Programmable Multi Axis Motion Controller with Low Jitter FPGA based EtherCAT Master

EtherCAT®

What is EtherCAT?

EtherCAT is a real-time Ethernet network protocol, originally developed by Beckhoff. EtherCAT sets new standards for real-time performance and topological flexibility.

Why EtherCAT?

There are several reasons and advantages:

- Exceptional performance
- Flexible topology
- Simple and Robust
- Integrated Safety
- Affordability

KSMC-ECAT is one of the **KSMC® Motion Controller** Series of products and is specialized in working as an EtherCAT master with Motion Controller functionalities. KSMC-ECAT is available on different hardware platforms as shown in Table-1. EM3 is our PCB-based product option which uses an in-house developed PCB as the master platform. The EtherCAT master runs on one of the real-time processes managed by RTOS. EM3 communicates with the host application over a network.

EtherCAT Master Controller

We have an in-house developed master controller called EE-Master. EE-Maser has Class-A features such as Cyclic PDO, Cable Redundancy, and a Distributed Clock, with many more features. Please refer to the ETG.1500 documents for details on EtherCAT Master.

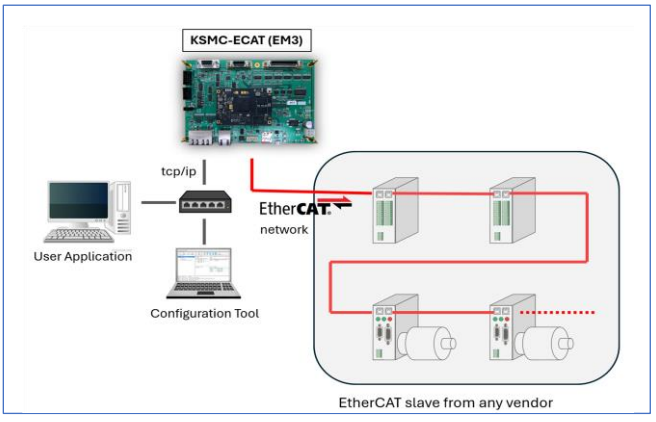
Hardware

The KSMC-ECAT.EM3 consists of two PCBs: a base board with a small SoM. The SoM features an SoC FPGA (2x ARM Cortex-A9) as its main processing unit. This hardware platform achieves very high performance (125usec PDO cycle with 32 drive units) with low jitter (timing variation). The base board's design can be tailored to the customer's requirements. We offer a pre-designed PCB (ECZIO) with several GPIOs and a 2-channel DAC.

Table-1: ESMC-ECAT Hardware Platform

Name	Type	H/W Platform	Features
EM1	PCB	KSMC-ECAT	EtherCAT Master/Motion Controller
EM2	PCB	LCZIO+SOM	EtherCAT Master/Motion Controller/Vision/Galvano Master
EM3	PCB	ECZIO+SOM	EtherCAT Master/PLC/Motion Controller User Application
EM4	PC	X86	EtherCAT Master/Motion Controller/PLC/User Application

Figure-1: KSMC-ECAT – EM3



Sodick America Corp.
Create the Spark, Innovate the Future

Be Flexible and Productive with KSMC-ECAT

Sodick

SODICK FAMILY

We opened our office in San Jose, CA, in the middle of Silicon Valley, back in 2000 as an R&D subsidiary of Sodick Co., Ltd.

MOTION SPECIALISTS

We have developed several Motion Controllers that have proven its stability, flexibility, and reliability in diverse types of Sodick machines (EDM, MC, 3DP, IMM) for over 20 years.

KSMC® Motion Controllers

- KSMC
- KSMC-SILINK
- KSMC-M4LINK
- KSMC-MALINK
- KSMC-A4
- KSMC-IX
- **KSMC-ECAT**

Software Package

The KSMC-ECAT EM3 is available with optional software to add on top of the EtherCAT Master.

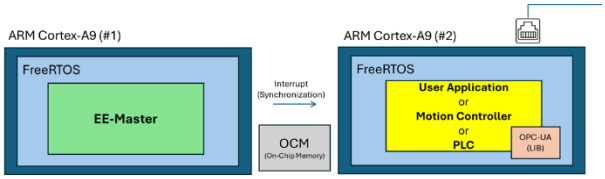
- Motion Controller (optional)
- PLC (optional)
- User Application
- OPCUA library (optional)
- Configuration Tool / RDI-L

User Application

Users can develop their own application for Core #2 instead of using a PLC or Motion Controller. In this case, the User Application will have direct access to EtherCAT PDO data.

Flexible Configuration

Core #1 runs the EE-Master and generates interrupt signals. Only one application (User Application, Motion Controller, or PLC) is allowed to run on Core #2. The EE-Master and the application running on Core #2 synchronize using the interrupt signals and share data via OCM. The OPC-UA library is also available for Core #2 upon request.



Motion Key Features

- Up to 32 motors
- Up to 8 interpolated axes (export control may apply)
- Up to 4 Coordinate System
- Motion Planner per each Coordinate System
- Motion-Axes association
- PID and Modern Control Theory
- Disturbance Observer and Adaptive Control
- Notch Filter
- User Program (Sequential PLC & Periodic PLC)
- Macro Variables (settings & statuses)
- User Defined I/O Data
- Various Motion Modes (Jog, Spline1/2, CW/CCW/ PVT, Rapid, Handwheel…)
- Small Segment Time (500usec) and PDO cycle (250usec with 32 motors)
- Data Gathering and Plotter

Motion Controller

For over 20 years, our in-house Motion Controllers have been used in more than 50,000 Sodick products. These include Sinker & Wire EDMs, Machining Centers, 3D Printers, and Injection Mold Machines. Our Motion Controller has proven its stability and flexibility with a variety of features and gives users flexibility in axis and motor movement. The KSMC-ECAT EM3 Motion Controller runs on RTOS and controls the motor's position by directly sending the data on the Process Data Object. It also provides a unique scripting program (Sequential PLC and Periodic PLC) that gives more flexibility to users in customizing motor and axis movement.

Sodick America Corp.
Create the Spark, Innovate the Future

Proven Stability and Reliability with Sodick machines over 20 years

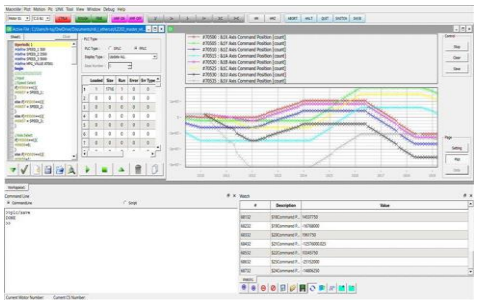
PLC (optional)

The Programmable Logic Control (PLC) language is standardized by the IEC (IEC 61131-3). This specifies the syntax and semantics of a unified suite of programming languages for programmable controllers. This suite consists of two textual languages, Instruction List (IL) and Structured Text (ST), and two graphical languages, Ladder Diagram (LD) and Function Block Diagram (FBD). Additionally, a set of graphical and equivalent textual elements named Sequential Function Chart (SFC) is defined for structuring the internal organization of programmable controller programs and function blocks. Configuration elements are provided which support the installation of programmable controller programs into controller systems. KSMC-ECAT EM3 provides the capability and flexibility in programming motion by supporting the standardized PLC. programs.

RDI-L

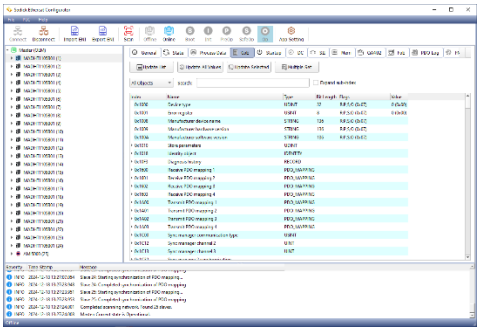
Customizing motion control according to the user's requirements is critical and important. For example, move the X-axis to a given position at a given velocity, but the axis velocity and acceleration should not go above the max value set by parameters. For the X-axis motor to follow the reference and command positions, the gains (position/velocity/current) must be well tuned. RDI-L (Realtime Debugging Interface for Link products) helps with these customizations. RDI-L features include:

- Setting parameters.
- Data Gathering & Plotting.
- Monitoring Statuses (Watch Windows).
- Edit/Download/Upload/Run PLC programs.
- Gain Tuning in different motion patterns.
- Firmware Update.
- Execute NC programs.



EtherCAT Master Configurator

EtherCAT configurator creates a complete network configuration (ENI – EtherCAT Network Information) from the standardized slave description files (ESI – EtherCAT Slave Information). It provides access to the process data and generates logical modules on the selected EtherCAT master, which enables an immediate diagnosis and signal test. Please refer to the EtherCAT Master Configuration Tool manual for more details.



TURNKEY SOLUTION

Give us detailed requirements & specifications and rest assured we can help with your developmental needs.

TECHNICAL SUPPORT

For any questions or inquiries, please contact us.

ksmc@sodick-america.com

2180 Bering Dr, San Jose, CA, 95131, USA

+1(408)943-1693

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