ADAM-6000 and ADAM-6200 Series

Intelligent Ethernet I/O Modules

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Software and Industry Solutions

2
Industrial Server

3
Intelligent System

4
Intelligent HMI and Monitors

5
Automation Computers and Controllers

6
Industrial Communication

7
Remote I/O & Wireless Sensing Modules

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Industrial I/O and Video Solutions

Transition and Vision for Remote DAQ Devices

IT and network infrastructure have become established technologies. In the future, there are will be many potentially key elements such as artificial intelligence, energy-efficiency, cloud computing, cyber-security, and mobile communication technologies being progressively leveraged in automation markets. We believe that these will also contribute to ideal remote data acquisition devices in IoT world.

To fulfill the transition requirements and future applications, Advantech has developed the ADAM-6000/6200 series of Ethernet I/O modules, comprising analog I/O, digital I/O, and relay modules. ADAM-6000/6200 series modules possess a multitude of advanced features that can cope with changes in hardware design and user expectations regarding useful software functions for applications in the field. With a new design and strong capabilities, ADAM-6000/6200 series modules can provide a well-integrated I/O solution for Ethernet control systems.

Major Functionality Comparison

		ADAM-6000	ADAM-6200
Daisy-chain with auto-bypass		-	✓
GCL		✓	✓
Peer-to-peer		✓	✓
Web server (HTML5)		✓	✓
Configuration backup		✓	✓
Access control		✓	✓
Protocol Support	Modbus/TCP	✓	✓
	MQTT	✓	✓
	SNMP	✓	✓
	RESTful	✓	✓

Flexible Deployment with Daisy Chain Networking and Auto-Bypass Protection

ADAM-6200 modules have built-in Ethernet switches to allow daisy chain connections in an Ethernet network, making it easier to deploy, saving on wiring costs, and helping to improve scalability. The two Ethernet ports are fully compliant with IEEE 802.3u 10/100 Mbps via standard RJ-45 connectors.

Although the daisy chain topology brings cost-saving benefits for users, it still comes with the risk that once any device in the chain suffers a power outage, it will cause the disconnection of all devices data stream.

Auto-Bypass Protection

To prevent this critical issue from happening, Advantech has refined the hardware design of ADAM-6200 modules so that they can rapidly recover the network connection within approximately 2.5 s, thereby greatly minimizing any potential damage.

Remote Monitoring and Control with Smart Portable Devices

At the early stage of automation, it was difficult to access or obtain online equipment data when conducting on-site inspections. Mostly, the only possible way to do this was by communicating with engineers on the factory floor or in a central control room where the SCADA program was running. With these factors considered, on-site inspections and debugging were invariably arduous tasks that took considerable effort to complete.

Overcoming this, the ADAM-6200 series of modules integrates HTML5, allowing users to remotely monitor the status of all online modules without bridging a SCADA system. These modules also allow users to perform basic I/O configuration on any built-in HMI device such as a smartphone or digital pad via the Internet. Moreover, users can further develop extended applications based on the default HTML5 file embedded in the module.

With its enhanced syntax structure and integration of rich web technologies such as CSS and JavaScript, the now widely used markup language HTML5 has enhanced the design of web content. This is particularly beneficial for ADAM module users because it allows them to implement more web services and APIs and to develop more interactive applications for configuring and monitoring their hardware.

ADAM-6000 GCL is the Simplest Logic Ethernet I/O

▪ **What is GCL?**

Graphic Condition Logic (GCL) gives controllability to Ethernet I/O modules. Users can define control logic rules using the graphic configuration environment in ADAM series modules and download defined logic rules to ADAM-6000/6200 Ethernet I/O modules. The modules will then execute the logic rules automatically, just like a standalone controller. For each Ethernet I/O module, 16 logic rules can be defined. In the configuration environment of Adasm/Apax .NET Utility, four graphic icons show the four stages of one logic rule, referring to the input, logic, execution, and output stages (refer to the image below). Users can simply click on each icon and a dialog window will appear to configure each stage. After completing all configurations, users can simply click a button to download the defined logic rules to their module.
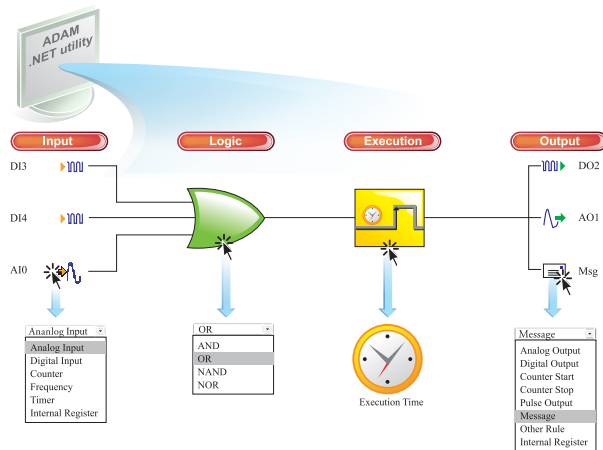
▪ **Supports Both Local and Remote Output**

When users define the destination of the output stage (e.g., digital output, analog output, counter, and pulse output), the target module can be set as either the local module or another remote module, thus giving the ability to develop complex logic rules.

Local Output   Remote Output
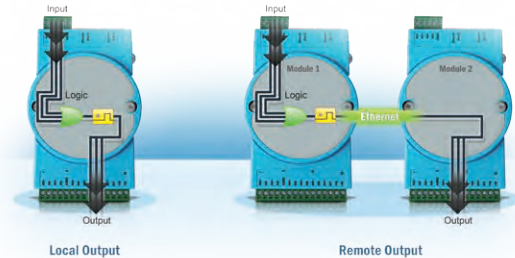
▪ **Fast Execution Time**

Advantech GCL features the shortest logic rule execution time on the market. When a local output is selected (i.e., the input and output channels are on the same module), the processing time (including an hardware input delay time, logic rule, execution time, and hardware output delay time) is <1 ms. When a remote output is selected (i.e., the input and output channels are on different modules), the total processing time (including processing and communication time) is <3 ms.

▪ **Sending Messages**

In GCL, you can define customized message. When the specified conditions are met, the message, module IP, and I/O status will be sent to the PC or device you define.

What Benefits Do Peer-to-Peer Modules Provide?

What is Peer-to-Peer?

Unlike client /server mode, peer-to-peer mode enabled modules to actively update their input channel status to a specific output channel. For this, a pair of modules is used: one input module and one output module. Users can define the mapping between them and the input value of one module will be transferred to the output channel of the other module.

No Controller Required

For Ethernet I/O modules without peer-to-peer functionality, a controller is needed to read data from the input module and then send the data to the output module. With peer-to-peer solutions, the controller can be removed since data will be automatically transferred. This not only simplifies the process but also helps save on system hardware costs.

No Programming Required

To utilize peer-to-peer modules, the only thing required is to configure the settings using Adam/Apax .NET Utility. Because no additional programming effort is needed, this greatly reduces system development time.
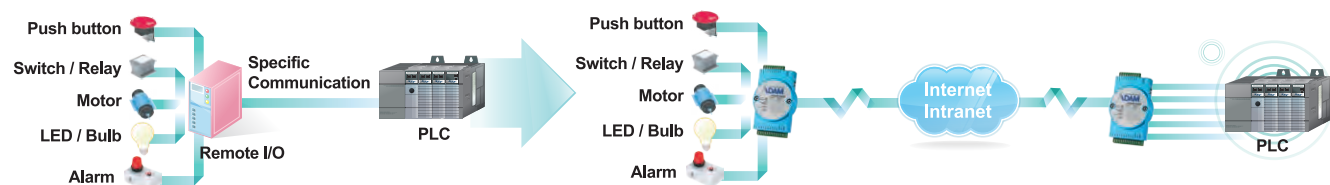
Fast Response Time

Advantech peer-to-peer modules offer the best execution times on the market; specifically, the execution time to transfer data from input to output is <1.2 ms.

Advanced Security

When peer-to-peer modules are employed, it is critical that they not be controlled by unauthorized computers or devices. ADAM-6000 series peer-to-peer modules allow users to decide which IP or MAC address has control authority. This can make ensure that output modules are controlled only by their paired input modules.
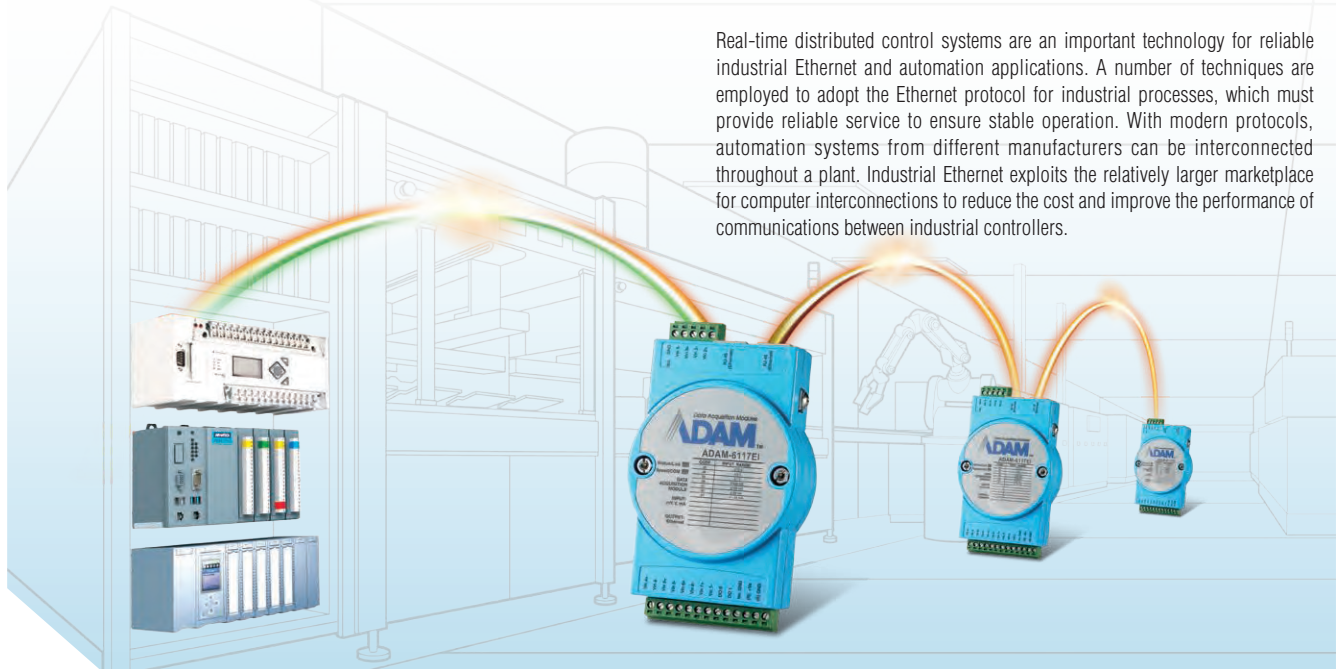
Simple and Flexible System Wiring

Long-distance wiring can introduce difficulties into any project. For some automation applications, if the PLC and the sensors are far away, a remote I/O module needs to be located near the sensors and a proprietary communication network needs to connect the PLC and the remote I/O module. However, with this setup, communication will be severely limited. Moreover, networks provided by PLC manufacturers are rarely open networks. Peer-to-peer modules can replace limited and closed networks with no limitations since they leverage the most open and flexible Ethernet networks.

ADAM-6100 Series
EtherNet/IP and Profinet I/O Modules

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Real-time distributed control systems are an important technology for reliable industrial Ethernet and automation applications. A number of techniques are employed to adopt the Ethernet protocol for industrial processes, which must provide reliable service to ensure stable operation. With modern protocols, automation systems from different manufacturers can be interconnected throughout a plant. Industrial Ethernet exploits the relatively larger marketplace for computer interconnections to reduce the cost and improve the performance of communications between industrial controllers.
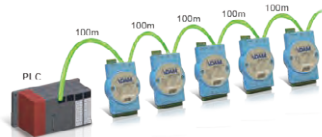
Real-Time Systems

A real-time system is one in which the correctness of a result depends not only on precise calculations but also on accurate timing. In computing, "real time" refers to a time frame that is very brief, to the point that it is virtually instantaneous. When a computer processes data in real time, it reads and handles data as it is received, producing results without any delay. A non-real-time computer process does not have a deadline. Such processes can be considered non-real-time—even if fast results are the preferred outcome. A real-time system, on the other hand, is expected to respond not just quickly, but also within a predictable period of time. In automation control systems, real-time technology provides multiple advantages, such as improved safety, quality, and efficiency. To build a real-time distributed control system, it is critical to establish reliable real-time communication among the controllers; accordingly, there is now increasing interest in the use of Ethernet protocols as the link-layer protocol, such as EtherNet/IP, PROFINET, EtherCAT, Ethernet PowerLink, SERCOS III.

EtherNet/IP

EtherNet/IP was developed in the late 1990s by Rockwell Automation for use in process control and other industrial automation applications, ensuring multi-vendor system interoperability. EtherNet/IP is a lot like standard office Ethernet, using the same TCP/IP messaging but with a new application layer added where data are arranged. This is known as object-orientated organization, which allows ordinary office Ethernet to become a markedly more versatile system. Today, EtherNet/IP is commonly used in industrial automation applications such as water processing, manufacturing, and utilities.

Profinet

PROFINET, the standard for industrial networking in automation, connects devices, systems, and cells to facilitate manufacturing that is faster, safer, less costly, and of higher quality. As it is fully compatible with office Ethernet, it can be easily integrated with existing systems and equipment while bringing enhanced features such as real-time performance and control as well as monitoring functions. Additionally, PROFINET features highly scalable architectures, remote access and maintenance of field devices over the network, and lower production/quality data monitoring costs.

Feature Highlights

Daisy Chain Connections

ADAM-6100 modules have two built-in Ethernet switches to allow daisy chain connections in an Ethernet network, making it easier to deploy while improving scalability and resistance against interference commonly found in factory settings.

2,500 V_{DC} Isolation Protection

With triple isolation, including power supply, I/O, and Ethernet communication, ADAM-6100 series modules ensure that I/O data are controlled correctly while preventing devices from breaking down.

Ethernet-Based Configuration Tool

Adam/Apax .NET Utility comes bundled with each ADAM-6100 module. With this utility, users can configure, set, and test ADAM-6100 modules via Ethernet.

Multiple Mounting Options

Advantech provides various mounting methods to fit the varying needs of different projects in the field. ADAM-6100 series modules support DIN rail mounting, wall mounting, and piggybacking.

ADAM-6000 Series Selection Guide

Spec. \\ Model	ADAM-6015	ADAM-6017	ADAM-6018	ADAM-6022	ADAM-6024
Interface	10/100 Mbps Ethernet				
Peer-to-Peer[1]		✓		-	Receiver Only[2]
GCL[1]		✓		-	Receiver Only[2]
Resolution		16 bit		16-bit for analog inputs 12-bit for analog outputs	16-bit for analog inputs 12-bit for analog outputs
Analog Input — Channels	7	8	8	6	6
Analog Input — Sampling Rate	10 Hz				
Analog Input — Voltage Input	-	±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, 0 ~ 150 mV, 0 ~ 500 mV, 0 ~ 1 V, 0 ~ 5 V, 0 ~ 10 V	-	±10 V	±10 V
Analog Input — Current Input	-	0 ~ 20, 4 ~ 20, ±20 mA	-	0 ~ 20, 4 ~ 20 mA	0 ~ 20, 4 ~ 20 mA
Analog Input — Direct Sensor Input	Pt, Balco, and Ni RTD	-	J, K, T, E, R, S, B thermocouple	-	-
Analog Input — Burnout Detection	✓	✓ (4 ~ 20mA only)	✓	-	-
Analog Input — Math. Functions	Max. Min. Avg.	Max. Min. Avg.	Max. Min. Avg.	-	-
Analog Output — Channels	-	-	-	2	2
Analog Output — Current Output	-	-	-	0 ~ 20, 4 ~ 20 mA @ 15 V$_{DC}$	0 ~ 20, 4 ~ 20 mA @ 15 V$_{DC}$
Analog Output — Voltage Output	- -	-	-	0 ~ 10 V$_{DC}$ @ 30 mA	0 ~ 10 V$_{DC}$ @ 30 mA
Digital I/O — Input Channels	-	-	-	2	2
Digital I/O — Output Channels	-	2 (sink)	8 (sink)	2 (sink)	2 (sink)
Digital I/O — Extra Counter Channels	-	-	-	-	-
Digital I/O — Counter Input	-	-	-	-	-
Digital I/O — Frequency Input	-	-	-	-	-
Digital I/O — Pulse Output	-	-	-	-	-
Digital I/O — High/Low Alarm Settings	✓	✓	✓	-	-
Isolation Protection	2,000 V$_{DC}$			2,000 V$_{DC}$[3]	2,000 V$_{DC}$[3]
Remark	-	-	-	Built-in dual loop PID control algorithm	-

Spec. \\ Model	ADAM-6050	ADAM-6051	ADAM-6052	ADAM-6060	ADAM-6066
Interface	10/100 Mbps Ethernet				
Peer-to-Peer[1]	✓	✓	✓	✓	✓
GCL[1]	✓	✓	✓	✓	✓
Digital I/O — Input Channels	12	12	8	6	6
Digital I/O — Output Channels	6 (sink)	2 (sink)	8 (source)	6-ch relay	6-ch power relay
Digital I/O — Extra Counter Channels	-	2	-	-	-
Digital I/O — Counter Input	3 kHz	4.5 kHz	3 kHz	3 kHz	3 kHz
Digital I/O — Frequency Input	3 kHz	4.5 kHz	3 kHz	3 kHz	3 kHz
Digital I/O — Pulse Output	✓	✓	✓	✓	✓
Digital I/O — High/Low Alarm Settings	-	-	-	-	-
Isolation Protection	2,000 V$_{DC}$				

ADAM-6200 Series Selection Guide

	Model	ADAM-6217	ADAM-6224	ADAM-6250	ADAM-6251	ADAM-6256	ADAM-6260	ADAM-6266
	Interface	10/100Mbps Ethernet						
	Peer-to-Peer[1]	✓	Receiver Only[2]	✓	✓	✓	✓	✓
	GCL[1]	✓	✓	✓	✓	✓	✓	✓
Analog Input	Channels	8	-	-	-	-	-	-
	Input Impedance	>10MΩ (voltage) 120Ω (current)	-	-	-	-	-	-
	Voltage Input	±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V	-	-	-	-	-	-
	Current Input	0 ~ 20, 4 ~ 20, ±20 mA	-	-	-	-	-	-
	Sampling Rate	10 Hz	-	-	-	-	-	-
	Direct Sensor Input	-	-	-	-	-	-	-
	Burnout Detection	✓ (4 ~ 20 mA)	-	-	-	-	-	-
	Resolution	16-bit	-	-	-	-	-	-
	Accuracy	±0.1% of FSR (voltage) @ 25°C ±0.2% of FSR (current) @ 25°C	-	-	-	-	-	-
Analog Output	Channels	-	4	-	-	-	-	-
	Voltage Output	-	0 ~ 5, 0 ~ 10, ±5, ±10 V	-	-	-	-	-
	Current Output	-	0 ~ 20, 4 ~ 20 mA	-	-	-	-	-
	Resolution	-	12-bit	-	-	-	-	-
Digital I/O	Input Channels	-	4 (dry contact only)	8	16	-	-	4
	Output Channels	-	-	7 (sink)	-	16 (sink)	-	-
	Relay Output	-	-	-	-	-	6 (5 Form C + 1 Form A)	4 (Form C)
	Contact Rating	-	-	-	-	-	250 V$_{AC}$ @ 5A 30 V$_{DC}$ @ 5A	
	Counter Input	-	-	3 kHz	3 kHz	-	-	3 kHz
	Frequency Input	-	-	3 kHz	3 kHz	-	-	3 kHz
	Pulse Output	-	-	5 kHz	-	5 kHz	5 kHz	5 kHz
	LED Indicator	-	-	8 digital outputs, 7 digital inputs	16 digital inputs	16 digital outputs	6 relay	4 digital inputs, 4 relay
	Power Consumption	3.5 W	6 W	3 W	2.7 W	3.2 W	4.5 W	4.2 W
	Isolation Voltage	2,500 V$_{DC}$						
	Watchdog Timer	System (1.6 s) Communication (programmable)						
	Communication Protocol	Modbus TCP, TCP/IP, UDP, HTTP, DHCP, MQTT, SNMP						
	Power Requirements	10 ~ 30 V$_{DC}$ (24 V$_{DC}$ standard)						
	Operating Temperature	-10 ~ 70°C (14 ~ 158°F)						
	Storage Temperature	-20 ~ 80°C (-4 ~ 176°F)						
	Operating Humidity	20 ~ 95% RH (non-condensing)						
	Storage Humidity	0 ~ 95% RH (non-condensing)						

Note 1: Peer-to-peer and GCL cannot be run simultaneously; only one feature can be enabled at a time.
Note 2: The ADAM-6224 can only act as a receiver and generate analog output when peer-to-peer or GCL mode is used.

ADAM-6100 Series Selection Guide

Model		ADAM-6117	ADAM-6150	ADAM-6151	ADAM-6156	ADAM-6160
Interface		10/100 Mbps Ethernet				
Support Protocol		ADAM-6100EI: EtherNet/IP ADAM-6100PN: Profinet				
Analog Input	Resolution	16-bit	-	-	-	-
	Channels	8	-	-	-	-
	Sampling Rate	10 Hz	-	-	-	-
	Voltage Input	±150 mV ±500 mV ±1 V ±5 V ±10 V	-	-	-	-
	Current Input	0 ~ 20, 4 ~ 20, ±20 mA	-	-	-	-
	Direct Sensor Input	-	-	-	-	-
Analog Output	Resolution	-	-	-	-	-
	Channels	-	-	-	-	-
	Current Output	-	-	-	-	-
	Voltage Output	-	-	-	-	-
Digital I/O	Input Channels	-	8	16	-	-
	Output Channels	-	7	-	16	6-ch power relay
Isolation Protection		2,500 V$_{DC}$	2,500 V$_{DC}$	2,500 V$_{DC}$	2,500 V$_{DC}$	2,500 V$_{DC}$
Connectors		2 x RJ-45 LAN (daisy chain) Plug-in screw terminal block (I/O and power)				