Power and Energy Management Solutions

- Plant Load Factor Management with an EMS System at a Power Plant
- Power RTU and Protocol Gateways for Generation, Transmission, Distribution and for Smart Grid Applications
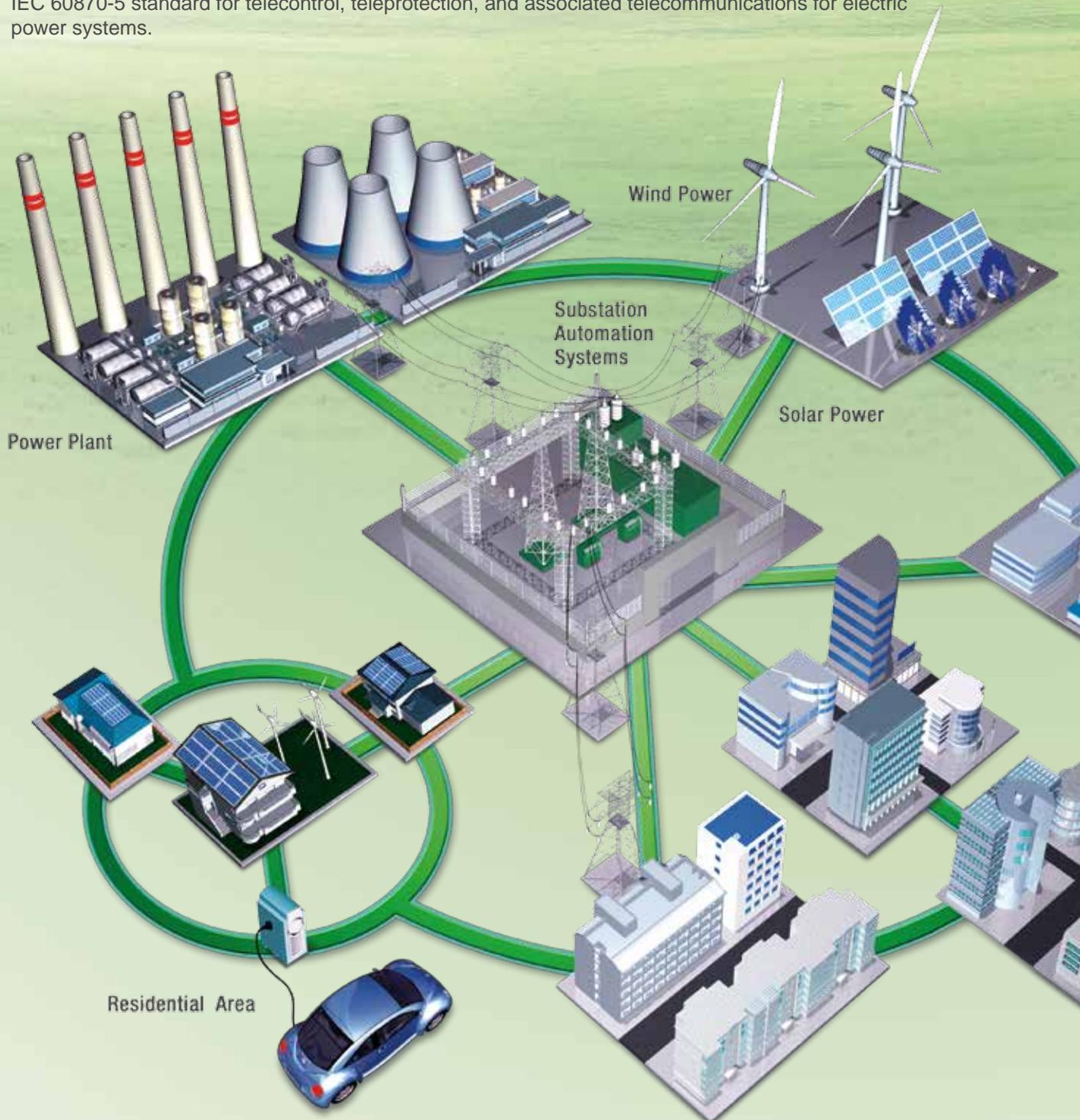
ADVANTECH

Enabling an Intelligent Planet

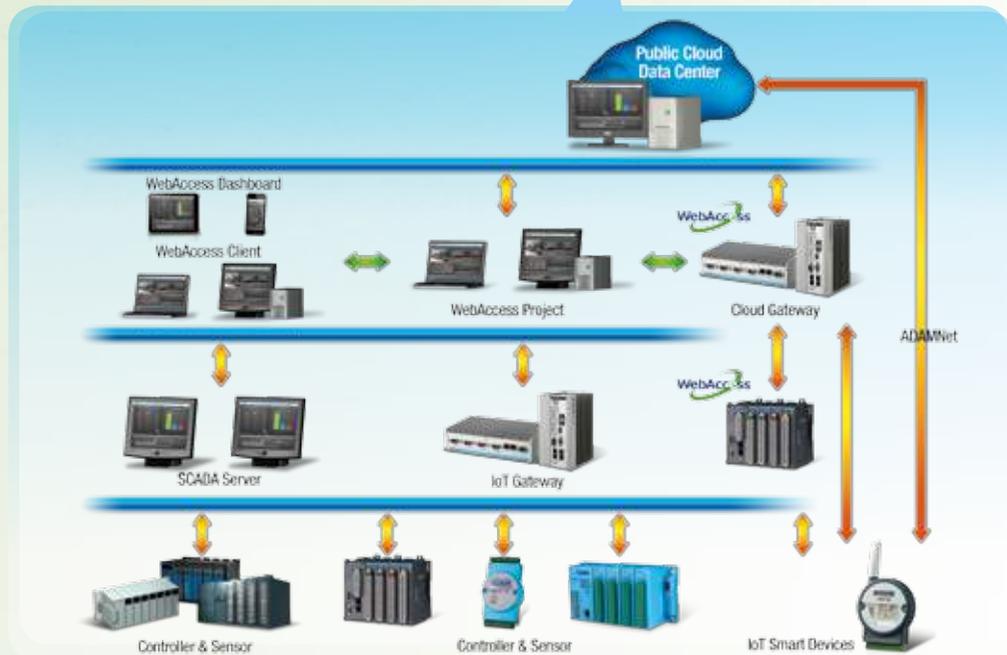WebAccess+ Alliance

waplus.advantech.com

Effective Power Plant Management using Smarter EMS Software and Devices

Power & energy applications are becoming more and more critical as demands for electricity continue to increase worldwide. New challenges are arising due to the limitations of traditional power resources as we try to minimize the impact our power usage has on the environment. To that end, renewable energies, such as wind and solar power are playing more significant roles in modern electricity grids. Furthermore, the modernization of legacy Transmission & Distribution (T&D) systems and providing reliable T&D information for electric power management are becoming key goals for today's power and energy applications.

To optimize the effectiveness of integration from various Distributed Energy Resources (DER) and ensure the interoperability and interconnectivity of control devices with varying proprietary protocols, the IEC 60870-5 standard for telecontrol, teleprotection, and associated telecommunications for electric power systems.

Wind Power

Substation Automation Systems

Solar Power

Power Plant

Residential Area

Advantech WebAccess, an IoT Software Framework for Energy Solutions

Power Grid

Power RTU/ Protocol Gateways

WebAccess

Public Cloud Data Center

WebAccess Dashboard

WebAccess Client

WebAccess Project

Cloud Gateway

ADAMNet

SCADA Server

IoT Gateway

Controller & Sensor

Controller & Sensor

IoT Smart Devices

Building Energy Saving Systems

- Cross-browser, Cross-platform Business Intelligence Dashboard
- Advanced SCADA Functions: Alarm, Schedule and Real-time database
- Supports ample drivers, including Advantech I/O, controllers and major PLCs
- Supports web-enabled video, audio and animation embedded in WebAccess software
- Supports custom report format by Excel Report integration
- Provides open interfaces - Web Services, Widget Interfaces and WebAccess APIs
- Distributed SCADA architecture with central database server and multi-layer interoperable SCADA nodes

| 100% Web-based | Redundancy | Supports Ample Protocols and Drivers | HTML5 Dashboard | Alarms |

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Plant Load Factor Management with an EMS System at a Power Plant

Introduction

Energy Management System (EMS) adds Plant Load Factor (PLF) for Capacity Monitoring

The concept of an EMS system is to read power data from each feeder and centralize the same data on a global display system. Since the concept and requirements of power utilization is changing drastically throughout the industry, proper power utilization is required. Advantech's proposal is to provide a system that achieves greater importing of the PLF.

• Monitoring power generation to distribute the flow of power online. It also provides runtime power status indicators
• Signal alarms at the consumer end when they are not performing scheduled load / low conditions
• Analysis and prediction for engineers to act upon
• Reports are generated when the recommended load fails and provides the reason for the loss of production
• The PLF System is a part of the predictive load management system which can allocate load based on the smooth operating load of the consumers. The system checks the load runtime and then ensures smooth load management and pushes the extra load to create full capacity.

What is Plant Load Factor (PLF) ?

Plant Load Factor (PLF) is a measure of average capacity utilization. It is a measure of the output of a power plant compared to the maximum output it could produce.

The two most common definitions are:
• The ratio of average load to capacity
• The ratio of average load to peak load in a period

Assuming the first definition, a higher load factor is better:
• A power plant may be less efficient at low load factors
• A high load factor means fixed costs which are spread over more kWh of output
• A high load factor means greater total output

Therefore a higher load factor usually means more outputs and a lower cost per unit, which means an electricity generator can sell more electricity at a higher spark spread.

EMS used by Advantech WebAccess

Value of System Integration

Before System Integration:

- No data availability for node
- Difficult to shut down
- Production loss can not be traced
- Load schedule utilization was not possible
- Alarms and control were not possible
- Poor PLF

After System Integration:

- Data is available throughout the network to the management and users
- Analysis is possible to understand the needs
- Improved PLF
- Production loss traced and analyzed
- Load schedule utilization is now possible
- Alarm and control is now possible
- Monitoring the smooth operating range of consumer as per top load %, mid-load %, low load % and downtime
- Daily load variation report with reasoning by both utility and power division
- Monthly load variation reports due to not utilizing power as per the load schedule utilization
- Reports sent when there's a failure to follow the recommended load
- Auto bill generation
- EMS dashboard

System Diagram

FPM-2170G
17" SXGA Industrial Monitor

ADAM-5560
7-slot PC-based Controller with Intel® Atom™ CPU

ADAM-5051D
16-ch Digital Input Module
Breaker Status
Transformer Status

ADAM-5056D
16-ch Digital Output Module
Power Feeder Breaker ON
Power Feeder Breaker OFF

ADAM-5017
8-ch Analog Input Module
MW Transducer:4-20 mA(Output)
VOLTAGE Transducer:4-20 mA(Output)
Frequency Transducer:4-20 mA(Output)
Power FactorTransducer:4-20 mA(Output)
Transformer Tap Position Indicator

ADAM-5081
Analogue Outputs
4-ch High Speed Counter/
Frequency Module

Power RTU and Protocol Gateways for Generation, Transmission, Distribution and for Smart Grid Applications
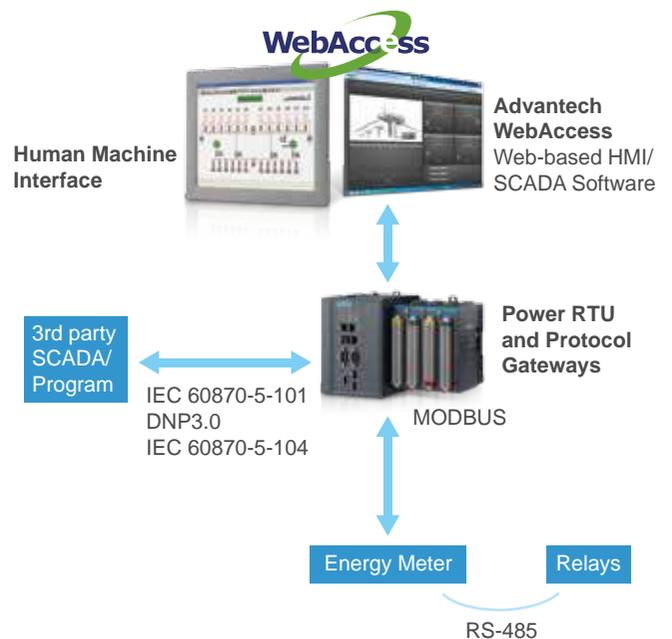

Introduction

The solution needed to monitor single and three-phase power measurements at a number of remote sites. The RTU captures power data from generation and exports units to grid through lease line modem / PLCC over IEC protocol. Any related data in power systems like MW, MVA, MVAR, Hz, Ampere, Volt, power factor, breaker status etc. can be available through the industry accepted power protocol.

- Communicates with existing SCADA systems in the domain of power and energy standards
- User-friendly configuration tools
- Used in many Smart Grid applications

Communication Media

- Optical Fiber
- PLCC
- Leased Line
- Radio Link
- GPRS

System Diagram

- **Human Machine Interface**
- **Advantech WebAccess** Web-based HMI/ SCADA Software
- 3rd party SCADA/ Program
- **Power RTU and Protocol Gateways**
- IEC 60870-5-101 DNP3.0 IEC 60870-5-104
- MODBUS
- Energy Meter
- Relays
- RS-485

IEC 60870-5-101

IEC 60870-5-101 [IEC101] is a standard for power system monitoring, control & associated communications for telecontrol, teleprotection, and associated telecommunications for electric power systems

- Link address and ASDU (Application Service Data Unit) addresses are provided for classifying the end station and different segments under the same
- Data is classified into different information objects and each information object is provided with a specific address
- Cyclic & spontaneous data updating schemes are provided.
- Facility for time synchronization

IEC 60870-5-104

IEC 60870-5-104 (IEC 104) protocol is an extension of IEC 101 protocol with the changes in transport, network, link & physical layer services to suit the complete network access.

- The standard uses an open TCP/IP interface to have connectivity to the LAN.
- Application layer of IEC 104 is preserved in the same way as IEC 101 with some of the data types and facilities not used
- There are two separate link layers defined in the standard, which is suitable for data transfer over Ethernet & serial ports.

Power RTU capable of performing the following functions:

- Designed around an open ended distributed processing configuration consisting of main processor, peripheral I/O modules, termination panels, power supplies & communication equipment/interface
- Collecting, processing and transmitting status changes, accumulated values and analog values
- Time resolution for time tagged events and function to time synchronization
- Receives and processes digital and analog commands from the master station(s)
- Accepts polling messages from the master station(s)
- Supports multi-tasking, to enable RTUs to concurrently scan input status, whilst executing application program or reporting functions
- Switching of channels if dual data communication channel is available
- Multiple communication protocol libraries available, including IEC870-5-101,104, DNP3 etc. It also contains protocols of different kinds of relays and intelligent energy meters. These protocols can be modified according to the user's needs.

Case Studies

We've already implemented a lot of power RTU cases, these are two ideal applications:
- In Orissa Power Transmission Corporation Limited (A Government of India Enterprise), their power protocol is IEC 60870-5-101. They chose the APAX-6572 as power RTU to transmit substation data to grid through PLCC (Power Line Career Communication).
- In Calcutta Electric Supply Corporation, their power protocol is IEC 60870-5-104. They chose and installed an APAX-6572 protocol gateway to transmit substation data to grid through OFC.

DNP 3.0

Defines a transport function (somewhat similar to the function of layer 4) and an application layer (layer 7) that defines functions and generic data types suitable for common SCADA applications.
- It makes heavy use of cyclic redundancy check codes to detect errors.
- The Remote Terminal Unit monitors data points and generates events when it determines that the data should be reported
- These events are each placed in one of three buffers, associated with "Classes" 1, 2 and 3. In addition to these, Class 0 is defined as the "static" or current status of the monitored data.
- The Remote Terminal Unit is initially interrogated with what DNP3 terms an "Integrity Poll" (a combined Read of Class 1, 2, 3 and 0 data).
- This causes the Remote Terminal Unit to send all buffered events and also all static point data to the Master station. Following this, the Master polls for the event data by reading Class 1, Class 2 or Class 3.

Intelligent Power Plant Management Solution

The solution is designed for efficient plant load factor management with reliable automation hardware and EMS software. It includes highly flexible and scalable DIN-rail PC controllers, reliable RS-232 serial device server and smart HMI/ SCADA software - WebAccess as a EMS software framework.

The EMS software can produce plenty of reports inclusive of quality energy audit, power flow information reports, UI based flow reports, energy consumption reports , down time reports, trip reports etc. The HMI of the systems can be displayed at many network nodes and worked within the local intranet and internet. The system also generates SMS for any fault condition of the plant or any abnormality of the power system.

Intelligent Power Plant Management		
Software System	• EMS for distributed power plants monitoring and power generation management • PLF for capacity monitoring • Power plant operation monitoring	
Solution Package		
Advantech WebAccess	Web-based HMI/ SCADA Software	• View, control and configure system remotely over an intranet or the Internet using standard web browser • Remote engineering and support with WebAccess Cloud Architecture • Business Intelligence Dashboard - cross-browser, cross-platform WebAccess • Supports open standard programming: TCL, JScript and VB script • Open real-time data connectivity: OPC, Modbus, BACnet, DDE Server • Google Maps and GPS location tracking integration
RSC-305-EMS	EMS-Plant Load Factor Management Software	• This is mathematical modelling software which works internally with WebAccess for EMS-Plant Load Factor Management.
ADAM-5560WA	7-slot DIN-rail PC Controller with Intel® Atom™ CPU	• Integrated VGA port for locally displaying HMI software • Can be operated with or without display/ keyboard/ mouse • Remote monitoring through Web Server • Remote maintenance via FTP Server • Supports .NET class library in Windows CE and XP embedded • Supports IEC-61131-3 SoftLogic Control Software
ADAM-5510	PC-based Programmable Controller	• Control flexibility with C programming • Complete set of I/O modules • Built-in 512 KB flash and 256 KB SRAM • Built-in real-time clock and watchdog timer • ROM-DOS operating system • 4 x I/O slot extensions
ADAM-4571L	1-port RS-232 Serial Device Server	• Supports RS-232 serial communication • Provides 10/100 Mbps auto-sensing Ethernet port • Supports baud rate up to 921.6 kbps • Provides COM port redirection (Virtual COM) mode

Intelligent Power RTU and Protocol Gateway

To accurately capture and transmit power data from generation, transmission and distribution to energy saving applications. The power RTU and protocol gateway play key roles in the smart grid applications. The ideal RTU and protocol gateway applications capture power data from generation and export units and send the data to the grid through lease line modem/ PLC over IEC protocol. With a user-friendly configuration tool, it is easy to define protocol settings, such as IEC-101, IEC-104, DNP 3.0. Each power RTU and protocol gateway can be monitored and measured at a number of remote sites by using the WebAccess, a software framework for power and energy solutions.

Intelligent Power Plant Management		
Software System		• Communicates with any existing SCADA system in the domain of power and energy standards • User friendly protocol configuration tools • Supports abundant communication protocols, including IEC870-5-101,104, DNP3 etc.
Key Capabilities		• DNP, IEC 60870-101, 104, Modbus interfaces • Client data mapping for electrical substation monitoring • Compliant with electric power standards for EMC and voltage isolation • Distributed architecture
Solution Package		
Advantech WebAccess	Web-based HMI/SCADA Software	• View, control and configure system remotely over an intranet or the Internet using a standard web browser • Mobile client supports for iOS and Android • Supports open standard programming: TCL, JScript and VB script • Open real-time data connectivity: OPC, Modbus, BACnet, DDE Server
RSK-PGA-800	User Friendly Configuration tool	• User Friendly Configuration tool is used to define Protocols setting (IEC-101, IEC-104, DNP 3.0) proper way in the Power RTU
APAX-6572	Intel® Atom™ D510 1.66 GHz, 2 GB RAM Controller with 3 x LAN, 2 x COM, VGA	• High performance controller with a scalable architecture to support versatile application needs • Adopts APAX I/O Modules, APAX-5040PE , APAX-5017 DI and AI data transmitted along with other data in modbus, such as multi function meter etc. converting into power protocols like IEC-101, IEC-104, DNP 3.0
PME-1230	3-phase Multifunction Power Meter	• Including MFM (Multi Function Meter) for getting data as well as DI status like transformer position, breaker on/off information and AI status like MW, MVA, power factor etc. for transmitting data

Choose Advantech as Your Best Partner

Founded more than thirty years ago, Advantech has become an intelligent service industry leader, and has offices around the world. Through close cooperation with a vertical field of systems integrators, Advantech provides a wider range of applications in each industry, and comprehensive smart city and Internet of Things (IoT) solutions in order to facilitate a convenient and smart life.

Advantech's mission is to continue to drive the earth to become more intelligent, to drive innovation of smart city, to build the model IoT industry, to assist industries to accelerate intelligence operations to become the most influential global businesses of smart city and Internet of Things (IoT).

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Smart city solutions

Advantech's five major smart city solutions make the system able to fully utilize Internet of Things (IoT) architecture for comprehensive sensing, reliable communications, and intelligent processing. These solutions provide a more intelligent experience to the public, business, and government, improving the overall quality and image of a city.

Digital Retail and Hospitality	Intelligent Hospital	Digital Logistics and Fleet Management
• Ustore Manager • iCloud Solution • In-Store Management • Central Control and Cloud Management • Restaurant Management	• Integrated Operating Room • Quality Nursing Care • Intelligent Outpatient Services	• Logistics & Warehousing Management System • Fleet Management System

Why Advantech

Designing specific solutions according to industry characteristics

In order to offer the market new value-added services, and to meet the needs of as it moves from "product" to "services", Advantech provides innovative SRPs (Solution Ready Packages) for various professional industries. Advantech also provides application solutions for industry-specific hardware and more intelligent services to its customers, allowing customers to focus on their work, and make application integration easier.

Perfect cloud integration solutions

Advantech has been cultivating various industries for many years, understanding the purposes and needs of users, and providing appropriate hardware and software to match solutions. With particular emphasis on the product development of cloud-based architecture in recent years, WebAccess[+], a new industrial cloud software, provides comprehensive evolution of intelligent remote detection management service that instantly detects and accurately grasps the system state.

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Model Corporate Citizen

Advantech is committed to being a model corporate citizen by helping to preserve the environment and by giving back to society. Our environmental program focuses on reducing, reusing, and recycling materials used in our manufacturing operations. Advantech's environmental compliance effort includes the following:

• ISO 9001 Certification
• ISO 14001 Certification
• ISO 13485 Certification
• OHSAS 18001 Certification
• TL9000 Quality Management System
• RoHS Directive Compliance
• WEEE Directive Compliance
• Authorized Sony Green Partner

After Service

Product Warranty
When the basic product warranty expires, users can buy warranty extensions. We provide a full-service to customers to lower maintenance costs.

Professional Installation
All new settings are tested by Advantech's professional team and we offer optional installation and integration services. After installation, we set the management and operation via the internet immediately, providing real-time information.

Complete Training
With a total training solution which including multimedia player software with user demonstrations and hands-on experience system maintenance staff can learn to operate their system in no time.

Intelligent Building and Urban Space Management	Intelligent Agricultural and Environmental Protection
• Intelligent Space Management • Intelligent Building Energy Management System • Urban Space Management • Transportation Control System	• Intelligent Environmental Protection • Intelligent Agriculture • Intelligent Water Affairs • Intelligent Plant Equipment Monitoring • Oil and Gas • Power and Energy

WebAccess⁺ Alliance

ADVANTECH WebAccess/NMS
ADVANTECH WebAccess+IMM
ADVANTECH WebAccess+IVS
ADVANTECH WebAccess/SCADA

Industry-Leading Quality Assurance
Advantech is a global embedded computing researcher, developer, and manufacturer, providing various industries a variety of industrial PCs, touch screen, data acquisition modules, and other products. With stable quality assurance, Advantech products can not only be used in inside, but also outside in harsh environments. With the support of Advantech industrial computers, Advantech provides intelligent and stable project planning to industries.

Customer-oriented Support
Advantech 's complete technical and repair support provides a variety of customizable after-sales services, including extended warranty, advance replacement, upgrade, fast repair and so on. With hotline AE 24/7 technical support, we keep you investment at peak performance and within your budget.

WebAccess+
Alliance

One for All · All for One

WebAccess/SCADA
Smart HMI/SCADA Software
- 100% browser-based HMI/SCADA software
- Easy to connect and control a variety of IoT Devices
- Supports a variety of mobile devices and browsers

WebAccess+IVS
Intelligent Video Software
- Intelligent Video Platform
- Intelligent Video Analytics Modules
- Modulized SDK ready for software integration

WebAccess+IMM
Interative Multimedia Software
- Digital Signage Management Platform
- Intelligent Programming Platform
- Supports Industries and Application Scenarios

WebAccess/NMS
Network Management Software
- Network Equipment Management and Monitor
- Integration of Network Topology
- Location Identification for Wide Area Deployment

Advantech invites system integrator partners to join the WebAccess+
Alliance to jointly develop the Internet of Things (IoT) and create business opportunities

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WebAccess+ Alliance Partner

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