



Application Story

EtherCAT Master Controller in Factory Automation

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Abstract

In current automation industry, the main stream products in real-time industry automation control are using hardware-based motion card and PLC (Programming Logic Controller). After popularization of high performance x86 PC, the traditional configuration will be replaced by soft-motion based on Ethernet protocols gradually because of its cost effective, powerful and flexible communication solution.

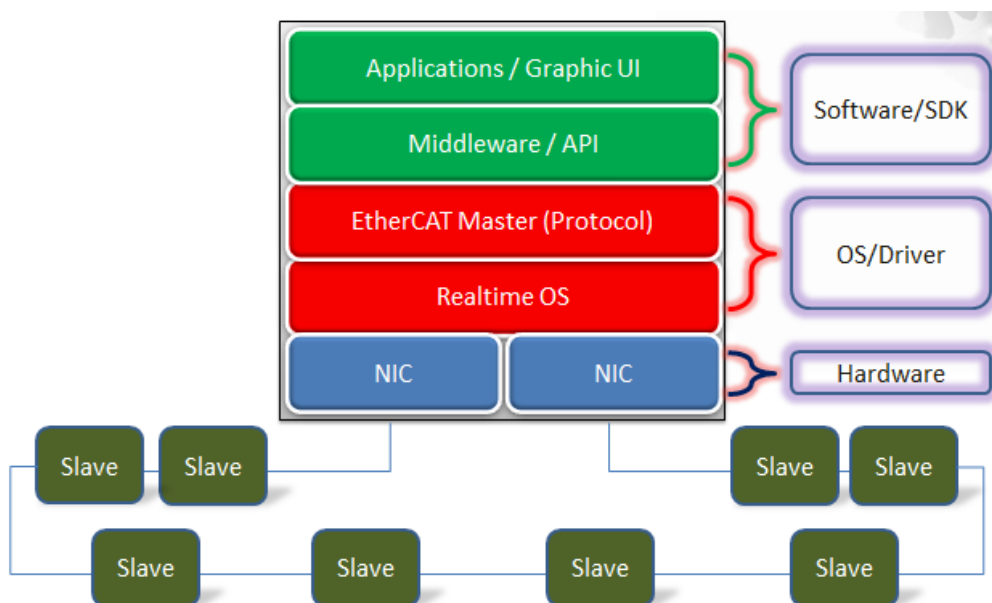
It is widely believed that EtherCAT will become the best solution in real time automation in the future. EtherCAT is an Ethernet-based fieldbus system, invented by Beckhoff Automation. The protocol is suitable for both hard and soft real-time requirements in automation technology. The goal during development of EtherCAT was to apply Ethernet for automation applications requiring short data update times with low communication jitter and reduced hardware costs. Axiomtek's IPC and eBOX approved by EtherCAT solution have been released to markets. These products will help our customers speed up development, deployment and expansion of smart automation and greatly reduces the cost of ownership in IoT solutions.

Industry Trend

Many new projects in industrial automation are starting with real-time Ethernet requirements to replace field buses. EtherCAT, Profinet and other Ethernet based protocols are becoming de facto standards for industrial communication. All the industries have the same requirements for their next-general equipment or devices. They must deliver better throughput and reduce their costs. Real-time Ethernet is a key factor that helps partners and customers in various domains to achieve these goals.

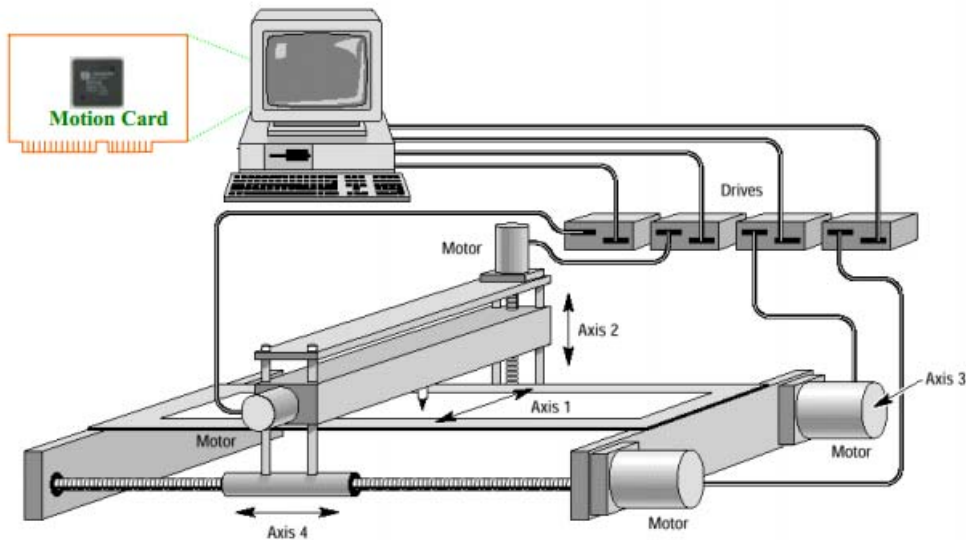
The following are the advantages that EtherCAT solution provides:

- Open x86/x64 PC base with Real Time OS
- Serial control
 - Real time (scan 100 servo motor < 100 μ s)
 - Easy wiring
 - Anti-interference
 - Remote control
 - Low cost because of the use of standard Ethernet components
- Best for high-speed motion control devices
- Used by semiconductor industry, PCB devices, measurement, and medical treatment



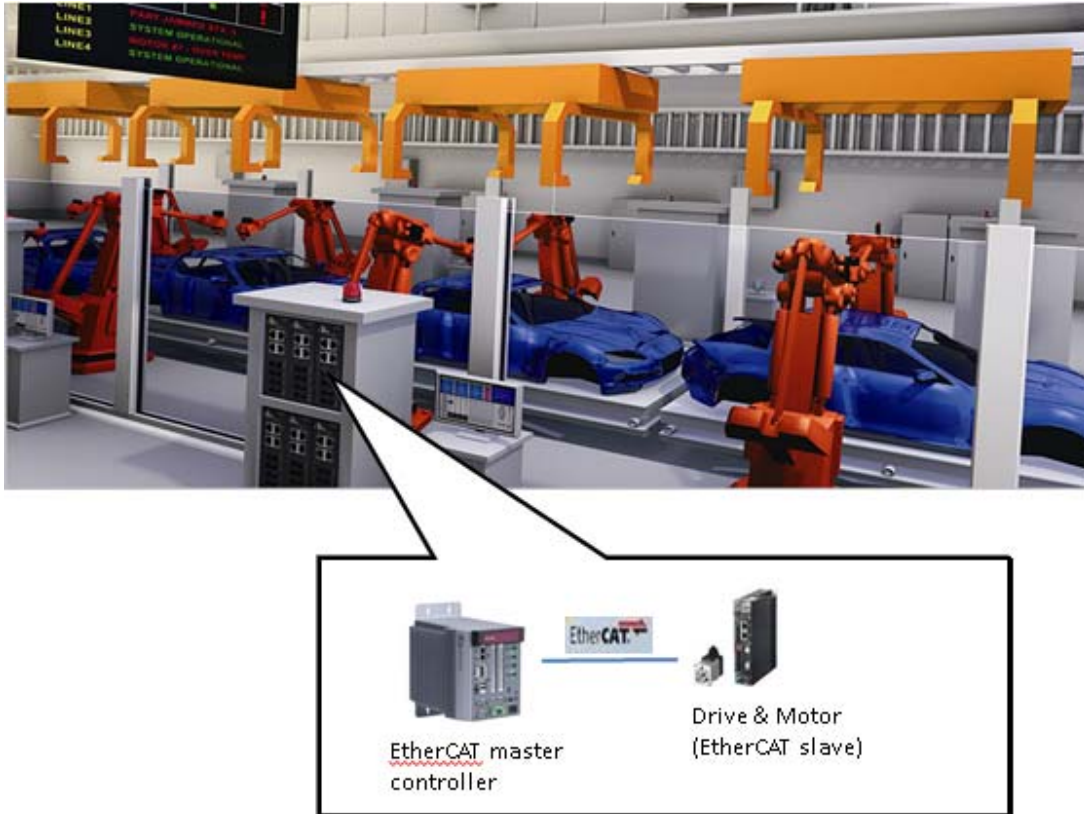
Graphic 1: EtherCAT solution structure

Below is the application environment for IPC914-213-FL and ITRI PCI motion card. This is the first generation product in one of our customers now and it's running smoothly and authentically.



Graphic 2: First generation of control system

The IPC932-230-FL-ECM and EtherCAT solutions (soft-motion) are the second generation product for robotic system. The resource conflicted and driver issue on motion card would be avoided effectively after adopting EtherCAT solution.



Graphic 3: Second Generation of control system

Comparing the first generation of a traditional control system with the second generation of an EtherCAT based control system, the difference and benefits are very obvious. Having the communication and safety bus combined on inexpensive Ethernet cabling streamlines complex and expensive wiring harnesses. The simplified cables alone translate into significant savings in the bill of materials.

Besides, the cabling savings, ease of installation and maintenance also provide compelling reasons why Industrial Automation customers are moving so quickly to Ethernet based communications.

It has taken a while but Industrial Automation is finally able to fully leverage Ethernet as a cost effective, flexible, and powerful communications solution.

System Design Features

IPC932-230-FL-ECM

The IPC932-230-FL-ECM open real-time EtherCAT master controller features high speed, accuracy, simplified cabling, and distributed time synchronization. The fanless embedded computer IPC932-230-FL-ECM has been verified for interoperability with IntervalZero EtherCAT Master which is based on Acontis EtherCAT Master Stack and IntervalZero RTX real-time extension module. The high quality industrial computer supports LGA1150 socket for 4th generation Intel® Core™ i7/i5/i3 (Haswell/Haswell Refresh) and Celeron® processor with the Intel® Q87 Express chipset. Equipped with various front-facing I/O connectors, the advanced EtherCAT master controller features compact construction with fanless design and wide operating temperature range at -10°C to 50°C for withstanding harsh operating conditions. The IPC932-230-FL-ECM is an ideal solution for industrial motion control, factory automation, multi-task machine control and internet of things applications.



- 4th Generation Intel® Core™ i7/i5/i3 & Celeron® processor
- 1 EtherCAT port, 1 GbE LAN port
- Verified with IntervalZero EtherCAT solution KingStarIO32
- Support Acontis EtherCAT master stack
- Support IntervalZero Windows real-time extension RTX2012
- EtherCAT communication cycle 250 us
- I/Os including dual independent display, 4 COM, 2 GbE LAN,
- 2 USB 3.0, 4 USB 2.0
- Wide operation temperature -10°C to 50°C

Graphic 4: Fanless EtherCAT Master Controller with 4th Generation Intel® Core™ i7/i5/i3 & Celeron® processors up to 3.3 GHz ,Intel® Q87 Chipset, PCIe and PCI Slots

eBOX560-880-FL-ECM

The Axiomtek eBOX560-880-FL-ECM EtherCAT controller is verified with IntervalZero EtherCAT Master middleware KingStar which is based on Acontis EtherCAT Master Stack and IntervalZero realtime extension RTX. With well-known Acontis EC-Master, it not only supports CoE, EoE, FoE and SoE enabling seamless integration with servo drives, but also offers Distributed Clocks function support for synchronization of all slave devices. With IntervalZero Windows real-time extension RTX that through a separate real-time scheduler transforms Windows 7 the general-purpose operating system into a fully functional RTOS that runs on multicore hardware, delivering deterministic time control to allow Master controller and Slave device communicating cycle time of 250 μ s.



**Graphic 5: eBOX560-880-FL-ECM
Fanless EtherCAT Master Controller
with Intel® Core™ i5/i3 & Celeron® Processor**

- Intel® Celeron® 2980U/Core™ i5 4300U Haswell & Core™ i3 5010U Broadwell ULT SoC
- 204-pin DDR3L SO-DIMM max. up to 8 GB
- 1 EtherCAT port, 1 GbE LAN port
- Verified with IntervalZero EtherCAT solution KingStarIO32
- Supports Acontis EtherCAT master stack
- Supports IntervalZero Windows real-time extension RTX2012
- EtherCAT communication cycle 250 us
- Fanless operation design with compact size
- 1 RS-232/422/485 and 1 RS-232 port
- One 2.5" SATA HDD drive bay and mSATA interface
- 1 PCI Express Mini Card slot and 4 USB 3.0 ports
- Supports DisplayPort and HDMI dual view

About Axiomtek Co., Ltd.

[Axiomtek](#) Co. Ltd. is one of the world's leading designers/manufacturers of PC-based industrial computer products. From our roots as a turnkey systems integrator specializing in data acquisition and control systems, Axiomtek has mirrored the PC evolution in various industries by shifting our focus toward the design and manufacture of PC-based industrial automation solutions.

Axiomtek Co., Ltd. established in 1990, has more than 60 distributor partners globally. Axiomtek offers Industrial PCs (IPC), Single Board Computers and System on Modules (slot CPU card, small form factor embedded boards & SoM), Fanless & Rugged Embedded System (eBOX, tBOX and rBOX), Industrial Firewall Platform, Industrial IoT Gateway Solution, EtherCAT Master Controller, Touch Panel Computers (TPC), Medical PCs (MPC), Human Machine Interface (HMI), Digital Signage and Players (DS), Industrial Network and Network Appliances (NA).

As an associate member of the Intel® Internet of Things Solutions Alliance, [Axiomtek](#) continuously develops and delivers cutting edge solutions based on the latest Intel® platforms.