11

EtherCAT Solutions and Automation Controllers

EtherCAT I/O Solution and Automation Controller Overview

Introduction

EtherCAT is a high-performance field network able to connect drive devices, intelligent sensors and I/O devices using Ethernet technologies, and is now a popular fieldbus in automation. Advantech, to fulfill real-time I/O demands for smart factories and equipment manufacturers, launched EtherCAT I/O product series, AMAX-4800 and AMAX-5000. They each have different form factors, but use the same Advantech mature I/O technology and standard EtherCAT for each single IO module.

Real-time I/O for Industrial 4.0

Industrial 4.0 will create a big demand for integrating IT and OT (Operation Technology: traditional automation technology). To bridge IT and OT, data needs to be aggregated from the field site. Following current trends, the data type and data volume from the field will go through exponential growth, therefore traditional SCADA systems with standard I/O will become overwhelmed trying to handle complex and time sensitive tasks. In the meantime, Ethernet-based Real-time I/O solutions have became price-acceptable in the market.

Controllers with time-deterministic responses and low cycle-times not only provide a very good solution for the executing device, but they also reduce the huge effort required for integrators to handle all data communication.

APAX-5000 with EtherIO

APAX-5000 is the first generation of real-time I/O systems in Advantech. It has hot swappable and high density I/O features, and is a competitive solution for facility and factory monitoring applications. APAX-5000 I/O system can be attached to general embedded systems, and can easily enable an embedded system to deliver 1ms real-time capability for maximum 768 I/O points.

AMAX-4800/AMAX-5000 with EtherCAT

AMAX-4800 series is a pioneer of EtherCAT I/O in Advantech. It features high volume I/O with good C/P ratio and user friendly designs. If a customer faces the challenge of limited space, AMAX-5000 series offers flexibility for future I/O expansion. It has an EtherCAT modularized slice I/O architecture in a very compact and slim form factor. And the easy slide-in design reserves space for extra expansion capability for future customer demands.

AMAX-5580, Controller IPC with EtherCAT Slice I/O Expansion

The trend in IPC is for smaller and more powerful applications. AMAX-5580 is an IPC designed for automation users. Its fanless design provides high reliability and its compact size facilitates installation in space limited cabinets. Its front-accessible design provides easy for installation and maintenance. AMAX-5580 is not only reliable and user friendly, but it also enhances I/O scalability. It offers I/O expansion through its EtherCAT slice I/O interface on the right hand side. One the other side, it can be expanded for GigE / PoE / USB 3.0 / Serial / CAN / Wireless interfaces. Its high flexibility makes it a perfect embedded automation platform that can fulfill most of requirements for smart factory solutions.

Advantech CODESYS

CODESYS is a well-known control software based on the international standard IEC-61131-3 softlogic. Through the embedded CODESYS RTE, Advantech IPC have the capability to handle EtherCAT real-time I/O, provide PLC-like logic control, and offer HMI in the factory or remote site. Advantech supports all kinds of CODESYS runtimes, including RTE, SoftMotion, and CNC/Robotics, which are based on the Windows Embedded 7/10 OS. To bridge IT and OT, Advantech has also developed many plugin packages, including the WISE-EdgeLink support, ODBC Database Direct Connection, MQTT, and Data Connect for 3rd party integration or customer interface development.

These functions help establish upstream communication and assist easy Industry 4.0 application deployment.

AMAX-5580 Controller IPC

- Intel 6th Generation CORE i CPU, i7/ i5/ Celeron
- DDR4 4G/8G Memory (Max capability 32G)
- Internal expansion slot for PCIe-mini card / M.2 / USB 2.0
- HDMI + VGA Dual Display
- 4 x USB3.0, 2 x GbE, 2 x RS-232/422/485
- Windows Embedded 7/10 Support
- Dual Power Input and Hardware monitoring
- CE/FCC/UL Certification

Advantech CODESYS Softlogic

- Follows IEC-61131-3 / PLCopen International Standard
- Supports RTE / Softmotion and CNC/Robotics
- CNC G-Code & M-Code Support
- Target Visualization and Web Visualization for HMI on near site and remote site
- ODBC Database Direct Connection
- Fieldbus Support : EtherCAT Master, CANopen, Ethenet/IP Master, Profinet Master
- Upstream Communication : Modbus / OPC DA / OPC UA / MQTT
- API/SDK for Development : Data Connect

AMAX-5400 PCIe Expansion Module

- Supports Max 4 slots, and support PCIex4 for first slot
- Auto Board ID configuration for software identification
- Full-bandwidth USB3.0 for vision application
- Multiple interface : USB3.0, PoE /GigE, RS-232/422/485, CAN, Wireless
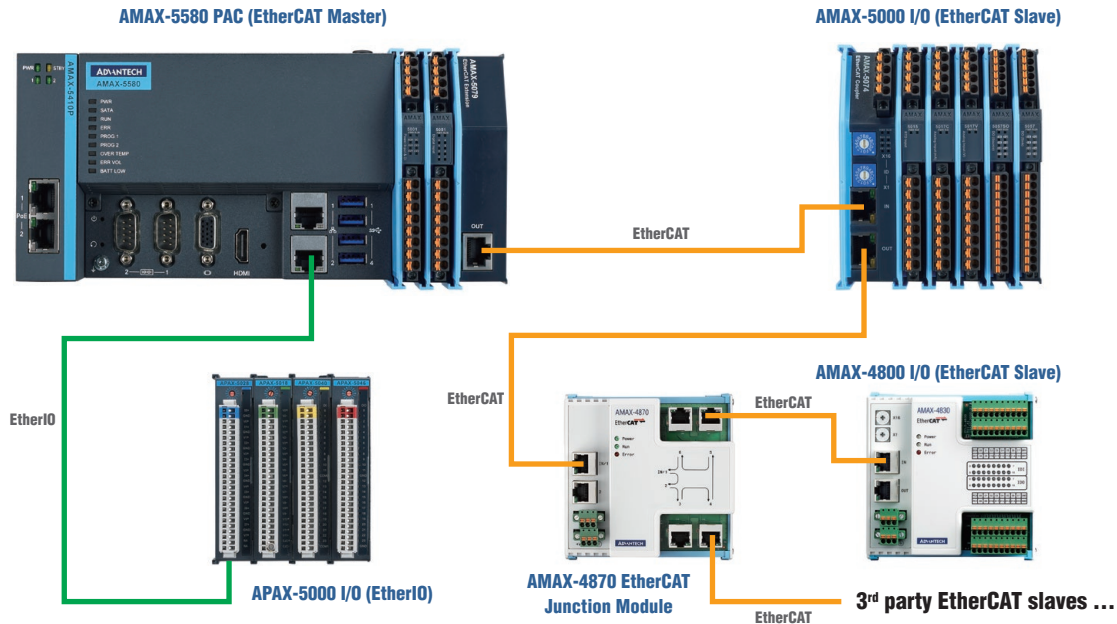- AMAX-5400E with PCI-mini +SIM card slot for cellular Networking

AMAX-5000 EtherCAT Slice I/O Module

- Standard EtherCAT slave
- Compact design and easy for slide-in
- Removable push-in terminal
- Supports centralized and decentralized I/O topology
- Supports multi-range for one module
- Sample rate 100S/s per channel for Analogue Input
- LED indicator for status check
- Wide operation temperature from -25~60 °C

APAX-5000 System

AMAX-5580 PAC (EtherCAT Master)   **AMAX-5000 I/O (EtherCAT Slave)**

EtherCAT

EtherIO

EtherCAT

AMAX-4800 I/O (EtherCAT Slave)

EtherCAT

APAX-5000 I/O (EtherIO)

AMAX-4870 EtherCAT Junction Module

3rd party EtherCAT slaves …

EtherCAT

AMAX-5580 series:

EtherCAT Master Controller

- **AMAX-5580** Intel® Core™ i7/i5/Celeron® Control IPC (Selectable CODESYS ready solution)

AMAX-5000 series:

EtherCAT Slave I/O

- **AMAX-5001** EtherCAT power module
- **AMAX-501X** EtherCAT AI module
- **AMAX-502X** EtherCAT AO module
- **AMAX-505X** EtherCAT DIO module
- **AMAX-508X** EtherCAT counter /encoder module

- **AMAX-5074** EtherCAT coupler module
- **AMAX-5079** EtherCAT extension module

AMAX-4800 series:

EtherCAT Slave I/O

- **AMAX-4870** EtherCAT junction module
- **AMAX-486X** EtherCAT relay output module
- **AMAX-481x** EtherCAT AI module
- **AMAX-482x** EtherCAT AO module
- **AMAX-483x AMAX-485x** EtherCAT DIO module

APAX-5000 series:

I/O Backplane

- **APAX-5001** 1-slot backplane module
- **APAX-5002** 2-slot backplane module

Analog I/O Modules

- **APAX-501X** Analog input modules
- **APAX-502X** Analog output modules

Digital I/O Modules

- **APAX-504X** Digital IO modules
- **APAX-5060** Relay output modules
- **APAX-5080** Counter modules

Remote Serial Modules

- **APAX-5090** 4-port RS-232/422/485 virtual COM with APAX bus (EtherIO)

AMAX-5400 series:

PCIe Expansion module for AMAX-5580 controller

- **AMAX-5400E** PCIe mini card expansion module

- **AMAX-5410** GigE vision frame grabber module
- **AMAX-5410P** PoE vision frame grabber module

- **AMAX-5424V** USB3.0 module

- **AMAX-5490** RS-232/422/485 communication module
- **AMAX-5495** CAN Port Module

EtherCAT Edge Controllers

AMAX-5580 Controller

APAX-5580 Controller

Model	☞ AMAX-5580	☞ APAX-5580
Description (English)	Intel® Core™ i7/i5/Celeron® Control IPC With EtherCAT Slice IO Expansion	Intel® Core™ i7/i5/Celeron® Control IPC With EtherIO Expansion
General		
Certification	CE, FCC, UL	CE, FCC, UL
Dimensions (W x H x D)	139 x 100 x 80 mm	128 x 106 x 110 mm
Form Factor	Passive Cooling and Front Accessible	Passive Cooling and Front Accessible
Power Requirement	24 V_{DC} ± 20%, Dual Power Input with Alarm output	24 V_{DC} ± 20%, Dual Power Input with Alarm output
Power Consumption	15 W (Typical), 42 W (Max)	28 W (Typical), 72 W (Max)
OS Support	Microsoft Windows 7 32/64 bit Microsoft Windows 10 64 bit	Microsoft Windows 7 32/64 bit Microsoft Windows 10 64 bit Linux Kernel 3.X
Sysem Hardware		
BIOS	AMI EFI 128Mbit Flash BIOS	AMI EFI 128Mbit Flash BIOS
Processor	Intel® Core™ i7-6600U 2.6GHz Skylake Dual Core, 4MB L2 Intel® Core™ i5-6300U 2.4GHz Skylake Dual Core, 3MB L2 Intel® Celeron 3955U 2.0GHz Skylake Dual Core, 2MB L2	Intel® Core™ i7-4650U ULT 1.7GHz Haswell Dual Core, 4 MB L2 ntel® Core™ i3-4010U ULT 1.7GHz Haswell Dual Core, 3 MB L2 Intel® Celeron 2980U ULT 1.6GHz Haswell Dual Core, 2 MB L2
Memory	Build in 4G for Celeron, 8G for Core i5/i7	Build in 4 GB for Celeron/i3, 8GB for i7
Retentive Memory	2M MRAM (Option)	2M MRAM (Option)
Ethernet	Intel® i210-IT GbE, 802.1Qav, IEEE1588/802.1AS, 802.3az	Intel® i210-IT GbE, 802.1Qav, IEEE1588/802.1AS, 802.3az
Storage	1x M.2, 2280 M-Key	1 x mSATA, 1 x SD, 1 x SD (for OS backup)
Expansion	AMAX-5400 (PCIe, left side), AMAX-5000 (EtherCAT, right side)	APAX-5402L + APAX-5002 X n, 2x APAX-5400 (PCIe) + APAX-5000 x 32 (max)
I/O Interfaces		
Serial Ports	2 x RS-232/422/485, DB9, 50 ~ 115.2kbps	1 x RS-232/422/485, DB9, 50 ~ 115.2 kbps
LAN Ports	2 x RJ45, 10/100/1000 Mbps IEEE 802.3u 1000BASE-T Fast Ethernet	2 x RJ45, 10/100/1000 Mbps IEEE 802.3u 1000BASE-T Fast Ethernet
USB Ports	4 x USB ports (4 x USB 3.0 compliant) 1 x internal USB	4 x USB ports (2 x USB 2.0, 2 x USB 3.0 compliant), 1 x internal USB
Display	1 x VGA, support up to 1920 x 1200 @ 60 Hz 24 bpp 1 x HDMI, support up to 4096 x 2160 @ 24Hz 24bpp	1 x VGA, supports 1920 X 1080 @ 60 Hz 24 bpp
Grounding Protection	Chassis grounding	Chassis grounding
Environment		
Operating Temperature	-10 ~ 60°C (14 ~ 140°F) @ 5 ~ 85% RH with 0.7m/s airflow	-10 ~ 60°C (14 ~ 140°F) @ 5 ~ 85% RH with 0.7m/s airflow
Storage Temperature	-40 ~ 85°C (-40 ~ 185°F)	-40 ~ 85°C (-40 ~ 185°F)
Relative Humidity	10 ~ 95% RH @ 40°C, non-condensing	10 ~ 95% RH @ 40°C, non-condensing
Shock Protection	Operating, IEC 60068-2-27, 10G, half sine, 11 ms	Operating, IEC 60068-2-27, 50g, half sine, 11 ms
Vibration Protection	Operating, IEC 60068-2-64, 1 Grms, random, 5 ~ 500 Hz, 1hr/axis (M.2)	Operating, IEC 60068-2-64, 2grms, random, 5 ~ 500 Hz, 1 hr/axis (mSATA)
CODESYS Softlogic		
Runtime Support	Pure Logic Control (RTE), P2P Motion (RTE + Softmotion) Advanced Motion (RTE + Softmotion + CNC/Robotics)	
Visualization (HMI) Option	Target Visualization (VGA or HDMI) Web Visualization (Web Browser)	
Fieldbus Support	EtherCAT Master MODBUS/RTU Master (Client) MODBUS/TCP Master (Client) and Slave PROFINET Master ETHERNET/IP Master CANopen	
Advantech Value-added Function	Advantech Direct Database connection (FBD) OPC/DA & OPC/UA Server (supported after SP13) PLCHandle Driver for WebAccess Advantech MQTT Agent Advantech Data Connect (API)	

EtherCAT Edge Controllers-
PCIe Expansion Modules

PCIe Module

Model	☞ AMAX-5400E	☞ AMAX-5410	☞ AMAX-5410P
Description (English)	PCIe mini card expansion module	2-port GigE vision frame grabber module	2-port PoE vision frame grabber module
Communication	**PCI mini card** **Interface:** Full size mini PCI express 2.0 **SIM card slot:** Nano SIM card **Antenna:** 1x SMA hole on the top	**Ethernet** **Compatibility:** IEEE 802.3, IEEE 802.3u, IEEE802.3ab, IEEE802.3x, IEEE802.3af **Speed:** 10/100/1000 Mbps **No. of Ports:** 2 Gigabit Ethernet Media Access Control (MAC) and physical layer (PHY) ports. **Input Voltage:** 24 V_{DC} direct from AMAX-5000 controller	**Ethernet** **Compatibility:** IEEE 802.3, IEEE 802.3u, IEEE802.3ab, IEEE802.3x, IEEE802.3af **Speed:** 10/100/1000 Mbps **No. of Ports:** 2 Gigabit Ethernet Media Access Control (MAC) and physical layer (PHY) ports. **Input Voltage:** 24 V_{DC} direct from AMAX-5000 controller **Output PoE:** Power 48 V_{DC} PoE Power output, 15.4W per port, total Max. 20W
LED Indicator	PWR, Standby		
Enclosure	Aluminum housing		
Interface	PCIe x1		
Power Consumption	0.5W@24V_{DC}		2.5W@24V_{DC}
Isolation Voltage	2,500 V_{DC}		
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)		
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)		
Certification	CE, FCC class A		

Preliminary

Model	☞ AMAX-5424V	☞ AMAX-5490	AMAX-5495
Description (English)	4-port USB3.0 vision frame grabber module	2-port Isolated RS-232/422/485 communication module	2-port CAN module
Communication	**USB 3.0** **Host Bus:** 4-lane Gen 2.0 PCIe interface, compliant with PCI Express Base Specification, Revision 2.0 **Controller:** Host Controller – Fresco FL1100 Compliant with USB 3.0 Specification and Intel® xHCI Specification, Revision 1.0 **Max. current:** 1500 mA maximum per port **Data Transfer Rate:** SuperSpeed (5.0 Gbps); High Speed (480.0 Mbps); Full Speed (12.0 Mbps); Low Speed (1.5 Mbps)	**Serial Communication** **Data Bits:** 5, 6, 7, 8 **Stop Bits:** 1, 1.5, 2 **Parity:** None, even, odd **Baud Rate:** 50 bps ~ 230.4 kbps **Data Signals:** RS-232: TxD, RxD, GND RS-422: Tx+, Tx-, Rx+, RX RS-485: Data+, Data- **FIFO:** 256 bytes **Flow Control:** Xon/Xoff	**CAN** **Protocol:** CAN2.0 AB **Max. Speed:** 1Mbit/s **Signal Support:** CAN_H, CAN_L
LED Indicator	PWR, Standby	PWR, STBY, TX1, RX1, TX2, RX2	
Enclosure	Aluminum housing		
Interface	PCIe x4 (1st. slot on the left side of AMAX-5580)	PCIe x1	
Power Consumption	2.5W@24V_{DC}	2W@24V_{DC}	3W@24V_{DC}
Isolation Voltage	2,500 V_{DC}		
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)		
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)		
Certification	CE, FCC class A		

EtherCAT Slice I/O Modules

Digital I/O

Model	☞ AMAX-5051	AMAX-5052	☞ AMAX-5056	☞ AMAX-5057	☞ AMAX-5056SO	☞ AMAX-5057SO
Description (English)	8-ch DI module	16-ch DI module	8-ch sink type DO module	16-ch sink type DO module	8-ch source type DO module	16-ch source type DO module
Digital Input/ Output — Input Channels	8-ch.	16-ch.	-	-	-	-
Output Channels	-	-	8-ch.	16-ch.	8-ch.	16-ch.
Rating	**Dry Contact** Logic level 1: close to Iso.GND Logic level 0: open **Wet Contact** Rated voltage: 24V_{DC} Logic level 1: 10~30 V_{DC} and -10~-30 V_{DC} Logic level 0: -3~3 V_{DC}		**Rated Voltage** 10~30 V_{DC} **Rated Current Output** Logic level 1: 0.3 A per channel Logic level 0: 25 µA per channel (leakage current)		**Rated Voltage** 10~30 V_{DC} **Rated Current Output** Logic level 1: 0.5 A per channel Logic level 0: 10 µA per channel (leakage current)	
Input / Output Delay	From logic level 0 to 1: 4ms From logic level 1 to 0: 4ms		From logic level 0 to 1: 10us From logic level 1 to 0: 100us		From logic level 0 to 1: 150us From logic level 1 to 0: 2ms	
Digital Filter	3ms		-		-	
LED Indicator	Pwr, Run, Error, DIO status					
Interface	100Mbps EtherCAT					
Power Consumption	2W@24V_{DC}		2.5W@24V_{DC}		2W@24V_{DC}	2.5W@24V_{DC}
Isolation Voltage	2,000 V_{DC}					
Watchdog Timer	System (1.6 seconds)					
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)					
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)					
Certification	CE, FCC class A					

Digital I/O w/ Timestamp

Preliminary   **Preliminary**

Model	AMAX-5051T		AMAX-5056T
Description (English)	8-ch DI module (2-ch w/ timestamp, 6-ch w/o timestamp)		2-ch sink type DO module w/ timestamp
Digital Input/ Output — Input Channels	2-ch. w/ timestamp	6-ch. w/o timestamp	-
Output Channels	-	-	2-ch. w/ timestamp
Rating	**Wet Contact:** Logic level 1: 11~30 V_{DC} Logic level 0: -3~5 V_{DC} (similar to EN 61131-2, type 3)	**Dry Contact:** Logic level 1: Close GND Logic level 0: Open **Wet Contact:** Logic level 1: 11~30 V_{DC} Logic level 0: -3~5 V_{DC} (similar to EN 61131-2, type 3)	**Rated Voltage** 10~30 V_{DC} **Rated Current Output:** Logic level 1: 0.3A per channel Logic level 0: 25 µA per channel (leakage current)
Input / Output Delay	< 0.5us	< 10us	<0.5us
Resolution Timestamp	1ns	N/A	1ns
DI Latch / DO Sync	First Edge & Last Edge DI Latch	N/A	DO Sync.
LED Indicator	Pwr, Run, Error, DI status		Pwr, Run, DO status
Interface	100Mbps EtherCAT		
Power Consumption	2W@24V_{DC}		
Isolation Voltage	2,000 V_{DC}		
Watchdog Timer	System (1.6 seconds)		
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)		
Operating/Storage Humidity	20 ~ 95 % RH (non-condensing) / 5 ~ 95% RH (non-condensing)		
Certification	CE, FCC class A		

Analog I/O

Preliminary
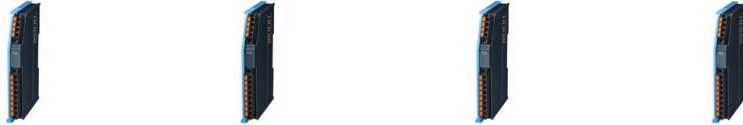
Model	☞ AMAX-5017C	☞ AMAX-5017V	AMAX-5017H	☞ AMAX-5024
Description (English)	6-Ch Current AI Module	6-Ch Voltage AI, multi-gain, 16-bit	4-Ch High speed AI module	4-Ch AO multi-gain, 16-bit
Analog Input — Channels	6-ch.	6-ch.	4-ch.	4-ch.
Input Type	mA	V, mV	V, mA	V, mV, mA
Input Impedance	120Ω	>10M Ω	Differential 800 kΩ, Common-mode 200 kΩ for voltage input Differential 500 Ω, Common-mode 200 kΩ for current input	-
Input / Output Range	±20 mA, 0 ~ 20 mA, 4 ~ 20 mA	±150 mV, ±500 mV, ±1V, ±5 V, ±10 V	±10 V, 0~20mA	0~5V, 0~10V, ±5V, ±10V, 4~20mA, 0~20mA
Resolution	16-bit with ±0.2% FSR accuracy @25°C	16-bit with ±0.1% FSR accuracy @25°C	16-bit with ±0.1% FSR accuracy @25°C	16-bit with ±0.01% FSR accuracy @25°C
Sample Rate	100 sample/s (per channel)		10k sample/s (per channel)	-
Burn-out detection	✓	-	-	-
Slew Rate	-	-	-	Configurable
Drift	-	-	-	± 50 ppm/°C
Current Load Resistor	-	-	-	Max. 500 Ω
Voltage Load Resistor	-	-	-	Min. 1KΩ
LED Indicator	Pwr, Run, Error			
Interface	100Mbps EtherCAT			
Power Consumption	2W@24V_DC		2.5W@24V_DC	3.5W@24V_DC
Isolation Voltage	2,000 V_DC			
Watchdog Timer	System (1.6 seconds)			
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)			
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)			
Certification	CE, FCC class A			

Temperature Module

Model	☞ AMAX-5015	☞ AMAX-5018
Description (English)	4-Ch RTD (2/3 wire)	6-Ch Thermocouple (Open detect)
Analog Input — Channels	4-ch.	6-ch.
Input Type	RTD: 2 or 3 wire	mV, V, T/C: J, K, T, E, R, S, B
Input Impedance	-	>2MΩ
Voltage Range	-	±50 mV, ±100 mV, ±500 mV, ±1 V, ±2.5 V
Temperature Range	**Pt 100 RTD:** Pt -50°C to 150°C Pt 0°C to 100°C Pt 0°C to 200°C Pt 0°C to 400°C Pt -200°C to 200°C IEC RTD 100 ohms (a = 0.00385) JIS RTD 100 ohms (a = 0.00392) **Pt 1000 RTD** -40°C to 160°C **Balco 500 RTD** -30°C to 120°C **Ni 518 RTD** -80°C to 100°C 0°C to 100°C	Type J (-210 ~ 1200° C) Type K (-270 ~ 1372° C) Type T (-270 ~ 400° C) Type E (-270 ~ 1000° C) Type R (0 ~ 1768° C) Type S (0 ~ 1768° C) Type B (300 ~ 1820° C)
Resolution	16 bit with ±0.1% FSR accuracy	
Sample Rate	100 sample/s (per channel)	
Burn-out detection	Yes	-
LED Indicator	Pwr, Run, Error	
Interface	100Mbps EtherCAT	
Power Consumption	2W@24V_DC	
Isolation Voltage	2,000 V_DC	
Watchdog Timer	System (1.6 seconds), Communication (Programmable)	
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)	
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)	
Certification	CE, FCC class A	

EtherCAT Slice I/O Modules

Encoder / Counder Module

Preliminary

Model	☞ AMAX-5080	AMAX-5081
Description (English)	2-Ch Counter/Encoder 32-bit	1-Ch TTL/RS-422 Encoder/Counter
Encoder / Counder Input — Channels	2-ch.	1-ch.
Encoder / Counder Input — Counting Range	32-bits	32-bits
Encoder / Counder Input — Counter Mode	- up/down - bi-direction - up - A/B phase - Quadrature mode - Frequency measurement	- Event counting - Frequency measurement - Pulse width measurement - PWM output - PSO (Position Synchronized Output) - Quadrature mode
Encoder / Counder Input — Signal Input	Logic level 0: 0~5V$_{DC}$ Logic level 1: 11~30V	Single-ended 5V RS-422 differential
Encoder / Counder Input — Sample Rate	1 MHz * 4	10MHz *4
Encoder / Counder Input — Preload FIFO Size	-	1024 (Absolute count or relative count)
LED Indicator	Pwr, Run, Error, A+, A-, B+, B-, Z+, Z-, L+, L-	
Interface	100Mbps EtherCAT	
Power Consumption	2W@24V$_{DC}$	
Isolation Voltage	2,000 V$_{DC}$	
Watchdog Timer	System (1.6 seconds), Communication (Programmable)	
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)	
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)	
Certification	CE, FCC class A	

Infrastructure

Model	☞ AMAX-5001	☞ AMAX-5074	☞ AMAX-5079
Description (English)	Power input modue w/ 4-ch. DI	EtherCAT coupler w/ power input	EtherCAT extension module
Power Input — Rated Voltage	24V$_{DC}$ (± 20%)		-
Power Input — Dual Power Input	Supported		-
Power Input — Max Current on Bus	2A		-
Power Input — Diagnosis Function	Over/under voltage for input 1&2 Over current output on bus		-
Digital Input — Input Channels	4-ch.	-	-
Digital Input — Rating	Wet Contact Rated voltage: 24V$_{DC}$ Logic level 1: 10~30 V$_{DC}$ and -10~-30 V$_{DC}$ Logic level 0: -3~3 V$_{DC}$	-	-
Digital Input — Input Delay	From logic level 0 to 1: 4ms From logic level 1 to 0: 4ms	-	-
Digital Input — Digital Filter	3ms	-	-
EtherCAT Coupler / Extention — Function	-	Coupling EtherCAT IO modules to 100BASETX EtherCAT network	
EtherCAT Coupler / Extention — Cable	-	Ethernet/EtherCAT cable (min. Cat. 5), shielded	
EtherCAT Coupler / Extention — Distance Between Stations	-	Max. 100 m (100BASETX)	
EtherCAT Coupler / Extention — Bus Interface		2 x RJ45 (1 x Input, 1 x Output)	1 x RJ45
LED Indicator	Pwr, Run, Error, Power Diagnosis LED		-
Interface	100Mbps EtherCAT		
Power Consumption	2W@24VDC	2.5W@24V$_{DC}$	No power from bus
Isolation Voltage	2,000 V$_{DC}$		
Watchdog Timer	System (1.6 seconds)		
Operation/Storage Temperature	-25 ~ 60°C (-14~140°F) / -40 ~ 85°C (-40~185°F)		
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)		
Certification	CE, FCC class A		

EtherCAT I/O Modules

Digital I/O

Model	☞ AMAX-4830-AE	☞ AMAX-4830SO-AE	☞ AMAX-4833-AE	☞ AMAX-4834-AE	☞ AMAX-4856-AE
Description	16-ch DI / 16-ch DO module (Sink)	16-ch DI / 16-ch DO module (Source)	32-ch DI module	32-ch DO module (Sink)	32-ch DI / 32-ch DO module (Sink)
Digital Input/Output — Input Channels	16-ch.		32-ch.	-	32-ch.
Digital Input/Output — Output Channels	16-ch.		-	32-ch.	32-ch.
Digital Input/Output — Digital Input	Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$		Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$	-	Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$
Digital Input/Output — Digital Output	Load voltage: 5 ~ 40 V$_{DC}$ Load current: 350mA/ch (sink) @ 25°C 250mA/ch (sink) @ 60°C Opto-isolator Response Time: 100us	Load voltage: 5 ~ 40 V$_{DC}$ Load current: 250mA/ch (sink) @ 25°C 200mA/ch (sink) @ 60°C Opto-isolator Response Time: 100us	-	Load voltage: 5 ~ 40 V$_{DC}$ Load current: 350mA/ch (sink) @ 25°C 250mA/ch (sink) @ 60°C Opto-isolator Response Time: 100us	Load voltage: 5 ~ 40 V$_{DC}$ Load current: 350mA/ch (sink) @ 25°C 250mA/ch (sink) @ 60°C Opto-isolator Response Time: 100us
LED Indicator	Pwr, Run, Error				
Interface	100Mbps EtherCAT				
Power Consumption	Typical 85mA @24V Max. 110mA @24V			Typical 85mA @24V Max. 130mA @24V	
Isolation Voltage	2,500 V$_{DC}$ (IO)				
Operation/Storage Temperature	-20 ~ 60°C (32~140°F) / -40 ~ 70°C (-40~158°F)				
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)				
Certification	CE, FCC class A				

Analog I/O

Model		☞ AMAX-4817-AE	☞ AMAX-4820-AE
Description		8-ch, 16-bit AI module	4-ch, 16-bit AO module
Analog Input — Channels		8-ch.	4-ch.
Analog Input — Input Type		V	V, mA
Analog Input — Input Impedance		120Ω	-
Analog Input — Input / Output Range		0~10 V, ±10 V	Voltage: 0~5 V, 0~10 V, ±5 V, ±10 V Current: 0~20 mA, 4~20 mA
Analog Input — Common-Mode Voltage Range		±275 V	-
Analog Input — Resolution		16-bit with ±0.1% FSR accuracy @25°C	16-bit with ±0.1% FSR accuracy @25°C
Analog Input — Sample Rate		10k sample/s (per channel)	
Analog Input — Current Load Resistor		-	< 625 Ω
Analog Input — Voltage Load Resistor		-	> 1 kΩ
LED Indicator		Pwr, Run, Error	
Interface		100Mbps EtherCAT	
Power Consumption		Typical 160 mA @24 V; Max.190 mA @24 V	
Isolation Voltage		2,500 V$_{DC}$ (IO)	
Operation/Storage Temperature		-20 ~ 60°C (32~140°F) / -40 ~ 70°C (-40~158°F)	
Operating/Storage Humidity		5 ~ 95% RH (non-condensing)	
Certification		CE, FCC class A	

EtherCAT I/O Modules

Digital Input + Relay Output

Model	☞ AMAX-4850-AE	☞ AMAX-4860-AE	☞ AMAX-4855-AE	☞ AMAX-4862-AE
Description	16-ch DI / 8-ch PhotoMOS module	8-ch DI & 8-ch Relay module	32-ch DI / 16-ch PhotoMOS module	16-ch DI / 16-ch Relay module
Digital Input/ Relay Output — Input Channels	16-ch.	8-ch.	32-ch.	16-ch.
Digital Input/ Relay Output — PhotoMOS Relay Channels	8-ch.	-	16-ch.	-
Digital Input/ Relay Output — Relay Channels	-	8-ch.	-	16-ch.
Digital Input/ Relay Output — Digital Input	Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$	Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$	Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$	Input Voltage: Logic 0: 3V$_{DC}$ max. Logic 1: 10~30 V$_{DC}$
Digital Input/ Relay Output — Relay Output	Relay type: PhotoMOS SPST(Form A) Load Voltage: 60V (AC peak or DC) Load current: 1.2A Peak load current: 4A @100ms(1 pulse) Isolation protection: 1,500 V$_{DC}$ Turn-on time: 1 ms typical Turn-off time: 0.6 ms typical	Relay type: Form A Contact Rating (resistive): 2A@250V$_{AC}$, 2A@30V$_{DC}$ Max. Switching Power: 500VA, 60W Max. Switching Voltage: 270V$_{AC}$, 125V$_{DC}$ Resistance: 30mΩ max. Operating Time: Max. 10ms Releasing Time: Max. 5ms Life Expectancy: Mechanical 2 x 107 ops. at no load. Electrical 3 x 104 ops. @2A/250V$_{AC}$	Relay type: PhotoMOS SPST(Form A) Load Voltage: 60V (AC peak or DC) Load current: 1.2A Peak load current: 4A @100ms(1 pulse) Isolation protection: 1,500 V$_{DC}$ Turn-on time: 1 ms typical Turn-off time: 0.6 ms typical	Relay type: Form A Contact Rating (resistive): 2A@250V$_{AC}$, 2A@30V$_{DC}$ Max. Switching Power: 500VA, 60W Max. Switching Voltage: 270V$_{AC}$, 125V$_{DC}$ Resistance: 30mΩ max. Operating Time: Max. 10ms Releasing Time: Max. 5ms Life Expectancy: Mechanical 2 x 107 ops. at no load. Electrical 3 x 104 ops. @2A/250V$_{AC}$
LED Indicator	Pwr, Run, Error			
Interface	100Mbps EtherCAT			
Power Consumption	Typical 85mA @24V Max. 110mA @24V		Typical 85mA @24V Max. 130mA @24V	
Isolation Voltage	1,500 V$_{DC}$ (PhotoMOS Relay) / 2,500 V$_{DC}$ (IO)			
Operation/Storage Temperature	-20 ~ 60°C (32~140°F) / -40 ~ 70°C (-40~158°F)			
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)			
Certification	CE, FCC class A			

Infrastructure

Model	☞ AMAX-4870-AE
Description	6-port EtherCAT junction module
EtherCAT Junction — Ports	In: 1 port Out: 5 ports
EtherCAT Junction — Cable	Ethernet CAT 5E
LED Indicator	Pwr, Run, Error
Interface	100Mbps EtherCAT
Power Consumption	Typical 140 mA @24 V; Max.190 mA @24 V
Operation/Storage Temperature	-20 ~ 60°C (32~140°F) / -40 ~ 70°C (-40~158°F)
Operating/Storage Humidity	5 ~ 95% RH (non-condensing)
Certification	CE, FCC class A

EtherIO I/O Modules

APAX Communication Module

Model	☞ APAX-5070
Description	Modbus/TCP communication coupler
General Dimensions (W x H x D)	30 x 139 x 100 mm
Power Consumption	2 W @ 5 V$_{DC}$ (typical)
Connectors	2 x RJ-45 (2-ch switch, shared IP address)
Communications Protocols	Modbus/TCP
Data Transfer Rates	10/100 Mbps
Connected I/O Modules	32 (max.)*
Digital Signals	768 (max.)
Analog Signals	192 (max.)
Environment Operating Temperature	-10 ~ 60°C (mounted vertically)
Storage Temperature	-40 ~ 85°C
Relative Humidity	5 ~ 95% (non-condensing)

Model	☞ APAX-5090
Description	4-port RS-232/422/485 virtual COM
General Dimensions (W x H x D)	30 x 139 x 100 mm
Power Consumption	2 W @ 24 V$_{DC}$ (typical)
Connectors	1 x 26-pin clamp-type terminal
Interface	COM 1, COM 2: RS-232/422/485 COM 3, COM 4: RS-232/422/485 (change mode via switch)
Environment Operating Temperature	-10 ~ 60°C (mounted vertically)
Storage Temperature	-40 ~ 70°C
Relative Humidity	5 ~ 95% (non-condensing)

*APAX digital I/O modules can use ID number 0 ~ 31, while AI/O modules and counter modules can only use ID numbers 0 ~ 15

APAX Analog I/O Module

Model	☞ APAX-5013	☞ APAX-5017	☞ APAX-5017H	☞ APAX-5018	☞ APAX-5028
Description	8-ch RTD module	12-ch analog input module	12-ch high-speed analog input module	12-ch thermocouple module	8-ch analog output module
General Dimensions (W x H x D)	30 x 139 x 100 mm				
Power Consumption	2.5 W @ 24 V$_{DC}$ (typical)	4 W @ 24 V$_{DC}$ (typical)	3.5 W @ 24 V$_{DC}$ (typical)	3.5 W @ 24 V$_{DC}$ (typical)	3.5 W @ 24 V$_{DC}$ (typical)
Analog Input Channels	8 (differential)	12 (differential)	12 (differential)	12 (differential)	-
Input Type*	RTD (2-wire or 3-wire)	V, mV, mA	V, mV, mA	V, mV, mA, thermocouple	-
Sampling Rates	10 sample/second (total)**	12 sample/second (total)**	1,000 sample/second (per channel)	12 sample/second (total)**	-
Resolution	16-bit (accuracy: ±0.1% of scale range)	16-bit (accuracy: ±0.1% of scale range for voltage; ±0.2% of scale range for current)	16-bit (accuracy: ±0.1% of scale range for voltage; ±0.2% of scale range for current)	16-bit (accuracy: ±0.1% of scale range for voltage; ±0.2% of scale range for current)	-
Input Impedance	>10 MΩ	>10 MΩ (voltage), 120 Ω (current)	2 MΩ (voltage), 120 Ω (current)	>1 MΩ (voltage), 120 Ω (current)	-
Wire Burnout Detection	✓	✓ (4 ~ 20 mA only)	✓ (4 ~ 20 mA only)	✓ (4 ~ 20 mA and thermocouple)	-
Analog Output Resolution	-	-	-	-	14-bit (accuracy: ±0.1% of scale range)
Channels	-	-	-	-	8
Output Type*	-	-	-	-	V, mA
Slew Rate	-	-	-	-	0.7 V$_{DC}$/µs (per channel)
Environment Operating Temperature	-10 ~ 60°C (when mounted vertically)				
Storage Temperature	-40 ~ 70°C				
Relative Humidity	5 ~ 95% (non-condensing)				

* Each channel can be configured with different type and range
** Sampling rate depends on used channel number.
Example: Using 6 channels on APAX-5017, sampling rate for each used channel will be 12/6 = 2 samples/second.

EtherIO I/O Modules

APAX Digital I/O Module

Model		☞ APAX-5040	☞ APAX-5045	☞ APAX-5046 ☞ APAX-5046SO	☞ APAX-5060	☞ APAX-5080
Description		24-ch digital input module	24-ch digital I/O module	24-ch/20-ch digital output module	12-ch relay module	4/8-ch counter module
General	Dimensions (W x H x D)		30 x 139 x 100 mm			
	Power Consumption	2 W @ 24 V_{DC} (typical)	2.5 W @ 24 V_{DC} (typical)	2.5 W @ 24 V_{DC} (typical)	2 W @ 24 V_{DC} (typical)	2.5 W @ 24 V_{DC} (typical)
	Status Display	LED per channel On: Logic level 1 Off: Logic level 0				
Digital Input	Channels	24	12	-	-	4 (sink)
	Input Voltage	Rated Value: 24 V_{DC}, For "0" signal: -5 ~ 5 V_{DC}, For "1" signal: 15 ~ 30 V_{DC} and -15 ~ 30 V_{DC}	Rated Value: 24 V_{DC}, For "0" signal: -5 ~ 5 V_{DC}, For "1" signal: 15 ~ 30 V_{DC} and -15 ~ 30 V_{DC}	-	-	For "0" signal: 0 ~ 3 V_{DC}, For "1" signal: 10 ~ 30 V_{DC}
	Type	Sink or source load	Sink or source load	-	-	-
Digital Output	Channels	-	12 (sink)	24 (sink)	-	4 (sink)
	Voltage Range	-	8 ~ 35 V_{DC}	8 ~ 35 V_{DC}	-	8 ~ 35 V_{DC}
	Rated Current Output	-	0.5 A (per channel, at signal "1")	0.5 A (per channel, at signal "1")	-	0.5 A (per channel)
Relay Output	Channels	-	-	-	12	-
Counter/ Frequency Input	Channels and Mode	-	-	-	-	8 (up and frequency mode), 4 (pulse/ direction, up/down, A/B phase mode)
	Counting Range	-	-	-	-	32-bit + 1-bit overflow
	Minimum Pulse Width	-	-	-	-	1 µs for high-freq. mode and other modes
	Counter Frequency	-	-	-	-	10 hz ~ 1 MHz for high-freq. mode and other modes
	Input Voltage	-	-	-	-	For "0" signal: 0 ~ 3 V_{DC}, for "1" signal: 10 ~ 30 V_{DC}
Environment	Operating Temperature	-10 ~ 60°C (when mounted vertically)				
	Storage Temperature	-40 ~ 70°C				
	Relative Humidity	5 ~ 95% (non-condensing)				