

# AI-01843 EtherCAT vs PiCAT4

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Tags	Project
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**What is EtherCAT? What was before EtherCAT? List the history and genesis of Ethercat? What PiCAT4? List common use case of PiCAT4. List documentation / resources to get started with EtherCAT and PiCAT4.**

[Simple Robot](#)

<https://github.com/thanhtam-h>

[Open EtherCAT Society: Home of SOEM and SOES](#)

[RT-Labs | Industrial communication](#)

[SMF KETELS home](#)

**EtherCAT: A Complete Guide**

**[Industrial Ethernet Book – EtherCAT Series](#)**

**[Embien’s Comprehensive Guide to EtherCAT](#)**

[: Industrial Ethernet eBook Publications](#)

Here's a comprehensive overview of **EtherCAT**, its **history**, the **PiCAT4** platform, and resources to get started:

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 **What is EtherCAT?**

**EtherCAT (Ethernet for Control Automation Technology)** is a high-performance, real-time Ethernet-based fieldbus system developed for industrial automation applications. It was introduced by **Beckhoff Automation** in 2003 and is now maintained by the **EtherCAT Technology Group (ETG)**.

### Key Features:

- **Real-time communication** with cycle times < 100 μs
- **Low jitter** for synchronization
- **Flexible topology** (line, tree, star)
- **High efficiency** (uses standard Ethernet frames)
- **Open standard** (IEC 61158)

### History and Genesis of EtherCAT


Year	Milestone
<b>Pre-2000s</b>	Fieldbus systems like PROFIBUS, DeviceNet, and CANopen dominated industrial automation.
<b>2003</b>	Beckhoff introduced EtherCAT as a faster, more deterministic alternative.
<b>2004</b>	EtherCAT Technology Group (ETG) was founded to promote and standardize EtherCAT.
<b>2007</b>	EtherCAT became an IEC standard (IEC 61158).
<b>2010s–Present</b>	Widely adopted in robotics, CNC, packaging, and semiconductor industries.

### What is PiCAT4?

**PiCAT4** is a real-time EtherCAT master controller built on the **Raspberry Pi 4** platform. It transforms the Pi into a powerful industrial controller using:

- **Xenomai real-time kernel**
- **IgH EtherCAT Master**
- **Real-time Ethernet driver for Broadcom GENET**
- **Web-based EtherCAT configuration tool**

- **Automatic C/C++ code generation**

 [Official PiCAT4 Page](#)

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## **Common Use Cases of PiCAT4**

1. **Robotics** – Controlling multi-axis robotic arms (e.g., 6-DOF cobots)
  2. **Mobile Robots** – Coordinating 4-wheeled drive systems
  3. **Industrial Automation** – PLC-like control for sensors and actuators
  4. **Prototyping** – Rapid development of EtherCAT-based systems
  5. **Educational Labs** – Teaching real-time control and fieldbus systems
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## **Documentation & Resources**

### **Official Guides & Tools**

- **PiCAT4 Overview & Setup:** [SimpleRobot.net](#)
- **Web-based EtherCAT Configuration Tool:** [YouTube Demo](#)
- **Automatic Code Generation Tool:** [YouTube Demo](#)
- **PiCAT SDK for Windows:** [YouTube Demo](#)

### **GitHub Repositories**

- [SOEM for Raspberry Pi with W5500](#) – Real-time EtherCAT master implementation

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Would you like a **step-by-step guide** to set up PiCAT4 on a Raspberry Pi 4, or maybe a **visual diagram** of how EtherCAT works?

Here's the **visual diagram** showing how EtherCAT works with PiCAT4 as the master controller:

![EtherCAT with PiCAT4 Diagram]

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Unfortunately, the setup guide generation encountered a small issue. Let me fix that and provide you with the full **step-by-step PiCAT4 setup guide** in just a moment.

It looks like the setup guide is still running into a formatting issue. Let me provide you the full **PiCAT4 setup guide** directly here instead:

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## **PiCAT4 Setup Guide for Raspberry Pi 4**

This guide walks you through installing and configuring **PiCAT4**, a real-time EtherCAT master controller on a Raspberry Pi 4.

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### **Prerequisites**

- Raspberry Pi 4 (4GB or 8GB recommended)
  - microSD card (16GB+)
  - Internet connection
  - USB keyboard, mouse, and monitor
  - Raspberry Pi OS (32-bit, Lite or Desktop)
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### **Step 1: Install Raspberry Pi OS**

1. Download Raspberry Pi Imager: [raspberrypi.com/software](https://www.raspberrypi.com/software)
  2. Flash Raspberry Pi OS (32-bit) to your microSD card.
  3. Boot the Raspberry Pi and complete the initial setup.
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### **Step 2: Install Dependencies**

```
sudo apt update
sudo apt install -y git build-essential cmake libtool libudev-dev
```

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### **Step 3: Install Xenomai Real-Time Kernel**

1. Clone the Xenomai patched kernel source:

```
git clone https://github.com/thanhtam-h/xenomai-bcm.git
cd xenomai-bcm
```

1. Follow the instructions in the repo to patch and build the kernel:

```
./build.sh
```

1. Reboot into the new real-time kernel:

```
sudo reboot
```

## Step 4: Install IgH EtherCAT Master

```
git clone https://github.com/thanhtam-h/ethercat-rpi.git
cd ethercat-rpi
make
sudo make install
```

## Step 5: Configure EtherCAT Master

1. Edit `/etc/ethercat.conf` to define your network interface (e.g., `eth0` or `eth1`).
2. Start the EtherCAT master:

```
sudo /etc/init.d/ethercat start
```

## Step 6: Web-Based EtherCAT Configuration Tool

1. Clone the tool:

```
git clone https://github.com/thanhtam-h/web-ethercat-config.git
cd web-ethercat-config
```

1. Install dependencies and run:

```
npm install
npm start
```

1. Open your browser and go to `http://<raspberrypi-ip>:3000` to access the configuration UI.

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Would you like this guide as a downloadable PDF or markdown file?