Advantech Energy Automation Solutions
Robust Products for a Variety of Energy Applications

- Smart Substation Solutions
- Solar Energy Solutions
- Wind Power Solutions
- Advantech Energy Automation Products

www.advantech.com/eA

Enabling an Intelligent Planet
Advantech is dedicated to exploring new technologies for the power and energy industry. With an edge in the research and design of industrial products, Advantech provides rugged and highly reliable system components that are not only environmentally friendly, but also power efficient with control technology enabled by intelligent software. Advantech’s products can be applied to various power and energy markets, including: renewable solar and wind power generation, nuclear simulation, substation automation systems, electrical car charging station solutions, and building energy saving systems.

On the other hand, power & energy applications are becoming more and more critical as demand for electricity continues to increase worldwide. Additionally, 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. Thus, Advantech’s power & energy solutions will focus on renewable energy generation and substation automation system development.

Introduction

Founded in 1983, Advantech is a leader in providing trusted innovative embedded & automation products and solutions. Advantech offers comprehensive system integration, hardware, software, customer-centric design services, and global logistics support; all backed by industry-leading front and back office e-business solutions. We cooperate closely with our partners to help provide complete solutions for a wide array of applications across a diverse range of industries. Advantech has always been an innovator in the development and manufacturing of high-quality, high-performance computing platforms, and our mission is to empower these innovations by offering trustworthy automation products and services. With Advantech, there is no limit to the applications and innovations our products make possible.

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- Energy Automation Product Selection Guide P. 9 & P. 10
Advantech provides IEC 61850 certified solutions for Smart Substations. Its UNO-4600 series Substation Automation Computers can operate as HMI/SCADA, Terminal (serial-port) Servers, Protocol or Communication Gateways, Cyber Security Servers (UTM), and Substation/Networking Records. With IEC 61850 certification for EMC, Shock and Vibration standards, and 90 ~ 220 V AC power supply, the modular UNO-4600 series are able to communicate with different devices across substations and serve as excellent computing platforms. The UNO-4600 series also come with diverse communication interfaces and flexible expansion capabilities, including Ethernet ports with LAN redundant teaming functionality, USB ports, COM ports, PCIe expansion slots, and substation domain I/O modules - UNOP series, etc. Thus, according to their application needs, customers can choose the most suitable platform and easily develop their own substation solutions.

### Product Range

- **UNO-4671A**
  - IEC 61850/3- IEEE 1613 Certified Intel® AtomTM D510 Substation Computer with 6 x LAN, 10 x COM, and 1 x PCI-104
  - Supports 2 x isolated RS-232 and 8 x isolated RS-232/422/485
  - Supports 8 x 10/100Base-T RJ-45 ports, 2 x 10/100SC Multi-Mode, and 4 x 10/100 SC Multi-Mode Smart LAN
  - Ordering Information UNO-4671A-A2E

- **UNO-4672I (UNO-4672/P154)**
  - Intel® Core™ Duo LV Substation Network Recorder/Analyzer with Smart LAN
  - Supports 2 x isolated RS-232 and 8 x isolated RS-232/422/485
  - Supports 2 x 10/100/1000Base-T RJ-45 ports, 2 x 10/100SC Multi-Mode, and 4 x 10/100 SC Multi-Mode Smart LAN
  - Ordering Information UNO-4672I-DE

- **UNO-4673A/4683**
  - IEC 61850-3/ IEEE 1613 Certified Substation Computers with 6 x LAN, 2 x COM, and 3 x Expansion Slots
  - Supports Intel® Atom™ D510, 1.86 GHz CPU
  - Supports fiber optics, RS-232, LAN, and COM
  - Supports PCI, Mini PCI, and PCI-104 expansion cards
  - Ordering Information UNO-4673A-A3E

- **UNO-P154**
  - 4-ch Fiber Smart LAN Network Data Acquisition Card for UNO-4672/4673
  - Supports 4 x LAN 100 Base-FX and 4 x Smart LAN 100 Base-FX (SC type Multi-mode)
  - Supports 1-ch Fiber SFP-RGB interface (ST Multi-Mode 850 nm)
  - Supports 1-ch SFP-4S5 RIG-B interface
  - Ordering Information UNO-P154-AE

- **UNO-1000I**
  - Expansion Card for Standard PCI and Mini PClE
  - Supports 2 x COM (DB9) and 2 x USB 2.0
  - Ordering Information UNO-1000I-AE

- **UNO-1000J**
  - Expansion Card for Standard PCI-104 and Mini PClEs
  - Ordering Information UNO-1000J-AE

- **UNOP-1000**
  - 4-port Isolated RS-232/422/485 with IRIG-B for UNO-4673A/4683
  - Ordering Information UNOP-1000-AE

- **UNOP-1514C**
  - 4-port Fiber Optic LAN Card for UNO-4673A/4683
  - Supports 4 x 100 Base-FX, 4 x 1000 Base-FX (SC type Multi-mode)
  - Supports 4-port Fiber Optic LAN (ST Multi-Mode 850 nm)
  - Supports 4-synchronous time stamp
  - Ordering Information UNOP-1514C-AE

- **UNOP-1624D**
  - 4-port Isolated RS-232/422/485 with IRIG-B for UNO-4673A/4683
  - Ordering Information UNOP-1624D-AE

- **UNOP-1618D/1628D**
  - 8-port Isolated RS-232/422/485 with/without Port-to-port Isolation
  - Ordering Information UNOP-1618D/1628D-AE

### System Description & Requirements

#### HMI/SCADA Application in Substation

- **Working status of devices within cabinet is controlled and monitored via HMI/SCADA, besides information and event trigger collection, time synchronization, such as IRIG-B function is also implemented in the automation controller.**

#### Application Requirements

- **Reliable IEC 61850-3 platform**
- **Redundancy**

#### Cyber Security for Smart Grid

- **Communication within smart substations is based on network connection, and so is connection between smart substations. Hence, the cyber security to ensure smart substation maintenance becomes more critical than before.**
  - The UTM (Unified Threat Management) is the key to preventing hacker attacks.

#### Application Requirements

- **Reliable IEC 61850-3 platform**
- **High-speed computing & packet acquisition**
- **Synchronized time stamp**
- **Data storage**

#### Data Gateway for IEC 61850

- **Within a substation, there are lots of devices using a wide variety of protocols.**
- **Status and information of devices need to be monitored and controlled reliably; hence, a reliable automation controller plays such an important data protocol gateway, communication server and IED analyzer at a substation.**

#### Application Requirements

- **Reliable IEC 61850-3 platform**
- **Isolated COM port**
- **IRIG-B Time Synchronization receiver**
- **Fiber optic LAN**

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**To view more product information, please refer to P. 9 & 10 selection guides.**
There are three different levels in Smart Substation architecture: Station Level, Bay Level and Process Level. For the functionality in smart substations, there are control, protection, monitoring and communication levels. A variety of devices are used in smart substations, including controllers, RTUs, protection devices and communication gateways etc.

Station Level Device Application

There are four main applications in Station Level of a Smart Substation:

1. **Cyber Security in Smart Substation**
   - Cyber Security and Unified Threat Management (UTM) are important to ensure connection reliability among substations and prevent attacks from hackers. Advantech's IEC 61850-3 certified platform, the UNO-4683, with the UNOP-1514C fiber LAN module offer a total solution for cyber security applications at smart substations.

2. **Environment Status Monitoring**
   - For environmental monitoring devices in station level, Advantech offers IEC 61850-3 certified distributed controller and I/O modules, APAX-5020PE series, which include APAX-5032PE controller, APAX-5071PE analog module, APAX-5040PE digital I/O module, and APAX-5058PE relay input module. APAX-5020PE series are used to monitor temperature, humidity, current and other status of devices. They can also integrate IP cameras and UPS systems for the security management.

Product Ordering Information

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
<th>CPU</th>
<th>IEC 61850-3 certify</th>
</tr>
</thead>
<tbody>
<tr>
<td>APAX-5020PE</td>
<td>32-bit Analog Module</td>
<td>Intel® Atom® N2800</td>
<td>Yes</td>
</tr>
<tr>
<td>APAX-5032PE</td>
<td>32-bit Analog Module</td>
<td>Intel® Atom® N2800</td>
<td>Yes</td>
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<td>APAX-5040PE</td>
<td>32-bit Analog Module</td>
<td>Intel® Atom® N2800</td>
<td>Yes</td>
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<tr>
<td>APAX-5058PE</td>
<td>32-bit Analog Module</td>
<td>Intel® Atom® N2800</td>
<td>Yes</td>
</tr>
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* To view more product information, please refer to P. 9 & 10 selection guides.

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Remote Control Station

UNO-4600 series could be used in Remote Distribution Substation control center or Regional Smart Substation as well. With rich and flexible communication ports and IRIG-B, UNO-4600 series can be used to respond to real-time data. IRIG time decode could more accurately record time information to facilitate data analysis.

UNO-4673A, with the UNOP-1514C fiber LAN module offer a total solution for cyber security applications at smart substations.

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**Solar Tracking System**

In Advantech’s solar tracking solution, the ADAM-4117 measures the input voltage signals from the sunlight transmitter to detect the direction of the strongest sunlight. The sunlight information is then sent to the PEC-3240, an Intel® Celeron® M Embedded Motion Controller, which can control the stepper motors of the sun tracking system and easily adjust the solar plates to the correct direction of the strongest sunlight. If two transmissions detect different sunlight strengths, the PEC-3240 will calculate the sunlight strength difference to adjust the stepper motors and find the optimal position of the solar cells. Combined with the ADAM-4117, the PEC-3240 with 4-axis motion control and 32-channel isolated digital I/O enables the solar tracking systems to continuously track the relative data and optimize the efficiency of solar cell modules.

**Solar Power Monitoring System Solution**

Solar Power Plant management requires fast sampling, recording and analysis of data such as sunlight strength and overall direct current power. Average energy conversion efficiency of solar cell modules and power conversion becomes also important. Advantech provides two solutions to fulfill solar power monitoring applications:

**Solution 1: APAX series**

Advantech’s Distributed Computers, APAX series, serves as efficient power controllers due to their outstanding performance in monitoring, recording, control, storage, and remote maintenance functionality. The APAX-5620 is a low-power consumption controller, which serves as a communication and master controller. The APAX-5020 I/O series with a variety of I/O modules, are used to collect weather, sunlight information, temperature sensors, thermal overload, etc.

**Solution 2: UNO series + ADAM-4000 series**

Advantech’s Open Embedded Controllers, compact and fanless UNO-1000 series, can serve as communication controllers and protocol converters. Also, Advantech offers Data acquisition modules and power converters are also important. Advantech provides two solutions to fulfill solar power monitoring:

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**Product Ordering Information**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>APAX-5020</td>
<td>APAX-5020 I/O Series with variety of I/O modules</td>
</tr>
<tr>
<td>APAX-5017</td>
<td>APAX-5017 12-ch Analog Input Module</td>
</tr>
<tr>
<td>APAX-5040</td>
<td>APAX-5040 24-ch Digital Input Module</td>
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**Wind Tower Management**

**Wind Power Turbine Gearbox Vibration Monitoring System Solution**

The vibration signals of a wind turbine gearbox contain a wide range of data, which can be used to detect defects within the gearbox. With ECU-1801 Energy Controller, ECU-1300 vibration signal modulation card, and ECU-1040 simultaneous analog input card, Advantech provides an ideal solution for Wind Power Turbine Gearbox Vibration Monitoring Systems. With a reliable Ethernet communication port, the analysis of data can be transferred to the remote management center in real time.

**Wind Power Box-type Transformer Monitoring System Solution**

Box-type substations in a wind power plant integrate the generated power into a power grid. Like traditional substation monitoring systems, the status of the transformer must be monitored in real time. Advantech Energy remote I/O modules, DMU-3015/5010, monitor the status of the various parts of the transformer i.e. oil temperatures, voltage, current, and transfer the data to the remote control center via Ethernet.

**Product Ordering Information**

<table>
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<tr>
<th>Model</th>
<th>Description</th>
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<tr>
<td>ECU-1801</td>
<td>ECU-1801 Energy Controller with 2 x LAN, 3 x COM, IRIG-B, and I/O Extension</td>
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<tr>
<td>ECU-1040</td>
<td>ECU-1040 simultaneous analog input card</td>
</tr>
<tr>
<td>DMU-3015</td>
<td>DMU-3015 Oil Temperature Monitoring Module</td>
</tr>
</tbody>
</table>

**Wind Farm Management**

**Wind Farm Management Solution**

Wind Farm Management system includes the Message Management, Communication Management, and Power Generation Management. Advantech’s wind farm management solution, the Wind Power Management System (WPMS), is based on Advantech WebAccess, the web browser-based HMI/SCADA software. With WPMS, multiple wind farms can be remotely managed and maintained. It can also provide remote fault maintenance and early detection of problems to reduce maintenance costs. WPMS enhances power generation efficiency and enables real-time monitoring. Along with Advantech’s EVO series Ethernet Switches, UNO-4600 series Substation Computers, TPC-1070H and UNO-1170A Embedded Controllers, Advantech provides a total solution to fullfil wind farm management application.

**Product Ordering Information**

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<th>Description</th>
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<tr>
<td>ECO-1000</td>
<td>ECO-1000 Energy Controller with 2 x LAN, 3 x COM, IRIG-B, and I/O Extension</td>
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<tr>
<td>ECO-1010</td>
<td>ECO-1010 In-Line Vibration Signal Module Card</td>
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<tr>
<td>DMU-3015</td>
<td>DMU-3015 Oil Temperature Monitoring Module</td>
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**System Description & Requirements**

To view more product information, please refer to P. 9 & 10 selection guides.
### Energy Controllers

<table>
<thead>
<tr>
<th>Model Name</th>
<th>UNO-4671A</th>
<th>UNO-4671B (APAX-5040PE)</th>
<th>UNO-4673A/4683</th>
<th>ECU-1801A</th>
<th>ECU-1911</th>
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<tbody>
<tr>
<td>CPU</td>
<td>Intel Atom D510, 1.66 GHz</td>
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<td>Intel Atom D510, 1.66 GHz</td>
<td>Intel Core i5-2520M, 2.5 GHz</td>
<td>Intel Atom D510, 1.66 GHz</td>
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<td>2 GB DDR3 SDRAM</td>
<td>2 GB DDR3 SDRAM</td>
<td>2 GB DDR3 SDRAM</td>
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<tr>
<td>Dimensions</td>
<td>113 x 86 x 34.4 mm (6.9 x 3.4 x 1.4 in)</td>
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<td>220 x 150 x 89 mm (8.7 x 5.9 x 3.5 in)</td>
<td>266 x 146 x 45 mm (10.5 x 5.7 x 1.8 in)</td>
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<td>Weight</td>
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### PAC Controller

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<tr>
<td>CPU</td>
<td>XScale PXA270 520 MHz</td>
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<td>Memory</td>
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<td>Cooling System</td>
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<td>Power Input</td>
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<td>Diagnostics LED</td>
<td>Power, Energy, Run, Error</td>
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<td>Real-time Clock</td>
<td>Yes</td>
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<td>Control Software</td>
<td>C/C++ and library and NET class library for C and NET environments, Softlogic programming tool</td>
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<td>USB Ports</td>
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<td>Analog I/O Points</td>
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<td>Operating Temperature</td>
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<td>Memory</td>
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<td>Storage</td>
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<td>Operating Systems</td>
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<tr>
<td>Local Real-time I/O Modules</td>
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<tr>
<td>Digital I/O Points</td>
<td>768 (max.)</td>
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<td>Power Consumption</td>
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<tr>
<td>Operating Temperature</td>
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<td>Operating Systems</td>
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<tr>
<td>Local Real-time I/O Modules</td>
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<td>Operating Temperature</td>
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<tr>
<td>Memory</td>
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<td>Storage</td>
<td>1 x SD slot</td>
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<td>Operating Systems</td>
<td>-</td>
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<td>Local Real-time I/O Modules</td>
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<td>Operating Temperature</td>
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### Analog Input Module

<table>
<thead>
<tr>
<th>Model Name</th>
<th>APAX-5107PE</th>
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<tbody>
<tr>
<td>Description</td>
<td>12-ch AI Module</td>
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<td>Analog Input</td>
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<td>Input Type*</td>
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<td>Sampling Rate</td>
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<tr>
<td>Power Input</td>
<td>18 ~ 30 Vdc</td>
</tr>
<tr>
<td>PC/104 Expansion</td>
<td>PC/104</td>
</tr>
<tr>
<td>Power Input</td>
<td>18 ~ 30 Vdc</td>
</tr>
<tr>
<td>Input Accuracy</td>
<td>±0.1% of full range (current)</td>
</tr>
<tr>
<td>Voltage Input</td>
<td>4.095 V, 4.095 V, ±500 mV, ±5 V, ±10 V</td>
</tr>
<tr>
<td>Control Software</td>
<td>C/C++ and library and NET class library for C and NET environments, Softlogic programming tool</td>
</tr>
<tr>
<td>Onboard I/O</td>
<td>-</td>
</tr>
<tr>
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### Digital Input/Output Modules

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<tr>
<th>Model Name</th>
<th>APAX-5160S/3/IEEE 1613</th>
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<tbody>
<tr>
<td>Description</td>
<td>24-ch DI Module</td>
</tr>
<tr>
<td>Digital Input</td>
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<td>DI Channels</td>
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<tr>
<td>Analog Input</td>
<td>-</td>
</tr>
<tr>
<td>Input Type*</td>
<td>Sink or Source Input</td>
</tr>
<tr>
<td>Voltage Input</td>
<td>-</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>0 ~ 5 Vdc</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>-5 ~ 5 Vdc</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>15 ~ 30 Vdc</td>
</tr>
<tr>
<td>Rated Input Current</td>
<td>4.4 mA (max)</td>
</tr>
<tr>
<td>Rated Input Current</td>
<td>0.5 A</td>
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<tr>
<td>Over Voltage Protection</td>
<td>-</td>
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<td>General</td>
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* Each channel can be configured with different type and range.
** Sampling rate value depends on used channel number.