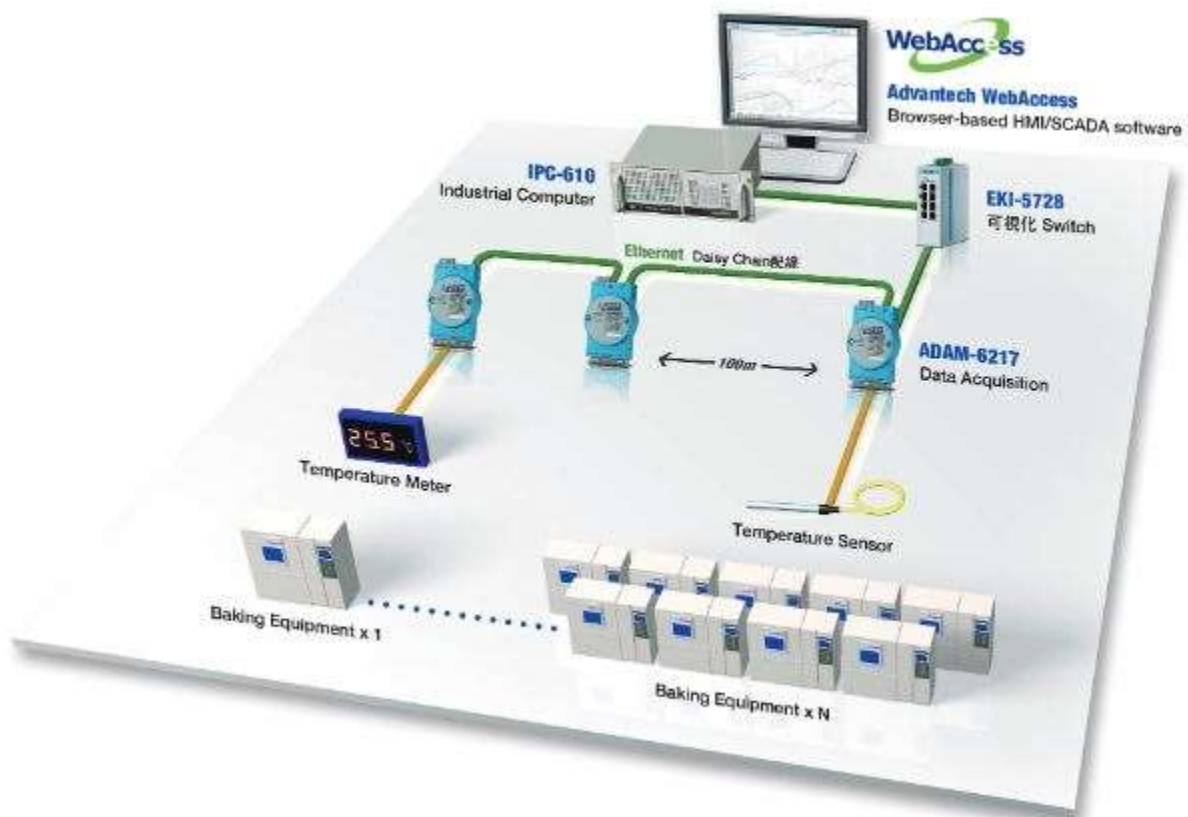


Real-Time Temperature Monitoring of PCB Baking Equipment

Unique Micro Design (UMD) *Application Briefs* are designed to provide ideas around systems and solutions that UMD can deliver and or develop, to solve customers' real world problems.

This includes adding value to various UMD key vendors, such as Advantech.



Systems Diagram

SOLUTION OVERVIEW

Introduction

Baking, a process that involves lamination, soldering, and printing, is often used in the manufacture of printed circuit boards (PCB) to eliminate moisture, dry graphite, and harden resin. However to avoid damage to or failure of the board components, the baking temperature and duration must be carefully controlled. Traditionally, PCB factories use standalone ovens with an embedded proportional integral derivative (PID) controller.

Operators must read the meter, record temperature variations, and then manually adjust the baking temperature and duration. Because of the extreme precision required, this system is vulnerable to errors. One of Taiwan's leading PCB manufacturers decided to implement a real-time temperature monitoring solution to ensure product quality and yield.

System Requirements

Accordingly, this leading manufacturer required a connected monitoring system that would enable automatic real-time data acquisition, remote control of operating parameters and automatic alarm alerts when temperatures reach pre-set thresholds. Graphs showing the historical temperature variation trends for the operating duration were also required for quality management and policy making.

Solution Offering

Advantech's solution involved installing six to eight RTD temperature sensors in each oven, which were then connected to an [ADAM-6217](#) analog input I/O module. The sampling rate could be set at one entry per second/5 seconds, depending on the usage deployment method that does not cause damage or interference to existing equipment. The sensors transmit data to Ethernet-based data modules, connecting the ovens in a network for sharing information.

System Diagram

Advantech's ADAM-6200 series facilitates connection to an Ethernet network in a daisy-chain topology, reducing the need for switching nodes and complex deployment. [ADAM-6200 series](#) products are also equipped with basic logic judgment capabilities, which allows them to activate on-site alarms if temperatures exceed the designated threshold.

ADAM modules used to monitor ovens are daisy-chained together, and the data acquired from the sensors travels along the Ethernet-based daisy chain, via an [EKI-5728](#) industrial switch, to arrive at [IPC-610](#). The IPC-610 system is equipped with Advantech's [WebAccess HMI/SCADA](#) software to facilitate the acquisition, storage, display and use of received data.

Advantech's WebAccess software is an open platform that supports diverse communication drivers to ensure easy expansion and integration. If PCB manufacturers wish to expand the scale of Intelligent automation, all existing and newly added applications can be easily integrated on the same platform, and all data can be accessed from any Internet browser in any location.

With the implementation of Advantech's solution, the PCB factory was able to acquire baking temperature data 24 hours a day, 7 days a week, with high sampling rates. When connected to the factory's MES, the temperature monitoring system can automatically set the baking temperature and duration according to the job recipes. This helps prevent board delamination, measling, or other failures and enables the factory to manage small-batch/diverse production.

Conclusion

Nowadays, PCB manufacturers face increasing pressure from both customers and competitors to adopt Industry 4.0. However, because of the Industry's low profit margins, manufacturers are more conservative when considering the plant-wide implementation of intelligent automation. Most manufacturers opt for partial implementation starting with their most critical process and equipment.

Advantech's real-time 24/7 baking temperature monitoring solution targets one of PCB manufacturers' biggest pain points and provides the most cost-effective, easy-to-deploy and easy-to-expand methods for ensuring product quality and yield goals.

SOLUTION COMPONENTS

SOFTWARE

WebAccess/
CADA



Advantech WebAccess, Brwoser-Based SCADA Software

- f* . Enables 100% web-based remote engineering, monitoring, and control
- f* . Driver support for major PLCs, PACs, I/O modules, CNCs, network switches, and computer platforms
- f* . Supports standard protocols including Modbus, OPC UA, OPC DA, Ethernet/IP, DNP3, SNMP, and BACnet
- f* . WebAccess/Dashboard 2.0 HTML5-based GUI for cross-browser, crossplatform data analysis; Widget Builder for creating custom widgets; and access to external databases and web service interfaces for data acquisition from third-party software systems
- f* . Provides WebAccess APP for remote monitoring/control and alarm push notification for Android/iOS mobile devices
- f* . Easily integrated with third-party software (e.g., MES and ERP) via open interface web services (RESTful API and SignalR), widget interfaces, and WebAccess APIs
- f* . Flexible database restore mode for automatic data access with improved query Speeds
- f* . Soft license online authentication

HARDWARE

ADAM-6217



Advantech Data Acquisition Module

8-ch Isolated Analog Input Modbus TCP Module

- 8-ch differential AI, 2-port Ethernet
- Daisy chain connection with auto-bypass protection
- Remote monitoring and control with mobile devices
- Group configuration capability for multiple module setup
- Flexible user-defined Modbus address
- Intelligent control ability by Peer-to-Peer and GCL function
- Multiple protocol support: Modbus TCP, TCP/IP, UDP, HTTP, DHCP
- Web language support: XML, HTML 5, Java Script

EK-5728



8GE Unmanaged Ethernet Switch,
ATEX/C1D2/IECEEx, E-Mark, -
40~75°C

- Communicates with SCADA software via Modbus/TCP
- Communicates with NMS (Networking management system) via SNMP
- Port-based QoS for deterministic data transmission
- -40~75°C operating temperature range
- 8.4~52.8 V DC wide-range power input
- EMS level 3 protection for extreme outdoor environments
- IEEE 802.3az Energy Efficient Ethernet (EEE)
- Jumbo Frame Support (Up to 9,216 Bytes)
- Supports redundant 12~48V DC power input and P-Fail relay
- Loop detection

IPC-610



Advantech Classic 4U 15 Slot Rackmount
Chassis

- 4U rackmount chassis supports up to 15 cards
- Shock-resistant disk drive bay design holds up to three 5.25" and two 3.5" (one front-accessible & one internal) disk drives
- Special hold-down clamp design with rubber cushions protects the cards from shock and vibration
- Power and HDD activity notification improves system availability
- Front-accessible air filter for easy system maintenance
- Lockable front door prevents unauthorized access
- 300 W / 400 W AC and 300 W DC ATX power supply options

SERVICES

Solution Architecture	UMD has extensive experience in the design, development and integration of ICT and data capture technology, including device interfacing.
Engineering	UMD can design, manufacture electronic devices, interfaces, cable assemblies and mounting hardware to meet specific needs
Software Development	UMD's Software Development Team developed all software applications in-house
Project Management	To ensure on time and on budget delivery.
Installation	This includes <ul style="list-style-type: none">• Installation• Implementation• Commissioning
Aftersales Support	This includes <ul style="list-style-type: none">• Management• Monitoring• Servicing