

# PACTECH

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Vol.83

## Precision Temperature Control x High-speed Response

### DAS-8x21 Assists Semiconductor IC Testing



#### Application Story

- ⚡ iAir Utility Smart Data Software Improves Basement Ventilation and Saves Energy
- ⚡ UA I/O U-7500M Series Enables CNC Data Integration Remote Monitoring

#### Products Column

- ⚡ From Serial Communication to Network Integration, PDS Builds Smart Systems
- ⚡ Power Smarter, Live Greener-PM-5133 Smart Energy Solutions

#### Technology Forum

- ⚡ IoTstar 2025 Supports Grafana-Improves "IoT Big Data" Analytics Applications

# CONTENTS

**PACTECH**

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## ○ ICP DAS Epoch

- 04** ICP DAS Focuses on AIoT and ESG: Building the Backbone of Digital Transformation with Sensing and Edge Computing

## ○ Application Story

- 06** Precision Temperature Control × High-speed Response, DAS-8x21 Assists Semiconductor IC Testing
- 10** iAir Utility Smart Data Software Improves Basement Ventilation and Saves Energy
- 13** UA I/O U-7500M Series Enables CNC Data Integration and Remote Monitoring

## ○ Products Column

- 16** From Serial Communication to Network Integration, PDS Builds Smart Systems
- 22** Power Smarter, Live Greener - PM-5133 Smart Energy Solutions

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## Technology Forum

**26** IoTstar 2025 Supports Grafana -  
Improves "IoT Big Data" Analytics Applications

## New Products

**31** CL-220-E PM1/PM2.5/PM10/Temperature/  
Humidity/Dew Point Data Logger Module

# ICP DAS Focuses on AIoT and ESG: Building the Backbone of Digital Transformation with Sensing and Edge Computing

Translated by Lynn

**D**riven by Industry 4.0 and the global push for net-zero, ICP DAS strengthens its “field-to-cloud” capabilities with edge AI, environmental sensing, energy efficiency, and communication security, creating next-gen smart manufacturing and ESG infrastructure. Solutions will be showcased at booth L1118, 2025 Taipei International Industrial Automation Exhibition.

## Edge Intelligence and High-Frequency Sensing: Enabling Data-Driven Decision Making

The AIB-2000 Edge AI Controller is the core of ICP DAS’s AIoT platform. Equipped with an ARM-based processor and an M.2 expansion slot, it supports AI accelerators such as NPU or GPU. Featuring multiple RS-485 ports, dual Ethernet, and USB expansion interfaces, the device can be deployed at the edge to execute deep learning models or equipment anomaly diagnostics. When combined with high-speed vibration acquisition modules e-AR300-T/e-AR400 and high-precision IEPE tri-axial accelerometers, it enables early warning and predictive maintenance for motors, bearings, and compressors. This significantly reduces downtime risks and labor maintenance costs.

For high-precision applications such as semiconductor manufacturing processes and AI chip testing, ICP DAS has introduced the DAS-8000 High-Speed Temperature Measurement Platform, which supports RTD and thermocouple input modes. It achieves up to 100Hz sampling rates per channel and expands up to 128 channels.

## Sensing-as-a-Service: Driving ESG Data Governance

As environmental regulations tighten and sustainability reporting becomes more demanding, ICP DAS offers modular, real-time, and visualized air quality and meteorological data management solutions through its Sensing-as-a-Service model. The DLW-1000 Micro Weather Station integrates multiple sensing functions, including PM2.5/PM10, CO<sub>2</sub>, TVOC, temperature and humidity, wind speed/direction, and barometric pressure. With IP67 protection and a positive/negative pressure ventilation design, it is suitable for deployment in smart cities, campuses, green buildings, and agricultural greenhouses. When integrated with the iAir Utility visualization platform and the IoTstar cloud management system, users can build ESG dashboards and set up alert rules.

The DL-300 Series Gas Monitoring Modules accurately detect NH<sub>3</sub>, H<sub>2</sub>S, TVOC, and CO with IP65 protection and touch display, enhancing safety and environment quality. The CL-20A-C Methane Detector provides early leak warnings, ideal for restaurants, basements, and other high-risk areas.

## Smart Energy Monitoring: Optimizing Data Centers and Process Efficiency

ICP DAS's PMC-284xM Power Meter Concentrator integrates smart meters (PM-3112/PM-3133) and wireless meters (iWSN series) via RS-485, Ethernet, and MQTT. It monitors power in data centers, facilities, HVAC, and lighting. Built-in IF-THEN-ELSE logic enables PUE calculation, demand control, alarms, and energy reports to optimize usage and save energy.

For ESG reporting and carbon inventory, the IoTstar platform allows users to set carbon emission coefficients, define emission source categories, and build carbon emission models. Combined with operational data, it generates carbon dashboards and predictive models.

## EtherCAT Solutions: High-Efficiency Integration and Precision Control

ICP DAS's EtherCAT solution ecosystem includes master controllers, I/O modules, gateways, and function libraries, providing a flexible, easily expandable backbone for smart control. The system supports IEC 61131-3 programming languages and the Win-GRAF SoftPLC development environment, enabling seamless integration of PLC logic and real-time control while lowering development barriers.

Through EtherCAT's Distributed Clocks

mechanism, ICP DAS products achieve microsecond-level synchronization, meeting the demands of multi-axis motion control, high-speed sampling, and precision machinery applications. With the ECAT-2610/2611 Gateway Series, existing Modbus RTU/TCP, CANopen, and DeviceNet devices can be integrated into EtherCAT systems, preserving the value of legacy assets.

ICP DAS also provides the ECATDAQ DLL function library and multi-language development tools. With only a standard network card, users can establish an EtherCAT master station and develop automation and data acquisition systems using Python, C#, and LabVIEW. This helps accelerate the implementation of smart manufacturing.

## Communication and Cybersecurity: Enhancing System Reliability

The BRK-2841M MQTT Broker is the core of ICP DAS's communication, with dual-host redundancy, MongoDB sync, and topic access control. Supporting MQTT V5.0 and HTTPS, it secures data integrity and transmission—forming a solid cybersecurity foundation for IIoT environments.

## ICP DAS Invites You to Build Smart, Low-Carbon Manufacturing

ICP DAS invites industry professionals to booth L1118, 4F, Hall 1, Taipei Nangang Exhibition Center, Aug. 20–23, 2025. Through demos and exchanges, we'll showcase a complete IIoT ecosystem—from sensing to cloud—toward resilient, low-carbon smart manufacturing. ■



# Precision Temperature Control × High-speed Response, DAS-8x21 Assists Semiconductor IC Testing

*Modern IC testing demands speed and precision. Active temperature control systems real-time regulate temperature to prevent inaccuracies and product failure. The ICP DAS DAS-8x21 multi-channel high-speed data acquisition, with centralized + distributed architecture, is adaptable to various environments and temperature control needs, creating an efficient, stable, and reliable solution for semiconductor testing.*

Written by Edward Ku (Translated by Eva Lee)

## Active Temperature Control System Ensures Stable and Fast Semiconductor IC Testing

ICs must be tested for temperature before leaving the factory to prevent malfunction. The accuracy and speed of temperature control directly impact the reliability of test results and production capacity. IC testing platforms require high-speed, stable temperature detection and real-time control feedback.

Active temperature control systems in semiconductor IC testing are indispensable. The system enables temperature regulation, ensures optimal device performance, enhances test accuracy, and shortens test cycle times. The DAS-8x21 assists IC testing in power consumption, especially for semiconductor applications with rapid temperature changes.

## Multi-I/O Module Integration Platform-DAS-8x21 Provides Extensive Temperature Data

The ICP DAS DAS-8x21 is a high-performance data acquisition system that integrates with multi-I/O modules, offering high modularity and expandability for industrial automation, data acquisition, and remote monitoring.

The DAS-8x21 supports real-time high-speed data transmission with 256 channels and 4/8 slots. Integrating with I-8000 and remote ET-2200 modules can easily develop a system combining "centralized" + "distributed" monitoring and control.

Built-in dual Ethernet ports and dual watchdog protection support fanless operation from -25°C to +75°C. Ideal for high-speed, simplified, multi-channel data acquisition and control.

## DAS-8x21 Flexible Deployment Features

- Multi-I/O modules: Supports I-8000 and ET-2200 series modules, including AI, AO, DI, DO...
- Distributed Architecture: Supports Ethernet module expansion with up to 8 ET-2200 modules for distributed deployment.
- 4/8-slot Design: Supports I-8000 series modules for flexible mixing and matching of AI/AO/DI/DO.
- High-speed Communication: TCP streaming all channel data return.
- Centralized Data Acquisition: The host collects data and transmits it back to the host.
- Communication Protocol: Modbus TCP, SDK development tools.

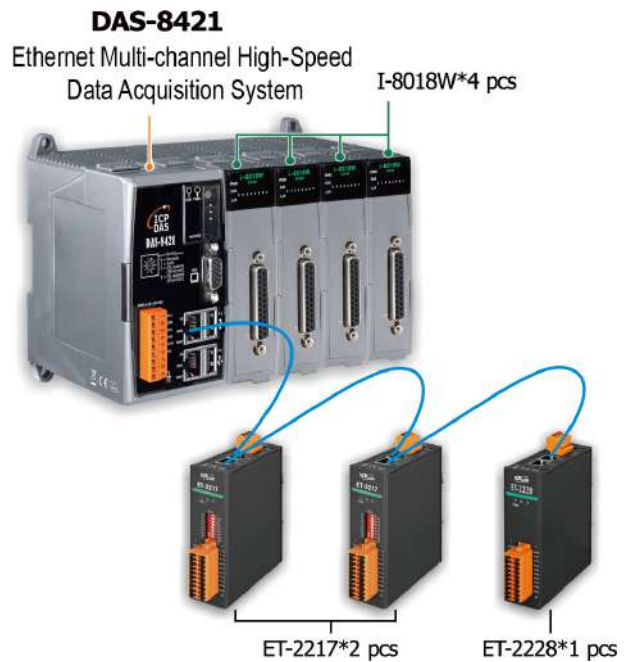
## DAS-8x21 Modular Architecture

- Host: DAS-8421 (Data Acquisition and Transmission Function)
- Local Modules: I-8018W × 4 (8-channel high-speed thermocouple analog input modules)
- Remote Modules:
  - ET-2217 × 2 (8/16-channel analog input modules)
  - ET-2228 × 1 (8-channel analog output module)

## Quick Temperature Measurement System Introduction

### Host: Central Data Exchange and Management (DAS-8421)

4 plug-in I/O slots, expandable to 12 I/O modules, supporting Modbus TCP and TCP Stream.



▲ Modular Architecture

Supports SCADA and high-speed data return, meets high-speed, real-time data acquisition and analysis needs.

### Temperature Control (I-8018W × 4)

Using 4 I-8018W modules (32 channels total), each channel provides a 100 Hz sampling rate, equivalent to measuring 100 temperature points per second, enabling real-time multi-point temperature monitoring during manufacturing.

### Voltage/Current Detection (ET-2217 × 2)

High-resolution input module, 8/16 channels per unit, collects operation status analysis of heating equipment and detects flow rate/pressure/voltage/current data.

### Heating Control (ET-2228 × 1)

Controls heater voltage/current output for precise temperature control.

## Advantages of Multi-Channel

## High-speed Measurement System

- Easy to get started: Plug-and-play for quick system setup.
- Flexible deployment: Easy expansion, easy to add/remove modules, suitable for most cases.
- High-speed temperature response: Temperature monitoring via thermocouples enables rapid temperature control logic design.
- High data synchronization: I/O data is centrally managed by the DAS-8421, and streaming

transmission reduces communication delays.

- Integrate ET-2200 Series Modules: Flexibly configure local and remote modules based on site space.
- Program-free: DAS-8000 series features automatic module recognition and initialization, lowering the setup barriers.
- Boost test efficiency: Flexible module expansion shortens test cycles and yields more accurate results. ■

Model	DAS-8421	DAS-8821
Communication Interface		
Ethernet	2 x RJ-45, 10/100/1000 Base-TX (auto-negotiation and auto MDI/MDI-X selection, LED indicators)	
Protocol	TCP Steaming (data access via library), Modbus TCP	
I/O Expansion		
I/O Types	I-8K Series / ET-2200 Series Modules	
I/O Slots	4	8
PC Software		
SDK	Windows Microsoft VC, C#, VB.NET SDK API and examples Python examples Linux C/C++ library and examples NET library and examples	

Model	Description	Resolution	Range
I-8018W I-8018W-16	8 /16-Channel High Speed Thermocouple Input Module	16-bit	J \ K \ T \ E \ R \ S \ B \ N \ C \ L \ M \ LDIN43710
ET-2217	Ethernet I/O Module with 8/16-ch AI	16-bit	Voltage: $\pm 150$ mV, $\pm 500$ mV, $\pm 1$ V, $\pm 5$ V, $\pm 10$ V Current: $\pm 20$ mA, 0 ~ +20 mA, +4 ~ +20 mA (DIP switch selectable)
ET-2228	Ethernet I/O Module with 8-ch AO	12-bit	Voltage: 0 ~ +5 VDC, $\pm 5$ VDC, 0 ~ +10 VDC, $\pm 10$ VDC Current: 0 ~ +20 mA, +4 ~ +20 mA

# Multi-channel High-speed Temperature Measurement

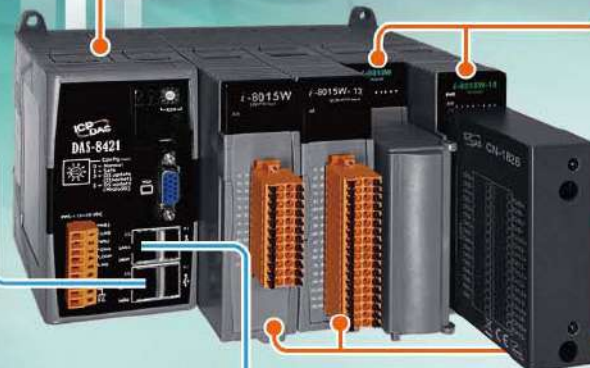
- ▶ Up to 48/96 channels for RTD temperature measurement.
- ▶ Up to 64/128 channels for thermocouple temperature measurement.
- ▶ Supports diverse I/O modules with convenient auto-configuration.
- ▶ Supports Modbus TCP and high-speed streaming communication protocols.

Supports Various Software Development Tools



◀ Rapid Temperature Change Testing Machine

**DAS-8421 4 Slots** ◊ **DAS-8821 8 Slots**  
Ethernet Multi-channel High-speed DAQ System



**I-8018W**  
**I-8018W-16**  
8/16-channel **Thermocouple** Input Module  
Accuracy : ±0.1 % FSR  
Sampling Rate : 100 Hz (per channel)

**I-8015W**  
**I-8015W-12**  
8/12-channel **RTD** Input Module  
Accuracy : ±0.1 % FSR  
Sampling Rate : 85 Hz (per channel)

**Ethernet**  
Supports up to 8 Modules

**ET-2217H / PET-2217H**

**Ethernet I/O Module with 8-ch High Speed AI**

- 1KHz high-speed sampling rate per channel.
- Support TCP Streaming, Modbus TCP/UDP, MQTT, and SNMP V2c Protocols.
- Daisy-chain Wiring.



**ET-2215H/PET-2215H**  
**ET-2215H-16/PET-2215H-16**  
8/16-channel **RTD** Input Module  
Accuracy : ±0.1 % FSR  
Sampling Rate : 90 Hz (per channel)



**ET-2218H/S1**  
**ET-2218H-16/S1**  
**PET-2218H/S1**  
**PET-2218H-16/S1**  
8/16-channel **Thermocouple** Input Module  
Accuracy : ±0.1 % FSR  
Sampling Rate : 100 Hz (per channel)



## Comprehensive Protection High-speed I/O Module

**USB-4018HS**

**8-Channel high-speed Thermocouple USB I/O Module**

- 100Hz high-speed sampling rate per channel.
- Automatic cold-junction compensation.



**USB-2255-32**

**Isolated 16-ch DI&16-ch DO USB I/O Module**

- USB2.0 High-speed, 6KHz read/write performance.
- Plug-and-Play without driver.
- Daisy-Chain Wiring.



**USB-2255-64**

**Isolated 32-ch DI&32-ch DO USB I/O Module**

- USB2.0 High-speed, 6KHz read/write performance.
- Plug-and-Play without driver.
- Daisy-Chain Wiring.



**USB-4018HS-16**

**16-Channel high-speed Thermocouple USB I/O Module**

- 100Hz high-speed sampling rate per channel.
- Automatic cold-junction compensation.



**USB-2563M**

**4-Port Industrial USB 3.0 Hub with Metal Case**

- Provides 4 Downstream Ports (Port Status with LED)



**E-Catalog**  
**Remote I/O**



# iAir Utility Smart Data Software Improves Basement Ventilation and Saves Energy

*Struggling to balance air quality and power costs in a building's basement? iAir Utility integrates sensor data for real-time monitoring, recording, and alerting to help managers optimize the operation of exhaust fans. The data can be analyzed to find the balance between energy savings and ventilation, reducing energy consumption while improving environmental quality.*

Written by Mac Cho (Translated by Carol Hsu)

## Fixed Exhaust is Imprecise. How Can Basement Ventilation Be Optimized?

Basements of modern office buildings often serve as parking, storage, or mechanical rooms. Limited ventilation makes air quality issues easy to overlook, and common complaints are that the environment is too hot and the air quality is too poor.

Although basements have exhaust fans, most run on fixed schedules. If too short, air quality suffers; if too long, airflow improves but electricity use rises, with seasonal weather also a factor. So, how to set the time of the exhaust fan to save electricity and maintain air quality?

Generally, if an exhaust fan can be switch-controlled, air quality and temperature can

be monitored in the graphic control software, automatically activating the fan when needed. However, many buildings still lack this function, relying on manually setting start and stop times via the panel. The author's office building is an example.

## Precisely Deploy Sensor Modules to Monitor Potential Risks in Basements

ICP DAS used four DL-303 modules to monitor temperature and CO<sub>2</sub>/CO levels in the parking lot on the 5th floor. After an incident where a septic tank blower wasn't restarted, causing gas to drift from B5 to the 1st floor, a CL-206-E was installed on B5. It monitors hydrogen sulfide levels to prevent accidents.

## iAir Utility Integrates Monitoring and Control for Smart Air Quality and Power Management

After setup, use ICP DAS's iAir Utility to read module data. The free version connects up to 8 modules, the advanced up to 64, with real-time monitoring, a trend chart, and database recording.

### Uninterrupted data recording provides a reliable basis for management decisions

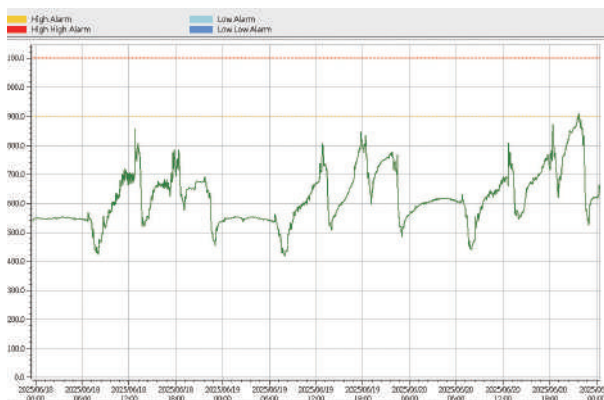
When using graphic control software, network disconnection may cause data loss. iAir Utility continuously records data in its built-in memory, so network disconnections are not a concern. If a log is stored per minute, it can store up to 300 days of data, with a maximum of 450,000 logs. The iAir Utility does not have to run 24 hours a day. You can reopen it anytime to read

and analyze the logs.

### Real-time voice alarms, no more ignoring abnormal conditions

iAir Utility also features alarm notifications. As mentioned, a sewer gas leak occurred in the basement, so an additional CL-206-E was installed to monitor hydrogen sulfide, requiring real-time monitoring rather than just reading and analyzing logs.

iAir Utility allows setting warning and danger thresholds for each air quality parameter, with customizable sounds and text-to-speech. After a warning sound, it broadcasts the abnormal value, e.g., 'Hydrogen sulfide exceeds the warning value, concentration is 3 ppm.' Alarms can be set to repeat or play at intervals, enabling security staff to receive notifications without constantly watching the screen and to review alarm history if away temporarily.



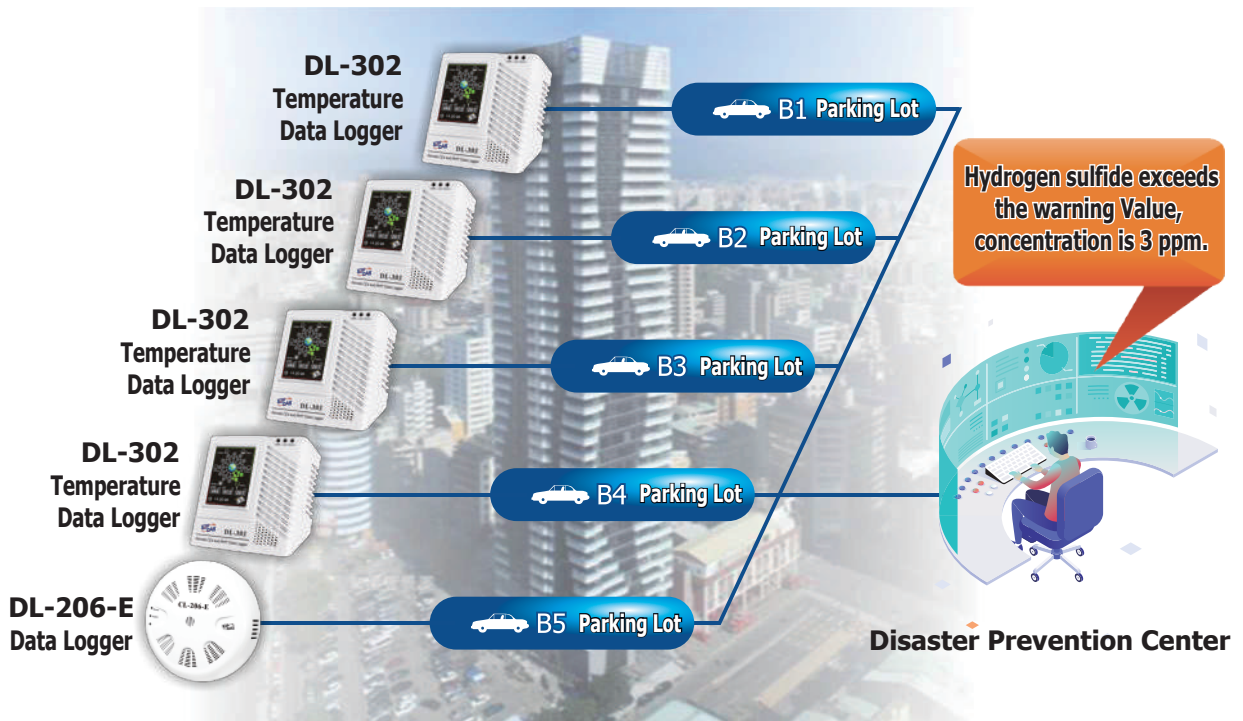
▲ In addition to recording data continuously, iAir Utility allows you to set warning and danger thresholds.



▲ iAir Utility monitors real-time data from air quality modules on each basement floor.

Module Name	Alias	Connect Status	Temperature(°C)	Humidity(%)	Dew Point Temperature(°C)	CO2(ppm)	CO(ppm)	PM2.5(μg/m3)
CL-207-WF	CL-207-Office	Normal	27.17	53.22	16.82	-	-	-
DL-303	Lobby	Normal	24.90	65.87	18.07	768	1	-
DL-303	B1	Normal	27.56	69.99	21.59	598	4	-
DL-303	B2	Normal	27.25	71.35	21.60	577	2	-
DL-303	B3	Normal	27.01	71.78	21.47	603	0	-
DL-303	B4	Normal	27.71	68.73	21.43	554	2	-
DLW1120	DLW1120	Normal	26.39	56.96	17.17	-	-	0

▲ The iAir Utility monitors real-time data and highlights values exceeding warning or danger values in yellow or red.



▲ iAir Utility uses text-to-speech to broadcast each floor's monitoring values, so the duty officer doesn't need to watch the screen constantly.

## Optimizing exhaust fan operation time with gas data to save 50% of electricity costs

The iAir Utility downloads logs from the module, stores them locally, and provides trend analysis to determine how long it takes CO<sub>2</sub> to stabilize after the exhaust fan is activated. Based on this, the fan operating time can be reduced from 15 to 10 minutes. The system also analyzes CO<sub>2</sub> rise patterns by day and night to optimize start times. At night, since the frequency of vehicles entering and exiting the building is lower and the air quality is generally good, we disable the turn-on setting for the exhaust fan, as well as the two daytime start-up times.

Since the power of the exhaust fan is fixed, the power consumption is proportional to the time. Although there is no power monitoring module installed, we can calculate the power saving of 50% while continuing to track air quality against targets.

## Sharing air quality data online to build a smart, transparent community

The iAir Utility can store logs to the local database, but also to the MySQL server. It also provides a web-based query so that residents can check the air quality and trend chart on the Internet. In the future, it will continue to be used with iKAN to make the community living environment smarter.

## More ICP DAS iAir Utility Software Information

The ICP DAS website provides detailed iAir Utility information, including Features, Support Module, and Tutorial Videos. Please refer to the QR code below. ■





## UA I/O U-7500M Series Enables CNC Data Integration and Remote Monitoring

*To meet the demand for CNC and IIoT integration in the manufacturing market, ICP DAS introduces the U-7500M UA I/O module with OPC UA function, which can exchange data with various CNC controllers to improve production efficiency and enhance equipment maintenance through real-time monitoring and event logging.*

Written by Tim Chen (Translated by Carol Hsu)

With the rapid development of Industry 4.0 and Smart Manufacturing, the integration of CNC and IoT is becoming increasingly important. For this reason, ICP DAS introduces the U-7500M UA I/O series with OPC UA communication capability, which can exchange data with Siemens SINUMERIK ONE CNC controllers.

This article explores the applications of the U-7500M in CNC systems, including data monitoring, event logging, and remote management, and its benefits for production efficiency and maintenance.

### OPC UA Data Integration is the Key to CNC Digital Monitoring Transformation

CNC (Computer Numerical Control) machines are automated tools controlled by programs, widely used in metalworking for precise and efficient cutting.

Originally, monitoring and data collection relied on field personnel or custom systems, resulting in high costs and inefficiency. With OPC UA, cross-brand data integration is simpler, supporting equipment management, predictive maintenance, and decision-making.

ICP DAS's U-7500M UA I/O module with dual communication capability (OPC UA Client/Server) seamlessly connects with CNC controllers to achieve real-time and stable data transfer to upper management systems such as SCADA, MES, or ERP.

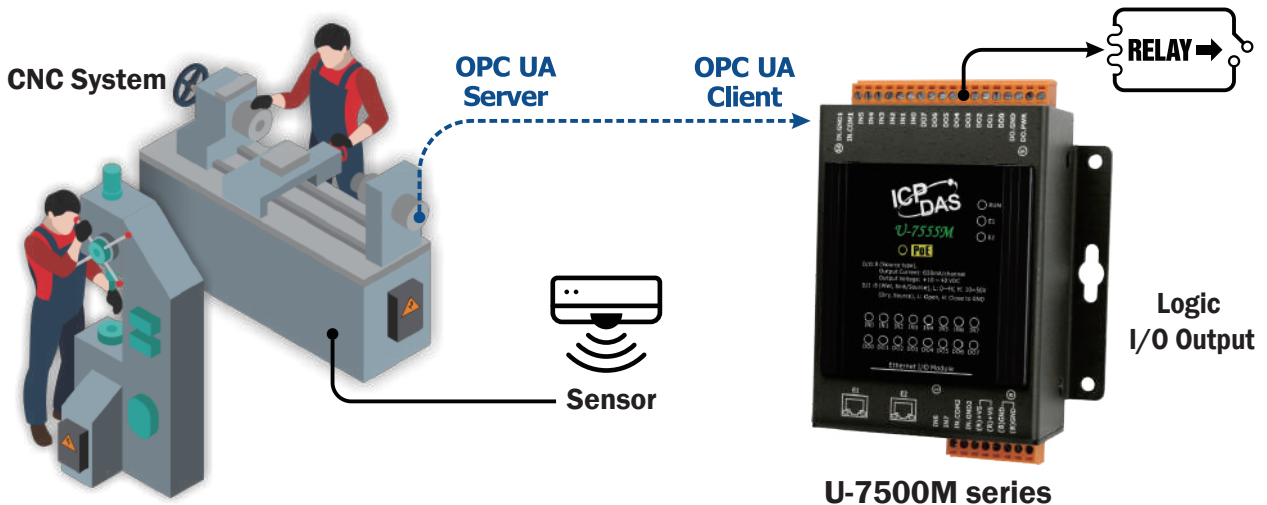
## Three Scenarios for CNC Data Monitoring, Integration, and Communication Optimization

### Real-Time CNC Data Monitoring and Analysis to Track Machine Status Every Second

As an OPC UA Client, the U-7500M connects to Siemens SINUMERIK ONE's OPC UA Server to receive machining parameters, equipment status, and alarms in real time. The data, shown on the monitoring platform, supports production tracking, quality analysis, and troubleshooting. The data stored in a database enables trend analysis and AI-based prediction for equipment issues and production optimization.

### Integrate MES/ERP Systems to Enhance Production Management

Using OPC UA, the U-7500M seamlessly integrates CNC production data into MES and ERP, enabling precise tracking of progress, workpiece history, and equipment usage without the need for complex conversions. This facilitates improved scheduling and resource allocation.



▲ The U-7500M series can connect to OPC UA servers of other brands' CNC systems to receive data.

## Bi-directional design for flexible CNC and industrial control integration

The U-7500M supports OPC UA server and client mode to access or share I/O data from CNC controllers or other industrial equipment (PLC, DCS). This enhances integration flexibility and scalability, eliminating concerns about device roles or master/slave settings.

## Event Log and Notification

The U-7500M records critical events and abnormal data, and provides real-time notifications to help users monitor device status. Below are its advantages in log management and message sending:

### Automated logs for accurate decision-making

The U-7500M supports event data logging to record key events (e.g., faults, parameter anomalies) and export them as reports on demand. These can be filtered and visually analyzed in Excel, enabling managers to track

issues, review productivity and downtime, and respond quickly.

### Notification of anomalies for rapid response

In addition to static reports, the U-7500M integrates with LINE, Email, and other tools for real-time event notifications. When anomalies occur (e.g., high temperature, abnormal vibration), it alerts maintenance staff to respond and reduce production loss risk.

In CNC system maintenance, this mechanism quickly locates fault periods and parameter changes via event logs, helping technicians diagnose problems accurately and reduce maintenance time.



▲ U-7500M provides real-time notification

### U-7500M Module Integrates CNC System and IIoT Data

With the continuous advancement of intelligent manufacturing and Industrial Internet of Things (IIoT), the CNC systems must integrate deeply with overall information. ICP DAS's U-7500M UA I/O modules enable real-time data transmission, centralized monitoring, and intelligent management.

### Flexible architecture for better data interoperability

The U-7500M module supports OPC UA Client and Server modes for seamless communication between Siemens SINUMERIK ONE CNC and IT/OT systems, providing a stable and scalable solution for real-time monitoring, parameter logging, and status alarms.

### Data Integration for more efficient decision-making

At the management level, the U-7500M's data integration capability provides real-time and accurate first-hand information to MES and ERP systems to enhance production scheduling and decision-making. Event logs and automated reports institutionalize problem tracking, while real-time alarms reduce monitoring burdens and provide valuable response time to equipment anomalies. The design supports predictive maintenance and minimizes the risk of downtime, showing the true value of the module to industrial operations.

### Bridge to Intelligent Manufacturing, U-7500M Leads CNC Data Transformation

Overall, the U-7500M series is not only a communication I/O module but also a bridge that connects OT and IT, allowing the CNC system to maximize its performance in the development of a smart factory. In the future, with the maturity of IIoT technology and the variety of application areas, the U-7500M series will play a role in more automation scenarios, helping manufacturing become smarter, more efficient, and sustainable. ■



## From Serial Communication to Network Integration, PDS Builds Smart Systems

*As factories move toward digitization, legacy serial devices face the challenge of networking. ICP DAS's PDS series can connect RS-232/485 devices to the network for remote monitoring and data integration. With multiple transmission modes, it offers flexible deployment, reduces integration costs, and supports smart factories.*

Written by Jim Hou (Translated by Carol Hsu)

### New Serial Communication Integration for Smart System Deployment

Serial communication is a common data transmission that sends data bit by bit, enabling stable data exchange between devices with only a few wires.

Serial communication is widely used in industrial automation, instrumentation, and embedded systems due to its simplicity, low cost, long-distance capabilities, and anti-interference properties. Typical devices include PLCs, power

supplies, motion controllers, barcode scanners, RFID readers, meters, and monitoring instruments. It enables real-time data transmission and device interconnection, which is crucial for industrial systems.

Over the past decade, the rise of networks and digital technology has driven demand for device networking to support remote monitoring, data recording, and smart decision-making. In response, ICP DAS introduces the PDS series, enabling devices to connect to networks with efficient, stable, and cost-effective integration solutions for smart deployment.

## The PDS Series Bridges Devices and Network Communication.

A Programmable Device Server (PDS) is an industrial device that connects serial devices (RS-232/485/422) to Ethernet for data exchange and remote monitoring.

Serial devices use the Transmission Control Protocol to connect to the network and transmit data. The interface used to send and receive serial data is called a Communication Port. The COM Port is responsible for communicating with serial devices, while TCP is responsible for transmitting data over the network.

The PDS series offers multiple built-in transmission modes to meet diverse communication needs, enhancing integration flexibility while balancing efficiency and ease of use.

This article uses ICP DAS's PDS-5105D-MTCP as an example to illustrate the PDS series' multi-transmission mode. The module serves as a "Serial-to-Ethernet Gateway," enabling RS-485 devices to connect to networks and allowing host systems to access them remotely via Ethernet.

## One machine, multiple functions-

## The PDS series enables versatile network transmission

### M0: Transparent Mode (Multi-echo)

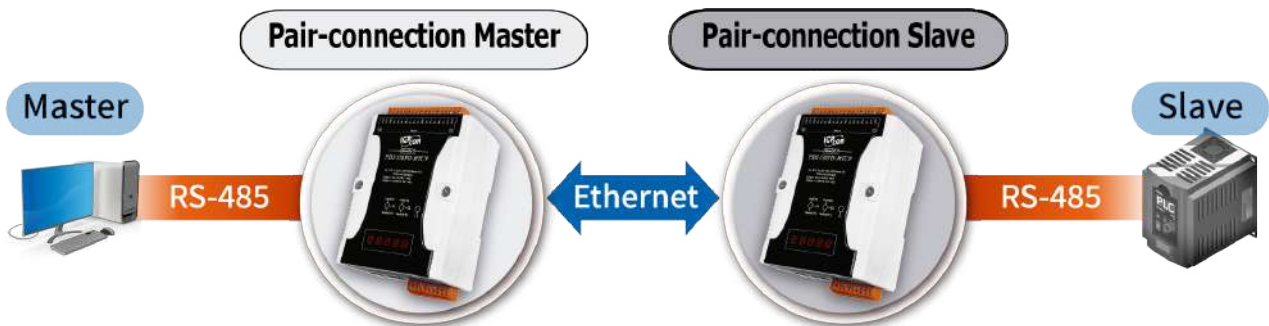
- Supports multiple TCP connections to the same COM port(s), allowing multiple users to connect to the same device(s) simultaneously via the network.
- TCP messages are immediately sent to the COM port, and COM port messages to all TCPs, with no processing.



▲ In M0 mode, multiple computers can connect to the same serial device(s) via the network.

- Supports pair -connection:

Pair-Connection (serial bridge or serial tunnel) is a connection between two computer hosts, servers, or serial devices without Ethernet functions, through TCP/IP protocol, to transmit data and control devices.



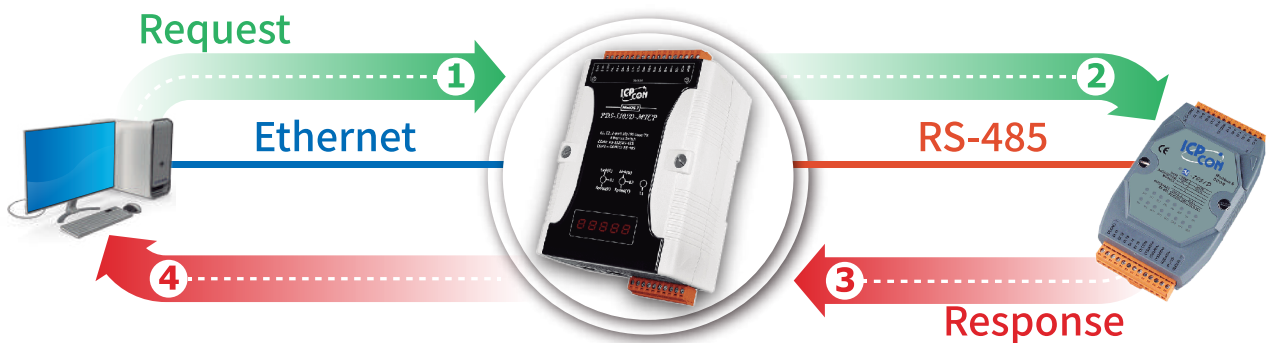
▲ The PDS series uses TCP/IP to connect serial devices via pair-connection

## M1: Master(TCP)/Slave(COM) Mode (Single-echo)

- Multiple Masters (TCP) can connect to the same Slave (COM)
- The response data received from the COM Port is returned only to the single master (the requester)

M1 mode is applicable for Virtual COM Port and TCP/IP connections. In this mode, data will be transmitted to the specific Master that has sent the request. If the Master does not send a request to the PDS, the PDS will not return any data.

**Scenario 1:** When the PDS receives a command from the Master, it forwards it to the Slave. If the Slave responds within the timeout, the response is returned to the Master; otherwise, the message is not returned to the Master.



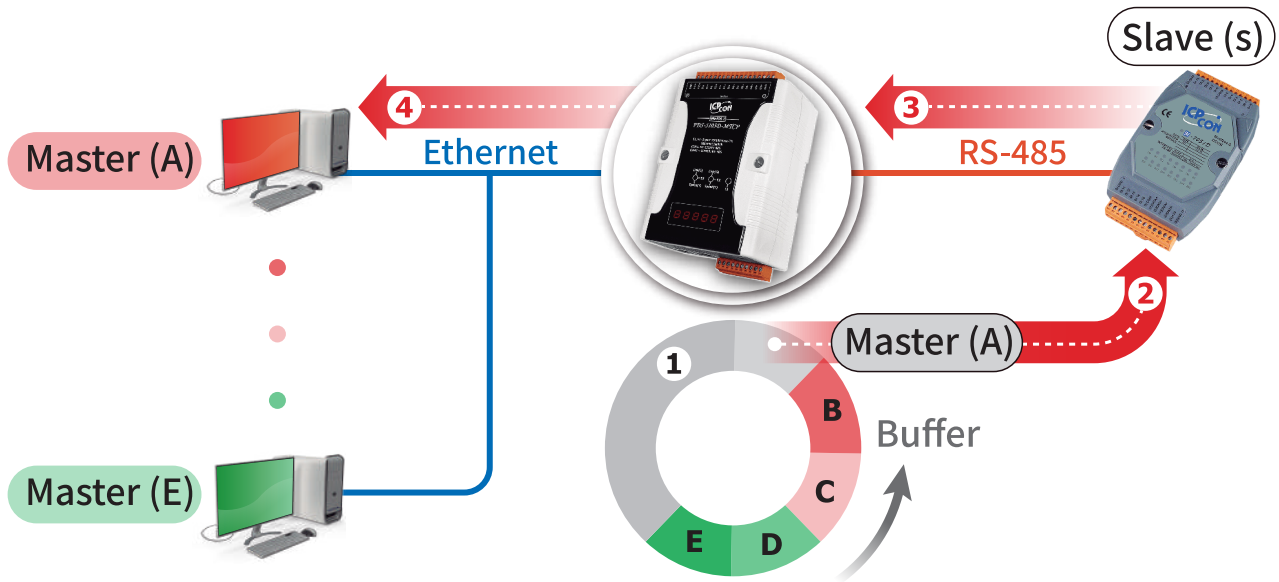
- ▲ The Master (TCP) sends a request to the PDS, which forwards it to the Slave; if the Slave responds within the timeout, the PDS returns the response to the Master.

**Scenario 2:** If the Master does not send any commands, the data actively transmitted by the Slave devices will not be returned to the Master.



- ▲ In M1 mode, if the Master does not send a command, even if the Slave device actively sends data, it will not be returned to the Master.

**Scenario 3:** When multiple TCP Masters connect to the same serial Slave, their commands are queued and forwarded one by one. Each response is returned only to the corresponding Master, ensuring communication sequence and independence. This achieves the application requirement of multiple Masters sharing the same serial Slave.

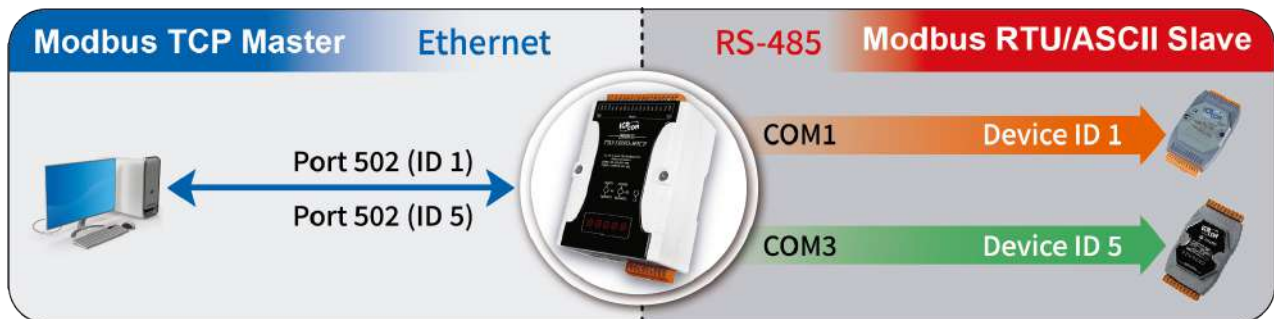


▲ In M1 mode, multiple masters can connect to query data from a slave serial device, with each master's commands queued sequentially to prevent data confusion or interference.

### M3: Modbus TCP/UDP to RTU/ASCII Gateway (TCP Port 502)

- All COM ports share the same TCP port (default TCP port: 502).
- Supports multiple Masters connected to the same Slave, same as M1 Mode Scenario 3.
- Supports the UDP protocol.

The PDS series modules act as gateways converting Modbus TCP to serial Modbus RTU/ASCII. In M3 mode, all COM ports share the same TCP port (default TCP port 502). Users must set the Device ID range corresponding to each COM port. For example: Set COM1's ID Range to 1~3 and COM3's ID Range to 4~5. When the module receives a Modbus TCP command, it will only send the corresponding command through the COM port matching the specified ID range.



▲ The PDS series can convert Modbus TCP to Modbus RTU or Modbus ASCII and send commands to the device via the corresponding ID.

## M4: Modbus TCP to RTU Gateway (TCP Port 10001...)

## M5: Modbus TCP to ASCII Gateway (TCP Port 10001...)

- Each COM port uses its own independent TCP port (default TCP ports: 10001 to 10010)
- Supports multiple Masters connected to the same Slave, same as M1 Mode Scenario 3.

M4 mode acts as a Modbus TCP to RTU gateway, and M5 as a TCP to ASCII gateway. Unlike M3, each PDS COM port has an independent TCP port, and masters must connect to the specific port for commands to be sent from the corresponding COM port. For example, connecting

to TCP port 10001 will send commands from COM1, and so on.

## M7: Modbus RTU to TCP Gateway

## M8: Modbus ASCII to TCP Gateway

- Each PDS COM port operates independently, letting users set its IP address and TCP port to suit different connection needs.

M7 mode functions as a Modbus RTU to Modbus TCP gateway, while M8 mode functions as a Modbus ASCII to Modbus TCP gateway. A serial master can access a Modbus TCP slave device via PDS using M7/M8.



▲ In M4 and M5 modes, each COM port corresponds to an independent TCP port.



▲ A serial master can access a Modbus TCP slave device via PDS using M7/M8.

## Flexible Architecture, Smart Integration: PDS Enables the Future of Industrial Control Networks

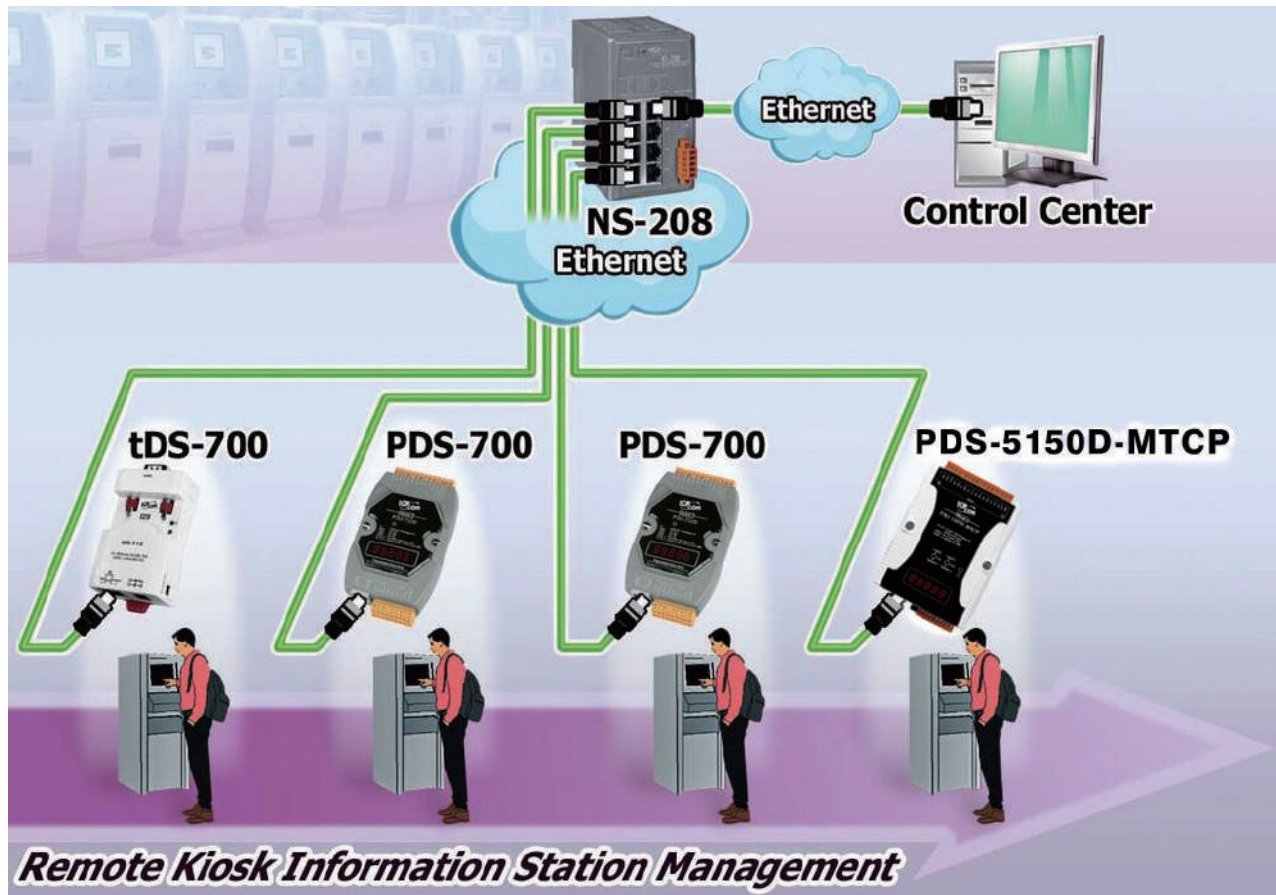
As smart industrial control systems spread, traditional serial devices need network connectivity for data upload and remote control. The PDS series converts RS-232/485/422 signals into network packets (e.g., TCP/IP), enabling scalable, manageable, and remotely integrated devices for future industrial automation.

In summary, PDS is more than a signal converter—it bridges legacy and modern systems. It enables equipment extension, cross-system integration, standardized management, remote diagnostics, and real-time monitoring.

With versatile communication modes, users can deploy suitable architectures, reducing integration complexity and costs.

## More ICP DAS PDS-5105D-MTCP Product Information

ICP DAS’s website offers detailed product information for the PDS-5105D-MTCP, including specifications, catalogs, manuals, and applications. See the QR code below. ■



▲ ICP DAS PDS series enables serial devices to connect to the network and become smart devices without any software and hardware modifications.



# Power Smarter, Live Greener- PM-5133 Smart Energy Solutions

*Facing dual challenges of energy saving and power optimization, the PM-5133 smart meter offers precise measurement, bi-directional monitoring, and intuitive visualization for real-time power management. Demand trend charts, harmonic information, alarm logic, Modbus protocol support, and cloud integration capabilities improve diagnostic efficiency and field responsiveness, enabling seamless energy data flow from the production floor to the cloud, creating a smart, safe, and visualized energy management system.*

Written by Bear Liu (Translated by Lynn Tang)

With rising demand for energy management, net-zero goals, and microgrids, accurate power data and effective monitoring are crucial for factories, integrators, and energy management consultants.

The PM-5133 three-phase smart power meter, designed for energy management, carbon inventory, and microgrids, integrates advanced monitoring, intuitive HMI, and alarm logic to meet demands for visualized data, power consumption alerts, and efficient energy management. It helps build smarter, more efficient energy systems, strengthening efforts in carbon reduction and smart manufacturing challenges.

## Accurate Measurement for Comprehensive Energy Management

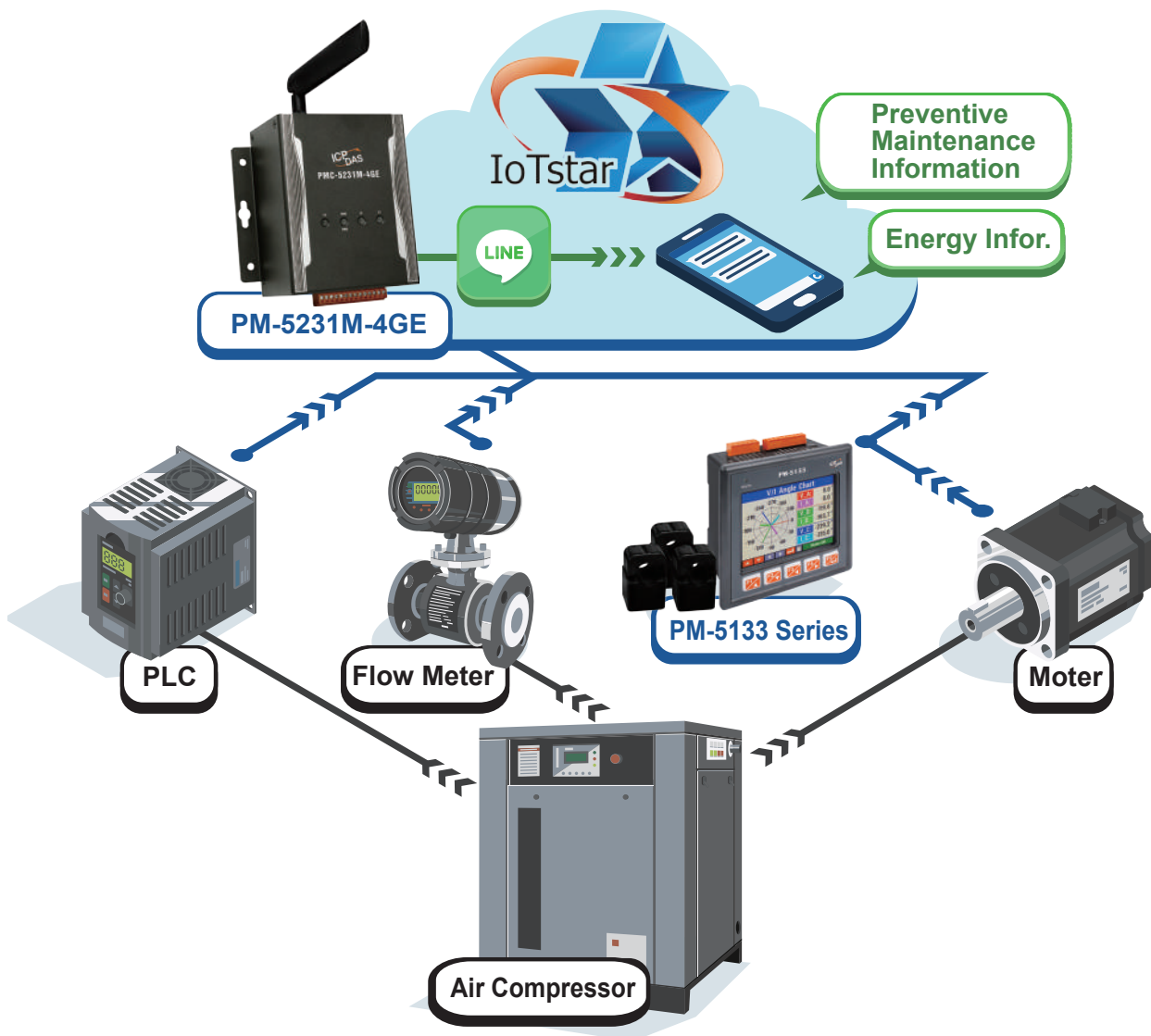
In today's global net-zero environment, precise power data acquisition is the foundation for driving energy conservation and improving efficiency.

The PM-5133 series achieves 0.5% high-accuracy measurement, ensuring reliable power readings even under complex loads. Clear phase-angle diagrams and built-in 31st-order harmonic analysis allow users to quickly evaluate power quality, detect abnormal harmonics in real time, and reduce equipment damage caused by poor

power quality.

The bi-directional kWh metering supports two-way energy flows in modern microgrids, enabling dual monitoring of consumption and generation for flexible energy management. To prevent data loss from network issues, the PM-5133 not only supports Modbus RTU communication but also provide data logger to stores up to 630,000 records locally, integrating seamlessly with PLCs, SCADA systems, and energy platforms.

The PM-5133 has two digital output channels that can directly drive relays for demand management and alarm notification. Through Modbus, edge-computing results and alarms are quickly reported to the control center, improving responsiveness. Together with ICP DAS PMC series power concentrators and IoTstar cloud software, it plays a critical role in data collection, analysis, and remote management—helping users monitor usage, respond to anomalies, and support both on-site alarms and centralized decision-making.



▲ PM-5133 integrates with ICP DAS PMC series concentrators and IoTstar cloud software for energy data collection, analysis, and remote management.

## Ergonomic Design for Safe and Convenient Operation

Maintenance of power equipment is often high risk, and making safety and usability are non-negotiable factors.

The PM-5133 series uses high-insulation materials and flame-retardant housing to ensure safety. Its split-core CT design prevents dangerous voltages during open-circuit conditions. Detachable terminals allow fast wiring and replacement without removing full connections, improving maintenance efficiency.

The dual-interface HMI (touchscreen and physical buttons) supports diverse scenarios. Its resistive touchscreen solves glove-use

issues in cleanrooms, ensuring intuitive and smooth operation. To meet modern information security requirements, the PM-5133 provides password protection to control parameter access, preventing misconfigurations and ensuring long-term stability. With more than 30 pages covering voltage, current, power, harmonics, alarms, and logs, the PM-5133's interface is clear and structured. Trend charts, histograms, and phase diagrams significantly enhance understanding, enabling quick assessments without complex calculations.

## Compact, Durable, and User-Friendly Industrial Design

Beyond performance and interface, the PM-5133 excels in industrial design as well.

The PM-5133's flame-retardant build and IP65-rated front panel provide safety and resist heat and dust common in factories, ensuring long-term stability. Its compact size with a standard 90x90 mm panel cutout makes installation easy in limited spaces. Voltage and CT terminals are placed on opposite sides for neat wiring, simplified maintenance, and enhanced aesthetics and reliability. The 3.5-inch resistive color touchscreen provides sharp, vivid visuals, readable in dim or bright environments, with a sleep function for energy saving. Resistive technology works with gloves, oil, or



▲ The PM-5133 series delivers more intuitive and comprehensive energy management information.

dust, ensuring reliable operation in cleanrooms and heavy industry. Beyond its practical design, the PM-5133 emphasizes user-friendly details, combining professionalism with care—reflecting ICP DAS’s commitment to industrial design excellence.

## Smart Energy × Data-Driven Insights: Seizing Carbon Management Opportunities

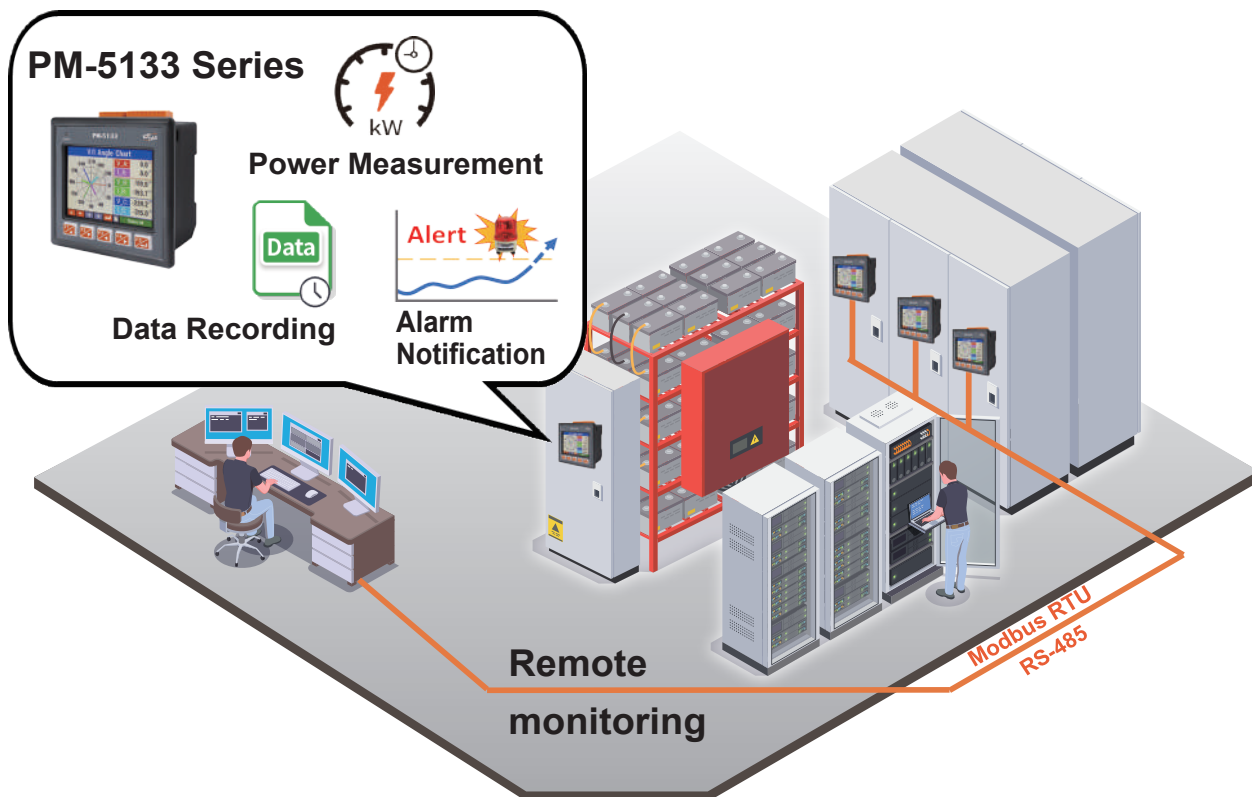
The PM-5133 series combines precision measurement, flexibility, user-friendliness, and stable operation, perfectly meeting the needs of system integrators, facility engineers, maintenance professionals, and energy management consultants for smart power monitoring. ICP DAS continues investing in R&D and innovation. With the PM-5133, it aims to deliver a competitive

and stable tool for energy management, helping customers seize opportunities in energy saving and carbon management. Choosing PM-5133 means choosing intelligent measurement and mastering the energy future.

## More Information on the PM-5133 Series



The ICP DAS website provides complete PM-5133 information, including specifications, catalogs, and user manuals. Please scan the QR code below. ■



▲ The PM-5133 series features power measurement, demand management, data logging, and touchscreen HMI—perfectly meeting smart monitoring needs.



## IoTstar 2025 Supports Grafana - Improves “IoT Big Data” Analytics Applications

*As the demand for IoT data analytics applications (Big Data analytics, Machine Learning...) expands, how to build a stable sensor database (Data Lake) with seamless interoperability is a key factor for the successful operation of IoT data analytics applications. Utilizing IoTstar 2025 can offer stable and reliable backend support for IoT data analytics tools, reducing the workload and allowing enterprises to quickly grasp the analyzed information, providing the right basis for informed decision-making.*

Written by Sam Huang (Translated by Eva Lee)

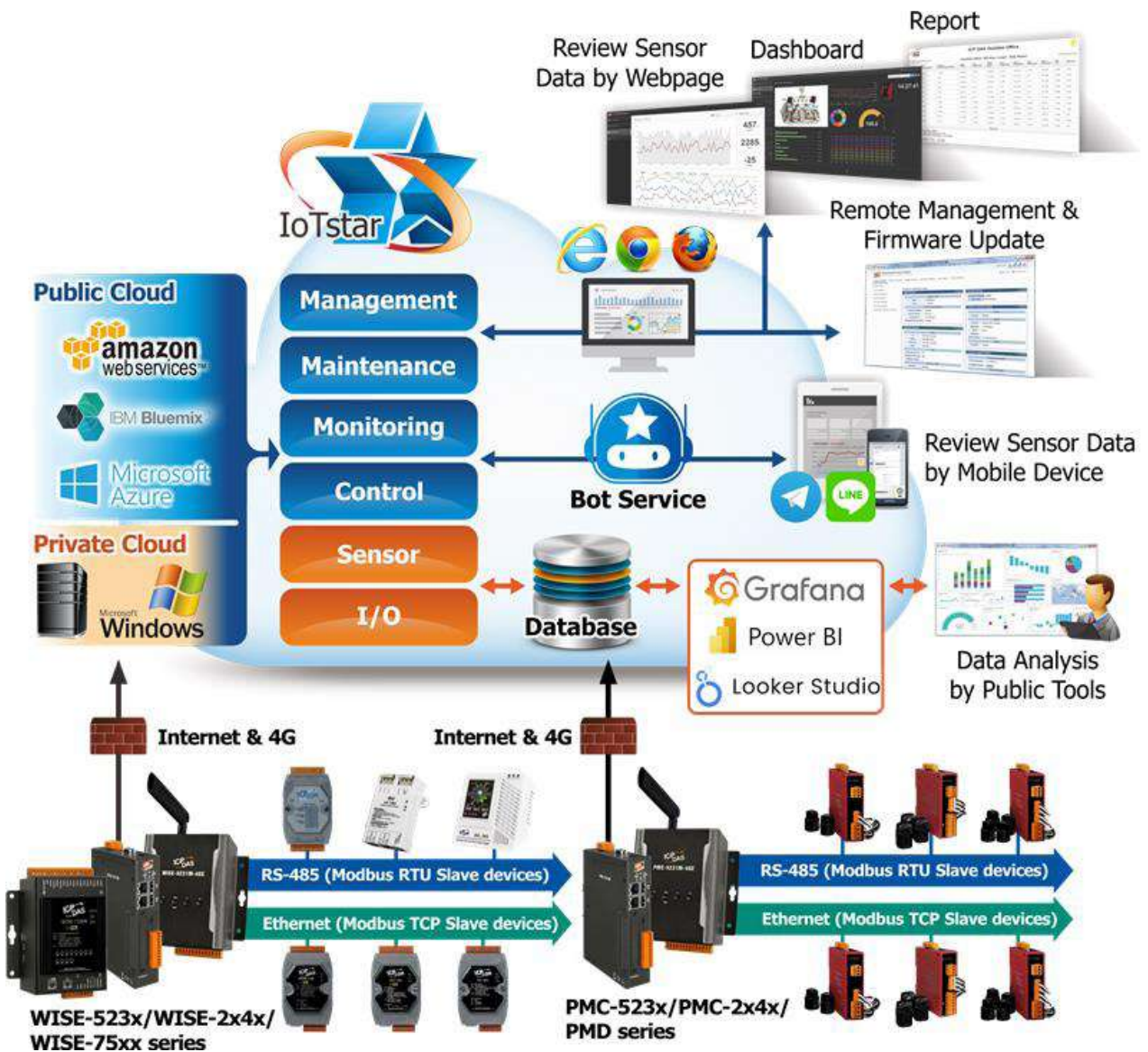
### IoTstar 2025 Introduction

IoTstar 2025 is the latest version of ICP DAS's IoT cloud management software. It can be installed on private PCs or VM systems hosted on cloud platforms such as Microsoft Azure, IBM Bluemix, Amazon AWS, and Google Cloud. No programming required; system configuration can be completed via web interface, and users can quickly establish an IoT cloud monitoring system with WISE/PMC/PMD controllers. IoTstar 2025 delivers comprehensive services like “Controller Remote Access Service” and “Sensor Data Collection Service”, etc. It can seamlessly integrate with data analysis tools (e.g., Grafana, Microsoft Power BI, Google Looker Studio...), and provides

the required Data Lake to quickly build “IoT + Big Data” analytics applications (e.g., Big Data processing, Real-Time Data analytics, Machine Learning...).

### Building a Data Lake for Data Analysis Tools

IoTstar 2025 collects data from sensors connected to remote WISE/PMC/PMD controllers and uploads it to a cloud database for storage, providing the sensor Data Lake for data analysis tools. Its features are as follows:



▲ IoTstar 2025 System Architecture

### Sensor Data Collection Service

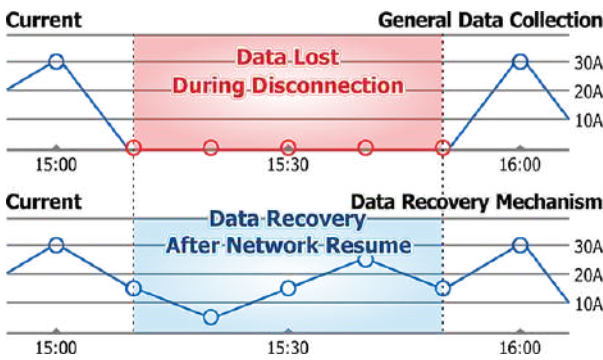
No programming is required! Use the web interface to set up IoTstar 2025 and WISE/PMC/PMD controllers, and collect/store field site sensor measurement data. IoTstar 2025 is compatible with the three leading database systems commonly adopted across the industry—MS SQL Server, MySQL, and Oracle.



▲ Sensor Data Collection Service

## Sensor Data Recovery Mechanism

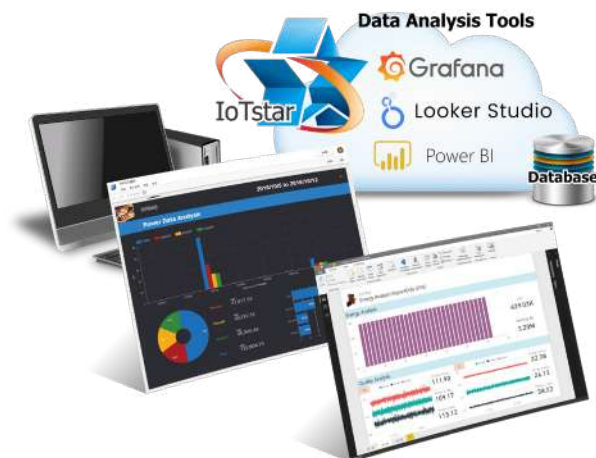
In typical cloud data collection processes, sensor data is gathered and sent to the cloud for storage in a database. However, if a network disconnection occurs, any data transmitted during that period may be lost. IoTstar 2025 addresses this issue with a built-in sensor data recovery mechanism. During a network disruption, WISE/PMC/PMD controllers temporarily store all data on their SD cards. When the network connection is restored, the stored data is automatically retransmitted to IoTstar 2025 and imported into the database, ensuring the completeness and integrity of historical sensor data.



▲ Sensor Data Recovery Mechanism

## Support SQL Database Interface

IoTstar 2025 supports SQL database



▲ Support SQL Database Interface

interfaces, enabling seamless connection to widely used data analysis tools such as Grafana, Microsoft Power BI, and Google Looker Studio. This helps users to build "IoT Big Data" analysis applications quickly.

## Seamless Connection of Data Analysis tools (e.g., Grafana)

### Grafana Introduction

Grafana is an open-source data analysis tool that supports multiple data sources and converts raw data into various charts, making it easier for users to understand and analyze. As a widely popular tool, Grafana allows users to query data value in real-time via a web interface, meeting the needs of enterprises for data-driven decision-making. The main features of Grafana are as follows:

- Support Cross-platform System (Windows, macOS, Linux, cloud).
- Support Multiple Data Sources (MS SQL Server, MySQL, Oracle, PostgreSQL, InfluxDB, more).
- Built-in Chart Components offer rich visualizations for data analysis.
- Provide Customizable Alert Rules for Notifications.

### Connecting IoTstar 2025 with Grafana

By connecting IoTstar 2025 with Grafana, users can quickly build an "IoT Big Data" analysis application in a few steps.



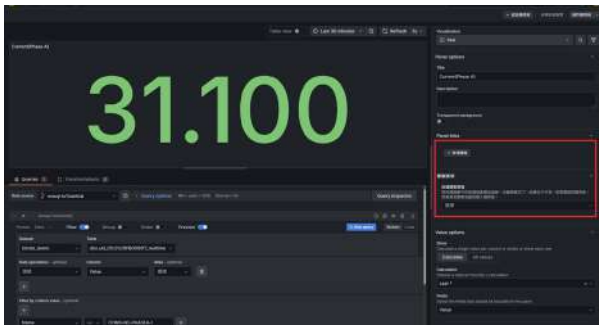
▲ Data Analysis Tool – Grafana

1. Build a sensor database using IoTstar 2025
  - A. Install and configure WISE/PMC/PMD controllers and sensors at the field site.
  - B. Install and initialize IoTstar 2025 at the management end, and configure the connection with database.
  - C. Configure the network connection between IoTstar 2025 and the WISE/PMC/PMD controllers.
  - D. Start IoTstar 2025 to begin collecting sensor data and storing it in the database.
 

(For details on the above steps, refer to the IoTstar 2025, WISE/PMC/PMD user manuals.)
2. Connect Grafana to the sensor database built by IoTstar 2025.
  - A. Log in to Grafana → Create Connection (select the database built by IoTstar 2025) → Create Data Source.
  - B. Connect the Data Source to the database built by IoTstar 2025.
    - Enter the database name, connection parameters, and login information.
    - Save and test the connection to the database.

After connecting Grafana to the database built by IoTstar 2025, then start to edit data analytics pages.

3. Set up the data analytics page
  - A. Create a data analytics page → Add chart components → Set the components' data source (select the database built by IoTstar 2025).
  - B. Set parameters for the chart components (e.g., Data set, Table, Column...) to read the sensor data. After setup is complete, the chart components will display the retrieved values.



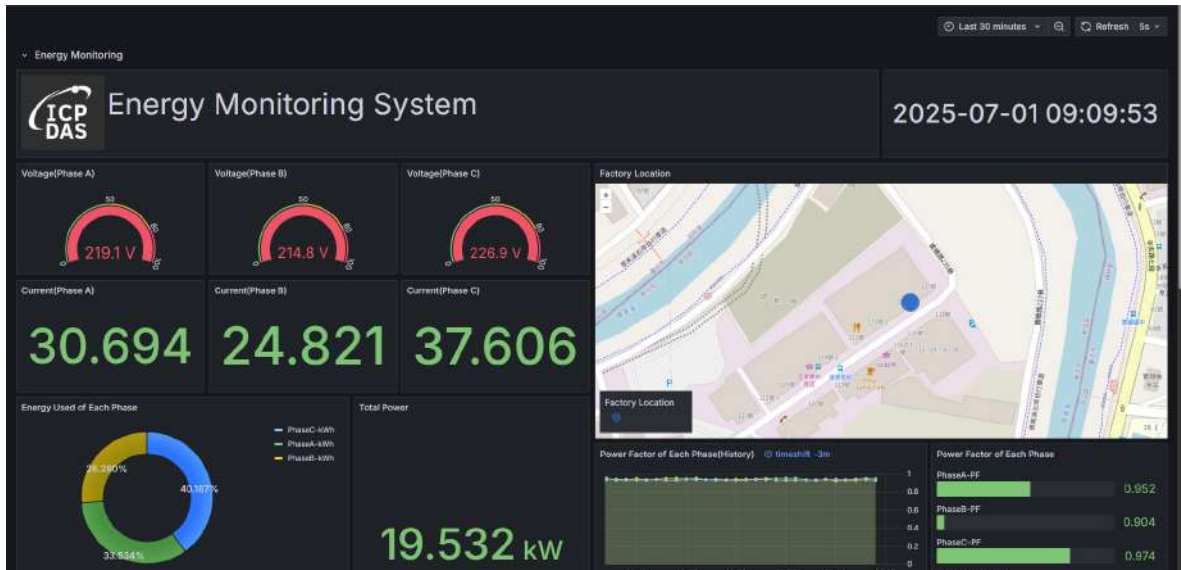
▲ Connecting IoTstar 2025 with Grafana

- C. Save the settings after the editing.

The following shows the power analytics page created by Grafana. This page displays power consumption data retrieved from the database built by IoTstar 2025.

## Conclusion

The IoTstar 2025 IoT cloud management software developed by ICP DAS can quickly build the sensor database (Data Lake) for IoT data analytics tools (such as Grafana, Microsoft Power BI, and Google Looker Studio). Its "Data Recovery Mechanism" ensures the complete preservation of sensor data and the accuracy of analytics results. Through support for SQL database interface, it can seamlessly connect to data analytics tools, helping users quickly build "IoT Big Data" applications. Using IoTstar 2025, it can provide a complete and stable backend support for "IoT Big Data" applications, and also significantly reduces the workload for data analytics tools. ■



▲ Application Example of IoTstar 2025 with Grafana

# CL-220-E

## PM1/PM2.5/PM10/Temperature/Humidity/ Dew Point Data Logger Module



The CL-220 series of data logger devices can be used to record PM1/PM2.5/PM10 and the number of particles (0.3 $\mu$ m, 0.5 $\mu$ m, 1 $\mu$ m, 2.5 $\mu$ m, 5 $\mu$ m, 10 $\mu$ m), CO, CO<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>S, HCHO, TVOC, temperature, humidity and dew point information, including the date and time stamps, and are able to store up to 450,000 downloadable records.

Real-time data can be accessed from the CL-220 data logger from anywhere and at any time using the free Windows software, the iOS App, or the Android App, as long as they are connected to the same local network as the data logger.

Support is provided for common industrial protocols such as DCON, Modbus RTU, and Modbus TCP, as well as the emerging machine-to-machine (M2M)/IoT (Internet of Things) connectivity protocol – MQTT. The CL-220 data logger can be connected via widely used communication interfaces including RS-485, Ethernet and PoE, meaning that the device can be easily integrated into existing HMI or SCADA systems, ensuring trouble-free maintenance in distributed control systems.

### Features:

- Able to record PM1/PM2.5/PM10, Temperature, Humidity and Dew Point
- Up to 450,000 records with date and time stamps
- Web-based Configuration Interface
- Simple and Powerful Software Utility, iOS App and Android App
- Supports the DCON, Modbus RTU/TCP, and MQTT Protocols
- Features RS-485/Ethernet/PoE Communication Interfaces
- Relay Output for Alarm or IAQ Device Control

For details on the CL-220-E PM1/PM2.5/PM10/Temperature/Humidity/Dewpoint Data Logger, visit: <https://www.icpdas.com/tw/product/CL-220-E>. ■

# MIS at Peace, Facilities at Ease

## Data Security Guaranteed!

- ▶ Supports OPC UA, MQTT, and RESTful protocols with encryption, authentication, and access control for secure data transmission.
- ▶ Includes event logging capabilities.
- ▶ Features built-in logic control and scheduling functions to enable intelligent management and improve production efficiency.
- ▶ Allows remote access to databases.

