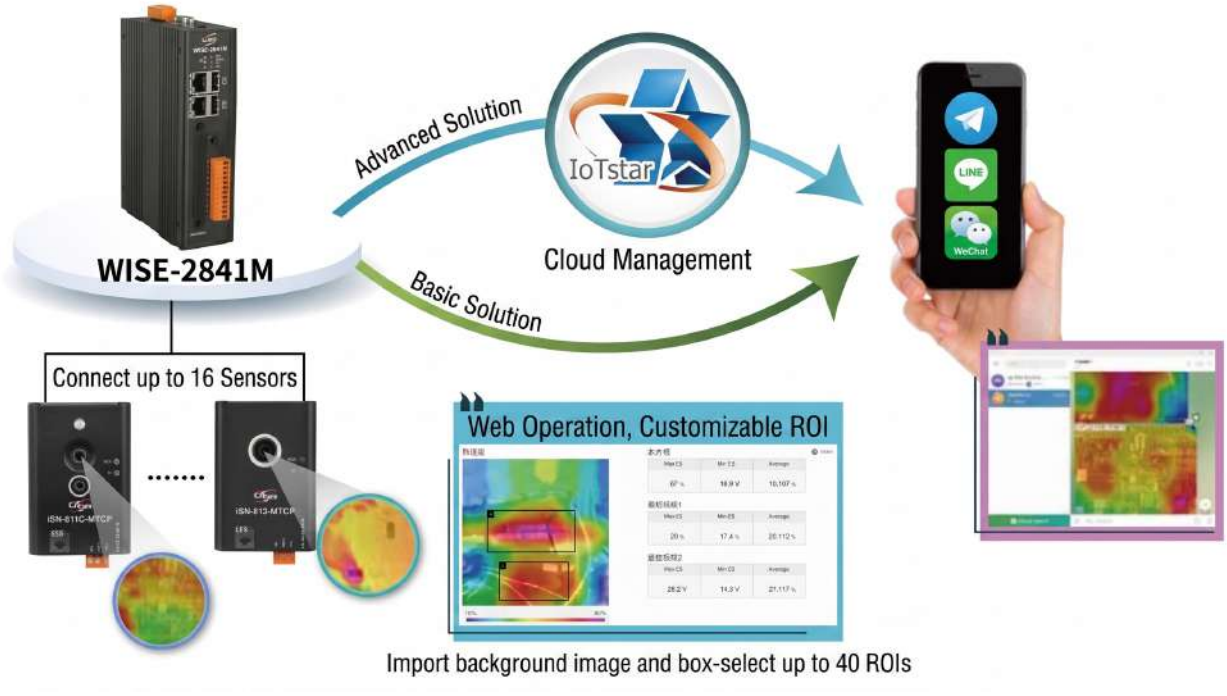
The shift to continuous monitoring exposes traditional limitations, driving the need for next-generation solutions.

ICP DAS iSN-81x Series: Thermal Sensing Nodes Built for the Industrial IoT

To solve these challenges, ICP DAS introduces the iSN-81x infrared thermal modules. Overcoming the cost and bulky sizes of traditional high-end thermal cameras, this lightweight, easily deployable solution leverages three core features to become an essential frontline IIoT sensing node.

Zero-Programming Edge Computing and Custom ROIs

First, from an implementation standpoint, it significantly lowers adoption barriers.



▲ Figure 1 | WISE-2841M Thermal Monitoring and Cloud Alerts
The WISE-2841M integrates infrared sensors for Web-based ROI and alarm setup, delivering real-time notifications to cloud and mobile devices.

Integrating the WISE-2841M edge controller and iSN-81x-MTCP thermal sensors, ICP DAS delivers a robust 'Zero-Programming' architecture. It empowers engineers to easily configure and monitor the system via an intuitive Web interface—no complex coding required.

At the operational level, the system blends thermal and field images for intuitive visualization, allowing users to easily define ROIs and configure max/min/avg temperature thresholds.

Upon detecting temperature anomalies, the WISE-2841M's IF-THEN-ELSE logic engine instantly triggers alerts, pushes notifications, and uploads data. This edge architecture reduces backend loads and immediately turns data into actionable insights, driving the successful execution of predictive maintenance.

Dual-Light Fusion: Seamless Overlay of Thermal and Field Images

Once basic monitoring is in place, the next step is helping field staff 'grasp problems at a glance.'

The iSN-811C-MTCP blends thermal and field images via "Dual-Light Fusion." Overlaying thermal images onto full-color field backgrounds allows administrators to track temperature distribution and exact equipment locations on one screen."

▲ Figure 2 | iSN-811C-MTCP Dual-Light Fusion
Fusing thermal and field images, the iSN-811C-MTCP instantly reveals hotspots, accelerating inspections.

This intuitive design drastically enhances on-site analysis. Particularly in environments with dense piping or complex electrical panels, maintenance teams can locate heat sources, cutting down inspection and response times while reducing potential risks.

Diverse Architectures for IT/OT Convergence

With sensing and analysis improved, the seamless flow and integration of data become the next crucial step.

In terms of communication, ICP DAS offers highly flexible options tailored to various factory generations, ensuring the seamless connection of IT and OT systems.

For legacy facilities, the iSN-81x-MRTU utilizes RS-485 and Modbus RTU. It provides excellent EMI resistance and supports cost-effective, large-scale daisy-chain deployments, enabling easy upgrades without overhauling existing infrastructure.

Targeting advanced digital environments, the iSN-81x-MTCP series delivers next-level integration. It simplifies deployment with PoE support, handling both power and data via one cable. By broadly supporting Modbus TCP, RESTful API, and MQTT, the system empowers flexible architectures—whether utilizing RESTful APIs to write to remote databases or acting as an MQTT client to push anomaly notifications to a Broker.

Within this framework, SCADA systems, cloud platforms, and IoT applications can instantly retrieve key data via a simple 'subscription' model, empowering businesses to smoothly construct data-driven intelligent monitoring architectures.

Cross-Domain Applications

HV Switchgear & Busbar Protection

In semiconductor and heavy industries, loose panel contacts can cause resistance-induced overheating and fires. Magnetically mounted inside cabinets, the iSN-81x delivers 24/7 non-contact monitoring.

Integrating the PM-3133 smart meter enables simultaneous temperature and power analysis. Instant threshold alerts empower preemptive maintenance, preventing unexpected outages and major losses.

▲ Figure 3 | HV Switchgear Hotspot Monitoring
Thermal imaging instantly detects switchgear hotspots, preventing electrical fires and downtime.

Multi-Dimensional Monitoring for Rotating Machinery

Single-parameter monitoring cannot address complex motor and pump failures. ICP DAS solves this with an industry-rare vibration and thermal edge-sensing integration.

Engineers can mount iSN-700 vibration sensors on motor casings and iSN-81x thermal modules at a safe distance. Simultaneous alerts for abnormal vibration and high temperatures trigger an automatic safe shutdown, protecting valuable equipment.

▲ Figure 4 | Predictive Maintenance Using Vibration and Thermal Imaging
Combined vibration and thermal monitoring provides early equipment failure warnings.

Conclusion

Implementing thermal predictive maintenance reduces annual operating costs by 8–12% through minimized downtime, optimized spare parts usage, and eliminated emergency repairs.

Infrared monitoring has transformed industrial safety. Using the iSN-81x series' Thermal Imaging Integration Technology, enterprises can detect critical signals early, advancing toward the ultimate goal of zero unplanned downtime.

Infrared Temperature Sensors

Model		iSN-811C-MTCP	iSN-812-MRTU	iSN-812-MTCP	iSN-813-MTCP	iSN-814-MTCP
Infrared Sensor						
Pixels		64 (8 x 8)	768 (32 x 24)		4800 (80 x 60)	19200 (160×120)
Temp. Range		-20°C~250°C	-40°C~300°C		-20°C~300°C	-20°C ~ 300°C
Sensing Distance		≤ 1M	≤ 2M		≤ 6M	≤ 10M
FOV	H	60° (D : S = 1 : 1.15)	110° (D : S = 1 : 2.86)		90° (D : S1 = 1 : 2)	88° (D : S1 = 1 : 1.93)
	V	60° (D : S = 1 : 1.15)	75° (D : S = 1 : 1.53)		67° (D : S2 = 1 : 1.32)	66° (D : S2 = 1 : 1.3)
Camcorder						
Resolution		QVGA (320 x 240)	--			
Illuminator		Yes	--			

Smart Meters

Smart Meters	Single-Phase Smart Meter	3-Phase Smart Meter	Multi-Circuit Smart Meter	iWSN Sensing Module
Meter Type	Wired Meter			Wireless Meter
Protocol / Freq.	Modbus RTU/Modbus TCP/Ethernet IP/CANopen			433MHz

Vibration Monitoring

Model	Ch.	SR	Conn.	Sensor Type	I/F	AO
iSN-701X-mA	1	32/64 KHz	BNC	External IEPE Accelerometer	Ethernet RS-485	0 ~ 20 mA 4 ~ 20 mA
iSN-701X						-
iSN-711-MRTU		up to 1KHz	4 Pin Terminals	Built-in MEMS	RS-485	
iSN-713-MRTU	3					
iSN-711-MRTU-IP68	1					
iSN-713-MRTU-IP68	3					

Farewell to Wear, Welcome Digital. PCC-1416 Comprehensively Replaces Traditional Mechanical

The PCC-1416 Electronic CAM Controller digitally replaces mechanical CAMs, eliminating mechanical wear while significantly reducing maintenance requirements. Powered by high-speed DSP and a high-resolution encoder, it ensures precise timing control. Featuring touchscreen operation, multiple recipe switching, and industrial durability, it significantly boosts changeover efficiency and production flexibility, packaging, printing, and turret test machines.

By Albert Deng (Translated by Carol Hsu)

CAM controllers have long been at the heart of industrial automation. With their simple structure and stability, traditional mechanical CAMs served production lines for years. In earlier eras of simpler processes and lower speeds, they were a dependable and practical solution.

With ever-increasing production speeds, diverse product specifications, and the need for finer process control, the inherent limitations of traditional mechanical CAMs are becoming evident. Physical contact causes inevitable wear, leading to precision loss and costly downtime. Moreover, complex line changeovers require time-consuming manual adjustments that rely heavily on experienced technicians, increasing both inefficiency and operational risk.

For modern factories prioritizing rapid line changeovers, diversified production, and high-resolution control, traditional cam-based control has become a bottleneck for efficiency and flexibility. Consequently, more customers are considering a key question: Is it possible to retain cam-based control logic while completely eliminating mechanical limitations?

This is exactly why ICP DAS launched the PCC-1416 Electronic CAM Controller.

Redefining CAM Control: From Mechanical to Digital.

The PCC-1416 is not a minor improvement but a complete reconstruction of CAM control using a digital architecture. By combining a high-resolution encoder for real-time positioning with high-speed DSP, it completely transforms mechanical-contact control logic into electronic signal outputs.

This design entirely eliminates mechanical wear, ensuring stable and precise control at high speeds while greatly improving equipment lifespan and long-term reliability.

Intuitive Operation, Ready to Use On-Site

Operationally, the PCC-1416 includes a 4.3-inch color TFT touchscreen HMI and a virtual keypad, turning complex, experience-based setups into a clear and intuitive interface.

Engineers can configure output trigger angles directly on the touchscreen without using a computer or writing code, or use “Teach Mode” to capture the current angle for quick adjustments. Even first-time users can operate the system with ease, significantly reducing reliance on specialized experts.

High-resolution electronic CAM, fast and stable

The PCC-1416 supports Binary/Gray Code and absolute encoders, achieving up to 12-bit resolution (4096 points) and 0.08° angular resolution. It ensures accurate, drift-free control even at high speeds, perfect for applications requiring strict timing and positional accuracy.

Multiple Recipe Management for Flexible Changeovers

In practical applications, the PCC-1416's flexibility is highly valued on-site. It supports 8 recipe banks, each featuring up to 32 control zones and 16 CAM outputs.

This design allows a single device to pre-store and quickly switch between multiple recipes, drastically reducing changeover and downtime. It is perfect for High-Mix Low-Volume (HMLV) and frequent-changeover production lines.

Built-in Safety and Reliability

With built-in Start Input protection and password management, the PCC-1416 prevents misoperation. This ensures stable performance and consistent quality from setup to mass production, regardless of shift changes.

Rugged Design for Harsh Environments

Meeting strict industrial standards, the PCC-1416 features an IP65-rated front panel and operates between -20°C and +50°C. It ensures stable, long-term operation even in dusty, oily, or humid environments.

Widely used in machine tools, automatic lathes, turret test machines, packaging, and printing, the PCC-1416 is the ideal replacement

for traditional mechanical CAMs in demanding industrial environments.

Turret Test Machines: Precise Coordination & Flexibility

Turret test machines require flawless synchronization and timing precision for complex, multi-step processes. With its digitalized architecture, the PCC-1416 serves as the core component enabling highly efficient and flexible production for these automated systems.

Precise Multi-Station Coordination and Seamless Transition

Turret test machines feature multiple stations for tasks like visual inspection, measurement, testing, labeling, and engraving. Using a high-resolution 0.08° encoder, the PCC-1416 precisely controls start/stop signals for each stage, ensuring operations begin immediately upon product arrival and transition seamlessly to the next step.

Efficient Performance in Complex Manufacturing

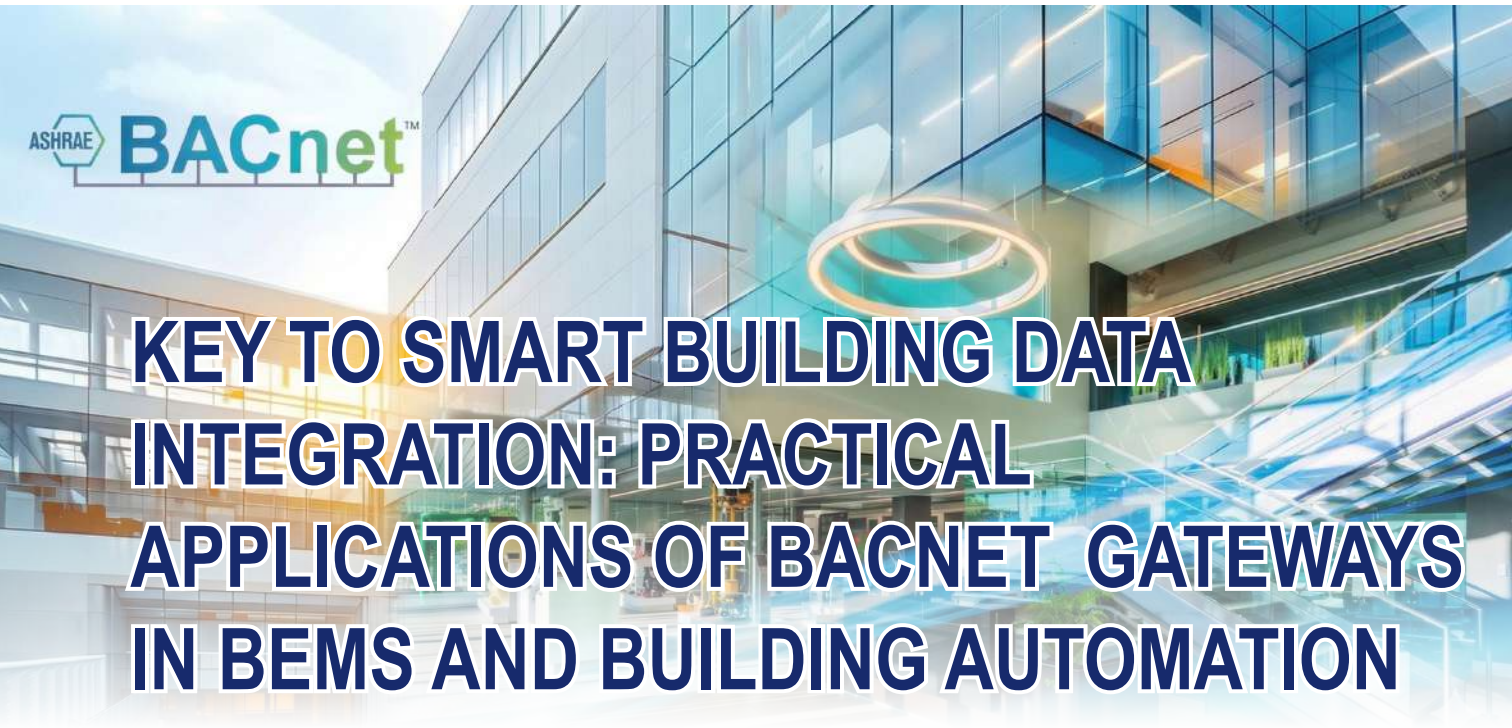
Modern turret test machines often coordinate up to 30 stages per cycle. The PCC-1416 provides up to 32 control zones (16 CAM outputs) per bank, effortlessly handling high-density triggering to ensure flawless timing for every action.

Key Shift: Upgrading Production Lines with the PCC-1416

Feature	Mech.CAM	PCC-1416 E-CAM
Operation	Physical Contact & Alignment	Fully Digital Control
Changeover	Manual Setup & Teardown	Touch Setup & Teach Mode
Flexibility	Fixed Process, Hard to Modify	Multi-Process, 1-Key Switch
Maintenance	High Wear, Periodic Maint.	Contactless, Maint.-Free

The value the PCC-1416 delivers to customers goes beyond merely upgrading traditional mechanical CAMs to electronic CAMs. It is a comprehensive integrated solution that enhances equipment stability, operational flexibility, and overall efficiency. While retaining your existing control logic and operational mindset, it empowers your production lines to become smarter and more agile, ensuring long-term competitiveness.

Powered by high-speed DSP and a high-resolution encoder, the PCC-1416 precisely tracks positioning to replace complex mechanical movements, bringing CAM control into the digital era. For machinery constrained by traditional CAMs, it represents a crucial step toward high efficiency, automation, and smart manufacturing.



KEY TO SMART BUILDING DATA INTEGRATION: PRACTICAL APPLICATIONS OF BACNET GATEWAYS IN BEMS AND BUILDING AUTOMATION

BEMS has evolved into the core of smart buildings, delivering real-time energy visibility, improved efficiency, and lower operating costs. By bridging protocols such as Modbus and BACnet and integrating AI-driven analytics, BEMS enables proactive energy optimization and enhances overall building performance.

By Johney Hu (Translated by Lynn Tang)

How BEMS Becomes the Core of Smart Buildings

Driven by global energy-saving and ESG initiatives, Building Energy Management Systems (BEMS) have become a standard solution for commercial buildings, factories, and public facilities. More than a monitoring system, BEMS plays a key role in improving energy management efficiency. Its key functions include:

- Real-time monitoring of energy use and equipment status
- Analyze energy efficiency and identify energy waste
- Reduce energy costs through optimized control strategies
- Build long-term data for better energy management decisions

By integrating HVAC, lighting, and environmental monitoring systems, BEMS not only improves energy control but also enhances indoor environmental quality, creating a more comfortable and healthier space for occupants.

In other words, the goal of BEMS is not only to reduce energy consumption, but also to achieve the best balance between energy efficiency and occupant comfort.

The Biggest Challenge for BEMS: Diverse Devices and Communication Protocols

Modern buildings use diverse systems, including chillers, HVAC, lighting, and smart meters. Different protocols often prevent them from communicating.

A typical BEMS project may include:

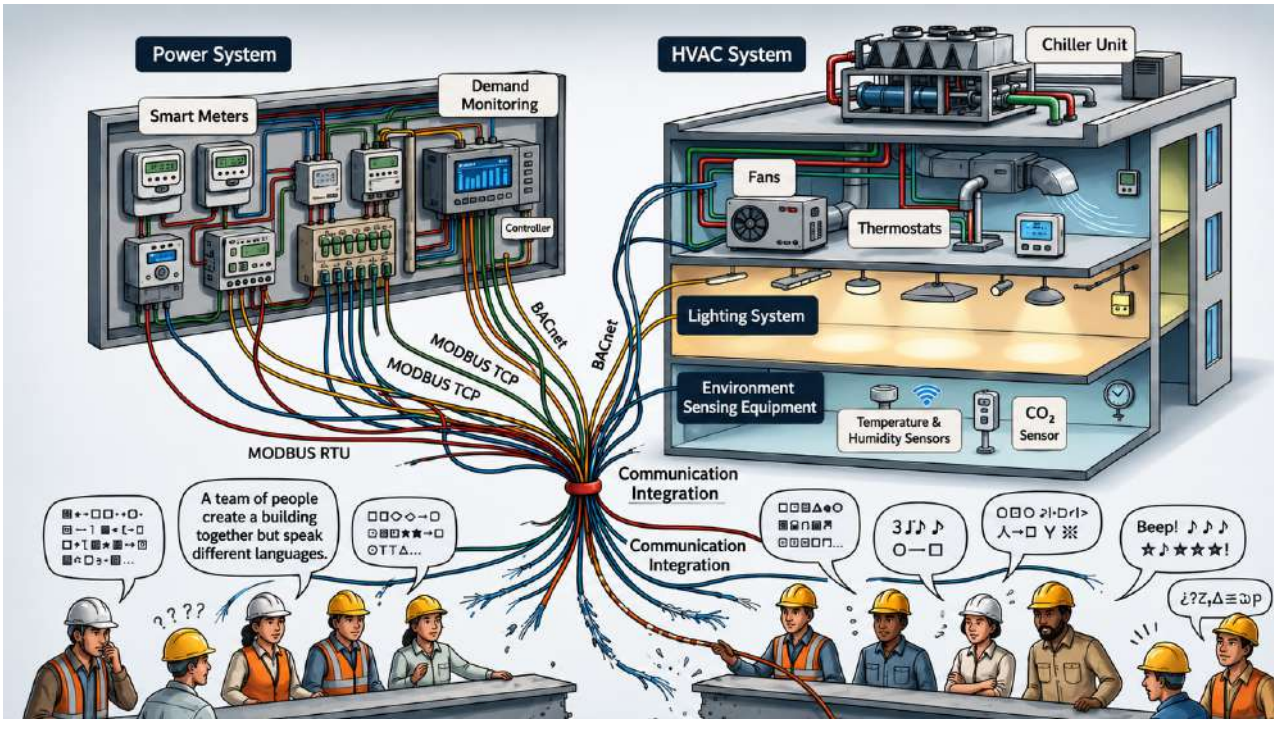
- Power systems (smart meters and demand monitoring)
- HVAC systems (chillers, fans, and temperature controllers)
- Lighting systems
- Environmental sensors (temperature, humidity, and CO_2)

These devices are typically supplied by different vendors and use different communication protocols, with Modbus RTU/TCP and BACnet being the most common. Although they are installed in the same building, they often cannot "speak the same language." As a result, system integrators must spend significant time on protocol integration and, in many cases, develop custom programs before data can be centralized in a BEMS platform.

BACnet: The Common Language of Building Automation

In building automation (BA), BACnet is an international standard developed by ASHRAE. Widely adopted in BEMS, it not only transfers data but also provides a standardized way to describe devices.

A BACnet device provides not only raw data but also data attributes. For example, a temperature point is defined as an Analog Input object with its unit and status. This allows the BEMS platform to identify each object automatically, reducing the need for address mapping. By using BACnet Objects, device functions are presented as standardized data models.



▲ Figure 1 | Different communication protocols in smart-building BEMS create isolated data silos.

This design allows devices from different vendors to be presented and operated consistently in BEMS. For system integrators, the key benefit is eliminating the need to develop communication interfaces for each device.

Communication Gateways Turn Integration into Configuration Instead of Development

Although BACnet is now widely used in smart buildings and BEMS, many existing devices still communicate through Modbus, including power meters, HVAC controllers, VFDs, and energy monitoring devices. Because they are reliable and economical, they are seldom replaced.

In practice, using communication gateways is a more efficient way to bridge different protocols. It reduces integration complexity and speeds up deployment.

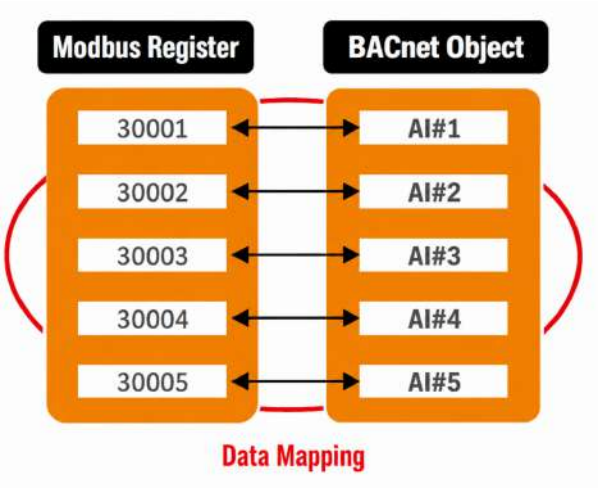
This approach offers three key advantages:

- No modification of existing equipment is required
- No custom programming is required
- Can be rapidly deployed and replicated across other projects

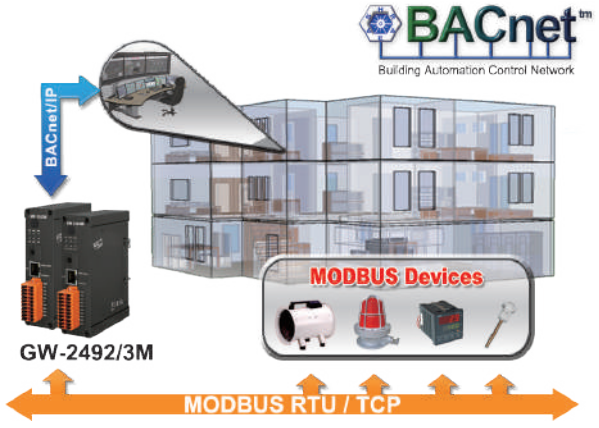
To meet these integration needs, ICP DAS developed BACnet gateways that act as the communication hub of BEMS, enabling stable and efficient data exchange across devices and systems.

Breaking Through the Modbus Barriers: GW-2492M / GW-2493M Gateways

In BACnet-based management systems, many field devices still communicate through Modbus. The GW-2492M (Modbus RTU) and GW-2493M (Modbus TCP) collect Modbus data and convert it into BACnet objects that can be directly recognized by BEMS platforms.



▲ Figure 2 | GW-2439M converts BACnet objects into Modbus registers, enabling seamless integration between legacy and modern systems.



▲ Figure 3 | GW-2439M converts BACnet objects into Modbus registers, enabling seamless integration between legacy and modern systems.

The GW-2492M and GW-2493M feature a built-in web interface. Simply select the required data points and BACnet objects, and the gateway automatically performs protocol conversion, reducing complexity and human error.

The Key to Long-Distance Wiring and Cross-Area Integration: GW-2139M BACnet MS/TP to Modbus TCP Gateway

In large commercial buildings and factories, BACnet MS/TP uses RS-485 communication, making it well suited for long-distance transmission. It is a proven and widely used solution for connecting devices within the same area or floor. However, in practice, BACnet MS/TP still has several limitations:

- Bus topology limits expansion (daisy-chaining)
- Efficiency drops as nodes increase
- Hard to manage across floors/areas
- Difficult maintenance & troubleshooting

As systems expand, wiring becomes more complex, management more difficult, and maintenance less efficient.

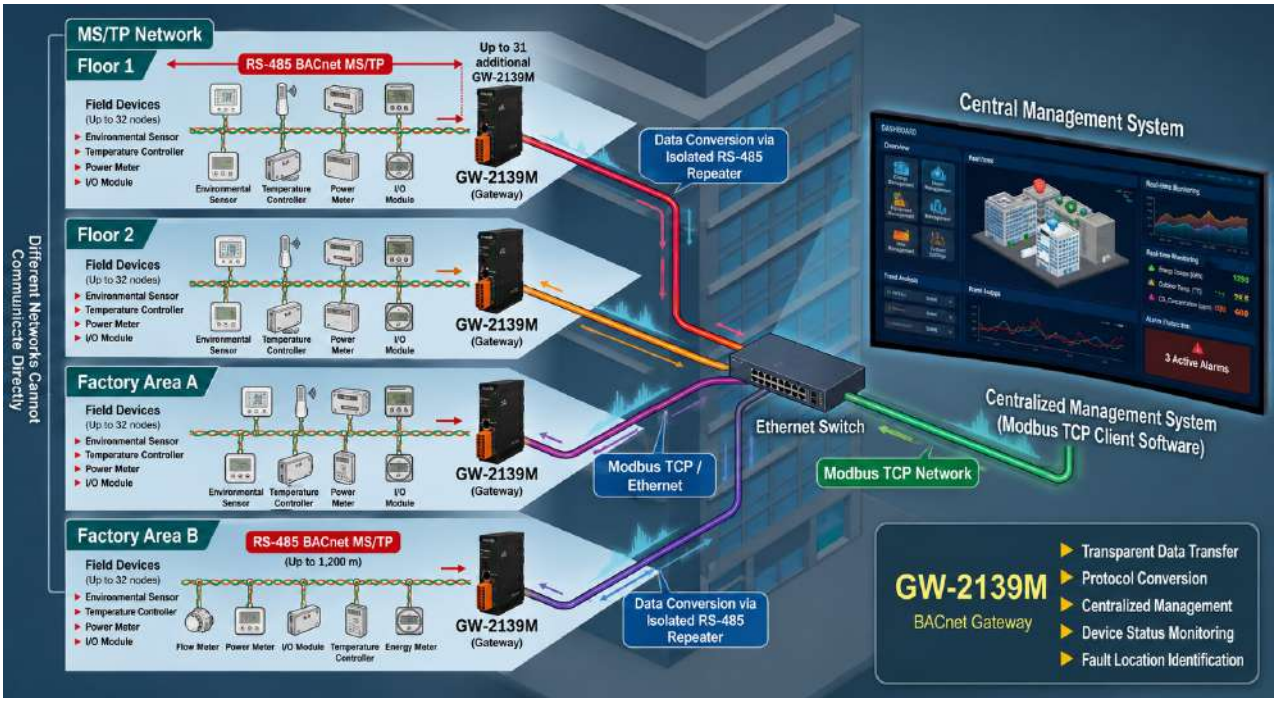
Under these circumstances, GW-2139M converts BACnet MS/TP devices to Ethernet, allowing daisy-chained devices to be integrated into a Modbus TCP network for centralized monitoring and management.

The GW-2139M improves cross-area integration while reducing the complexity of system expansion and maintenance, making BEMS more flexible and easier to manage.

Bridging Existing Assets: GW-2439M BACnet/IP Client to Modbus TCP Server/ RTU Slave Gateway

Not every building system starts from scratch. Existing monitoring systems are often based on Modbus, while new lighting and HVAC systems use BACnet. Integrating both has become one of the biggest project challenges.

The ICP DAS GW-2439M acts as a "reverse translator." It automatically maps data from



▲ Figure 4 | The GW-2139M integrates BACnet MS/TP devices into an Ethernet network, enabling centralized monitoring of HVAC, lighting, and sensors for greater efficiency and scalability in large buildings.

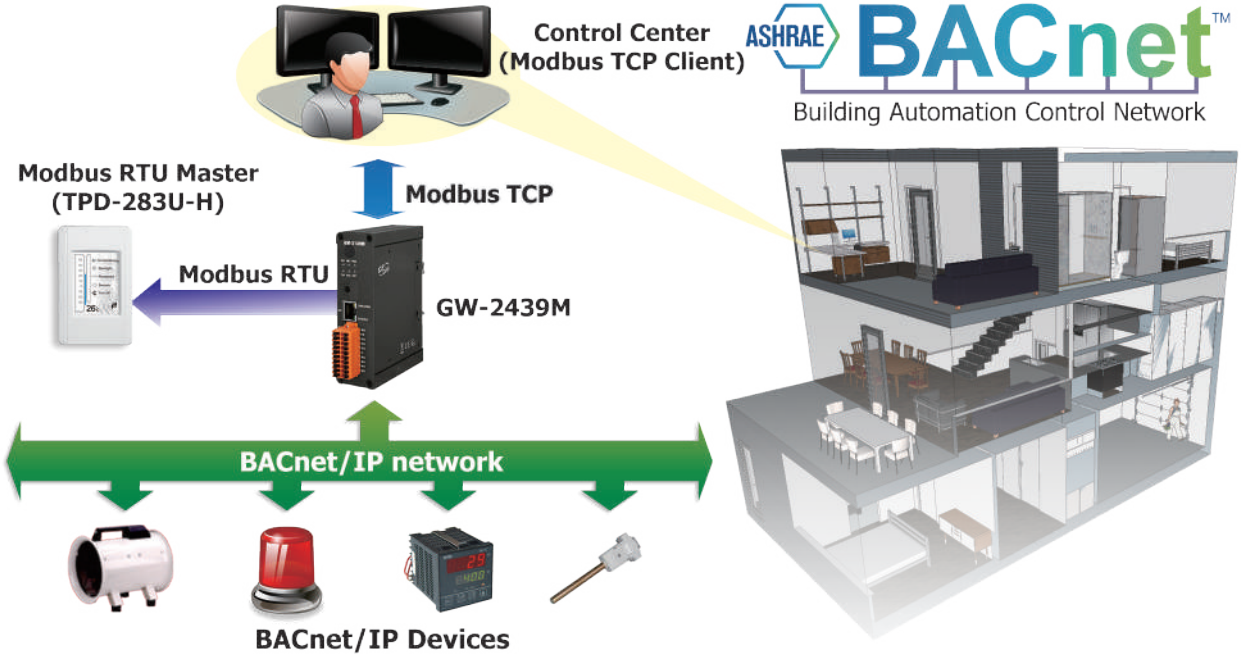
BACnet/IP devices to corresponding Modbus registers, allowing existing monitoring systems to read data from new devices without modification. Compared with manual point mapping or custom conversion programs, the GW-2439M provides higher integration efficiency and greater flexibility. Key features include:

- Automatic object conversion: Quickly converts BACnet Objects (AI, AO, AV, etc.) into corresponding Modbus registers.
- Batch setup and flexible configuration: Supports rapid deployment of large numbers of devices and data points.
- Unified data access: Allows existing Modbus systems to access all new device data through a familiar interface.
- Lower upgrade costs: No need to replace the existing monitoring host or redevelop the system.
- Easy project replication: Reuse the same integration logic across different sites to shorten deployment time.

With the GW-2439M, system integrators can add new BACnet devices without changing the existing architecture, enabling seamless integration of legacy and new systems while extending equipment life and reducing upgrade costs.

BEMS Application: AI-Based Energy Saving in a Department Store

In a Taipei department store energy-saving project, the GW-2493M (Modbus TCP to BACnet/IP Gateway) served as the core bridge for data integration and energy-saving control, enabling AI-driven management from sensing to decision-making.



▲ Figure 5 | The GW-2439M converts BACnet/IP data into Modbus format, enabling existing Modbus systems to integrate BACnet devices while reducing upgrade costs.

Environmental Sensing and Data Collection

The GW-2493M collects real-time CO_2, occupancy, temperature, and humidity data to reflect building load.

Edge Computing and AI Decision-Making

Collected data are sent to an AI edge computer. Using weather forecasts and real-time site data, AI determines the optimal HVAC strategy.

Protocol Conversion and Command Execution

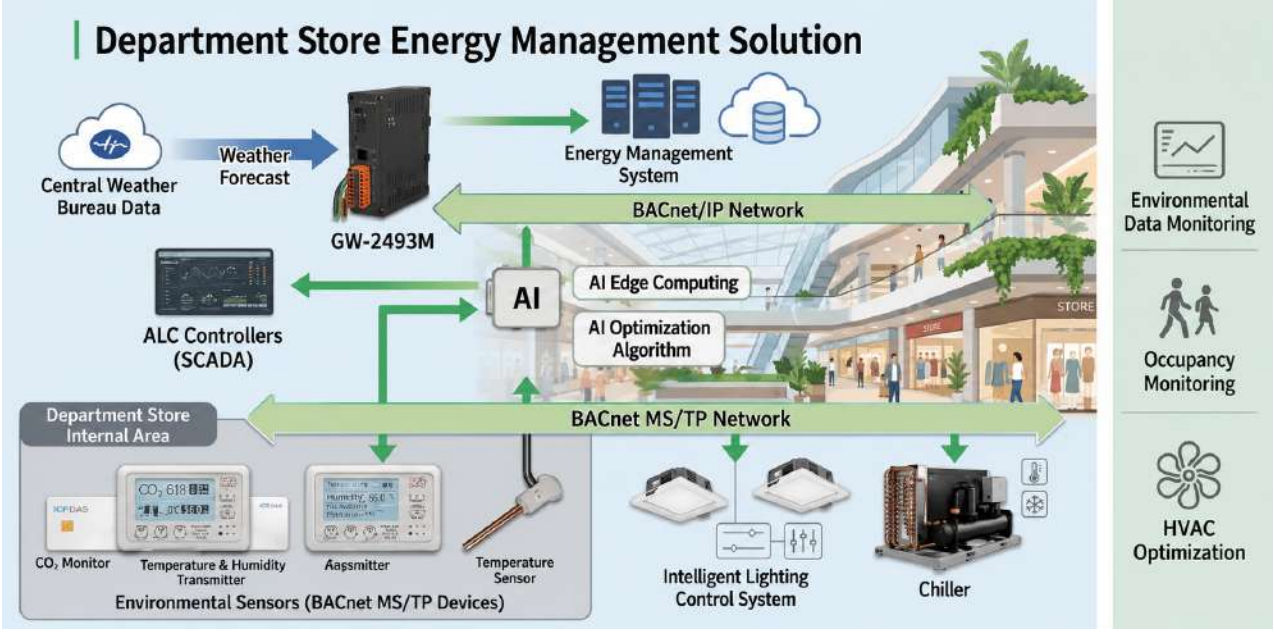
The GW-2493M converts AI control commands for Modbus and BACnet MS/TP devices, including chillers, cooling towers, and air handling units.

The project uses the GW-2493M to combine occupancy and CO_2 data for dynamic HVAC control. The system automatically adjusts VFD speed, chilled-water flow, and outdoor air intake based on occupancy and CO_2 levels, reducing energy use while maintaining indoor air quality. This upgrades conventional fixed control to data-driven energy management, achieving both energy savings and carbon reduction.

ICP DAS BACnet Communication Solutions

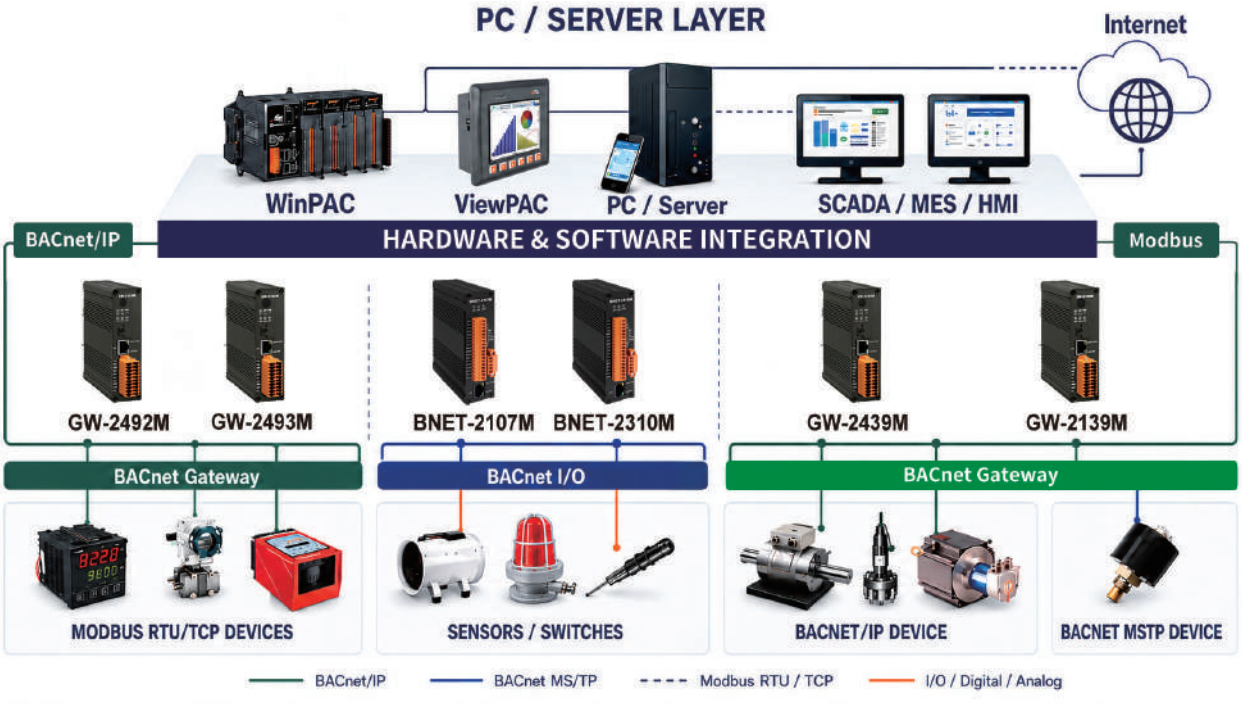
In smart buildings and energy management, the real challenge is not the equipment itself, but enabling different systems to work together.

BACnet provides a common language, while communication gateways make it practical. For system integrators, this is more than a technical solution—it is a key strategy for improving project efficiency and competitiveness. In future BEMS projects, fast cross-protocol integration will be a critical factor for project success.



▲ Figure 6 | The GW-2493M connects sensors, AI edge computing, and HVAC equipment to optimize HVAC operation for energy savings and comfort.

Over the years, ICP DAS has built extensive expertise in BACnet communication products. Backed by a strong R&D team, it continues to advance BACnet technologies and develop innovative, diverse BACnet products. Beyond product development, ICP DAS also provides comprehensive building energy-saving solutions and integration expertise, enabling more flexible building communication systems and more efficient solutions to meet evolving market needs.



BACnet Gateway Series Product Comparison Table

	GW-2139M	GW-2439M	GW-2492M	GW-2493M
Ethernet Protocol	Modbus TCP Server	BACnet/IP ClientModbus TCP Server	BACnet/IP Server	BACnet/IP ServerModbus TCP Client
Max. Conn.	8	3	8	8
RS-485 Protocol	BACnet MS/TP Master	Modbus RTU Slave	Modbus RTU Master	--
Device Capacity	32 BACnet MS/TP Slaves	10 BACnet/IP Servers	32 Modbus RTU Slaves	32 Modbus TCP Servers
Web Config	--	--	Yes	Yes
BACnet Objects	BI, BO, BV, AI, AO, AV, MSI, MSO, MSV			
BIBBs	DS-RP-A, DS-RPM-A, DS-WP-A, DS-WPM-A, DM-DDB-A, DM-DOB-A, DM-DCC-A, DM-RD-A		DS-RP-B, DS-RPM-B, DS-WP-B, DS-WPM-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B	

Smart Sensing · Precise Monitoring

Industrial Environment Sensor Guide

- Records 450,000 sensor data entries with timestamps for full traceability.
- Supports Modbus RTU/TCP and MQTT protocols with RS-485, Ethernet, and Wi-Fi interfaces for easy system integration.
- Supports remote monitoring to track air quality in real time and ensure environmental safety.
- Built-in relay output for connecting alarm lights, sirens, or HVAC systems to automatically regulate environmental conditions.

Industrial Environment Monitoring

DL-1029

DL-306-IP65

CL-229-E

Monitored Parameters

PM2.5 · PM10 · Ammonia (NH_3) · Hydrogen Sulfide (H_2S) · Carbon Monoxide (CO) · Carbon Dioxide (CO_2)

TVOC · Humidity · Temperature · Formaldehyde

Indoor Air Quality Monitoring

CL-204-E

DL-303

Monitored Parameters

Carbon Dioxide (CO_2) · Formaldehyde · TVOC · Humidity · Temperature

Fire Safety

CL-20A-C

CL-25-E

Monitored Parameters

Methane · Smoke · Humidity · Temperature

Smart Agriculture & Greenhouse Monitoring

DL-111S-WF

DLW-1120

DL-11

Monitored Parameters

Wind Speed · Wind Direction · Atmospheric Pressure · Sea Level Height

Humidity · Temperature · Illuminance · Rainfall

Smart City & Outdoor Monitoring

DLW-2069-01

Monitored Parameters

PM2.5 · PM10 · Wind Speed · Wind Direction

Atmospheric Pressure · Sea Level Height · Humidity · Temperature · Rainfall

E-Catalog
IIoT: Environmental Monitoring, Mini Weather Station

E-Catalog
工業物聯網 IIoT：
環境感測、微型氣象站

I-2533-UTA

CAN to Multi-mode Fiber Bridge

Intelligent CAN to Fiber Bridge Solution: Breaking Distance and Interference Limitations

To overcome the distance and EMI limitations of traditional CAN buses, ICP DAS introduces the I-2533-UTA. This intelligent CAN-to-fiber bridge provides a flexible and highly stable extension for long-distance industrial communication.

By bridging two CAN bus systems via fiber optics, the I-2533-UTA reshapes signals to minimize long-distance attenuation. The fiber's inherent immunity to electromagnetic interference makes it ideal for high-noise or cross-regional industrial environments, greatly enhancing communication reliability.

For system integration, the I-2533-UTA supports baud rate configuration and message filtering, allowing seamless communication between different CAN networks. Its fiber optic architecture extends transmission up to 2 km regardless of baud rate, overcoming the traditional trade-offs between distance and performance.

Furthermore, the product supports CAN 2.0A / 2.0B protocols and uses a rotary switch for baud rate configuration, facilitating rapid on-site deployment. It also features fiber broken-line detection and a wide operating temperature range of -40°C to +75°C, maintaining stable operation in harsh environments.

The I-2533-UTA is suitable for application scenarios requiring long-distance, highly reliable communication, such as smart manufacturing, energy management, and transportation systems, providing a more flexible upgrade option for CAN systems.

For more product information, please visit: https://www.icpdas.com/en/product/I-2533-UTA

e-PoE404 / e-PoE204

4/2 port 10/100/1000 Mbps PoE (PSE) Ethernet Expansion Module

Integrating high-speed transmission, precise sync, and smart power to optimize machine vision and edge deployment.

Driven by smart manufacturing and machine vision trends, field devices require higher bandwidth, precise synchronization, and simplified wiring. ICP DAS's e-PoE404 / e-PoE204 industrial PoE expansion modules extend PAC systems, providing a unified solution for both data transmission and power supply.

Utilizing the high-speed e-Bus x4 interface, the e-PoE404/204 modules seamlessly integrate with AXP, EMP, and ALX PACs to provide 4 or 2 Gigabit PoE ports. With IEEE 802.3af/at support (up to 30W per port), they deliver both data and power over a single cable, significantly reducing wiring complexity and installation costs.

Supporting up to 1 Gb/s with Jumbo Frame and Link Aggregation, the modules easily handle high-resolution image data for AOI and multi-camera setups. Additionally, built-in IEEE 1588 PTP delivers precise multi-device synchronization, ensuring data and image consistency essential for high-speed motion control and machine vision.

Additionally, the e-PoE series features smart power management that auto-detects devices and assigns power priorities, along with an SDK for remote control and status monitoring. To ensure industrial reliability and long-term stability, the modules include comprehensive overvoltage, overcurrent, and over-temperature protections.

In summary, by solving power and communication integration challenges while delivering high bandwidth and precise synchronization, the e-PoE404/204 acts as a vital node for smart factories, visual inspection, and edge computing—helping enterprises quickly build efficient and scalable industrial networks.

For more product information, please visit: https://www.icpdas.com/en/news/show.php?num=2831&page=1

Thermal Monitoring Solution

Spot Temperature Anomalies Instantly

24

27°C

79°C

24/7 Unmanned Monitoring

Real-Time Anomaly Alerts

Instant Overheat Alerts

Non-Contact Monitoring

IR Temp. Sensing Modules

iSN-813-MTCP

iSN-812-MTCP

iSN-811C-MTCP
(Thermal & Visual Fusion)

Modbus TCP / RTU

RESTful | HTTP | MQTT

Edge Computing

Edge Computing Controller

Supports up to 16 sensors

WISE-2841M

"No-Code" Logic Configuration

40+ Custom Regions of Interest

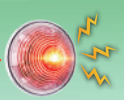
Thermal & Field Image Fusion

Real-Time Alerts

IoTstar Cloud & Traceability

IoTstar 2025

Audio-Visual Alarms (ALM-Horn Series)



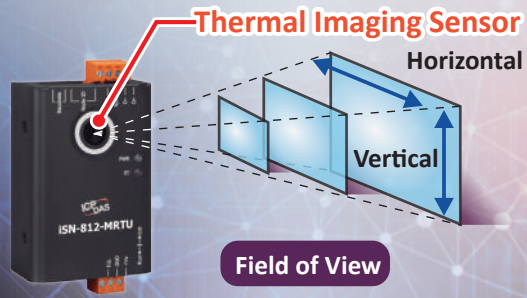
Water Mist Valve

Mobile Notifications

Temperature Rise Monitoring

E-Catalog
紅外線
溫度感測模組

E-Catalog
Infrared
Temperature
Sensing Modules



Model	Pixels	Temp. Range	Distance	H	V
iSN-811C-MTCP (Camcorder)	64 (8x8)	-20°C~250°C	1M	1.15M	1.15M
			10cm	11.5cm	11.5cm
iSN-812-MRTU iSN-812-MTCP	768 (32x24)	-40°C~300°C	2M	5.72M	3.06M
			10cm	28.6cm	15.3cm
iSN-813-MTCP	4800 (80x60)	-20°C~300°C	6M	12M	7.92M
			10cm	20cm	13.2cm
iSN-814-MTCP	19200 (160x120)	-20°C~300°C	10M	19.3M	13M
			10cm	19.3cm	13cm

Note: Accuracy / Resolution: ±5°C Max. / 0.1°C

ICP DAS 泓格科技 ICP DAS CO., LTD.

Industrial Computer Products and Data Acquisition Systems

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