

ebs group

ecore

SOFTWARE REFERENCE ARCHITECTURE

**Real-time control,
made simple.**



Supported by:



Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag

ecore
SOFTWARE REFERENCE
ARCHITECTURE

ecore
EVALUATION BOARD
VI

ecore
MASTER CONTROLLER
VI

ecore
SLAVE CONTROLLER
VI

IN BRIEF

What is ecore?

“ecore is more than a Real-Time Control Platform — it is the result of 60,000 engineering hours.”

ecore is the ready-to-use real-time platform for AMD® Zynq® UltraScale+™ MPSoCs. It lets your machine run precise, split-second control and a modern, connected operating system on a single device – with low-latency control algorithms, optionally based on Simulink®, executing in parallel with an embedded Linux distribution. A lightweight hypervisor ensures clean separation between management tasks and real-time control.



Most teams that build this kind of controller spend years getting the foundations right. With ecore, those foundations are already done: backed by more than 60,000 engineering hours, tested, maintained and proven in real industrial products. You start where others finish.



100% Model-based

Develop control apps end-to-end in Simulink®.



Hard Real-Time

Deterministic <1 µs FPGA latency.



Totally Synchronized

across internal & external time domains.



Simple Operation

Web UI, REST API, Parameter Manager.



Standardized Toolchain

provided alongside.



Seamless Integration

Plugs easily into existing structures.



Open-Source Foundation

Debian Linux & Jailhouse Hypervisor



365/24/7 Operation

Watchdogs, A/B updates, auto-rollback.



Secure Design

Secure Boot, signed firmware, encryption.

APPLICATIONS

Why ecore?

→ Time-to-Market

60,000 hours invested.
Be up to 3 years ahead.

→ Costs Down — Sales Up

No expensive HiL or licenses. Development, prototyping, in-loop tests in one system.

→ Control in the microsecond range

Essential for the operation of modern power electronics.

→ Industrial Hardware Available

Use as dev platform, in test benches, prototypes, batch production.

→ Focus on What's Yours

You build the application, we maintain the framework.

→ Field-Proven

ecore hardware and software are now in use in thousands of production applications.

Where ecore performs

ecore is the perfect solution for applications, that where real-time performance, high availability and fast development cycles are important.



Frequency Inverter



Multi-Level Inverter



Robot Control



Automated Test Rigs



Sensor Data Fusion



High-End Measurement



Battery energy storage



Autonomous Systems

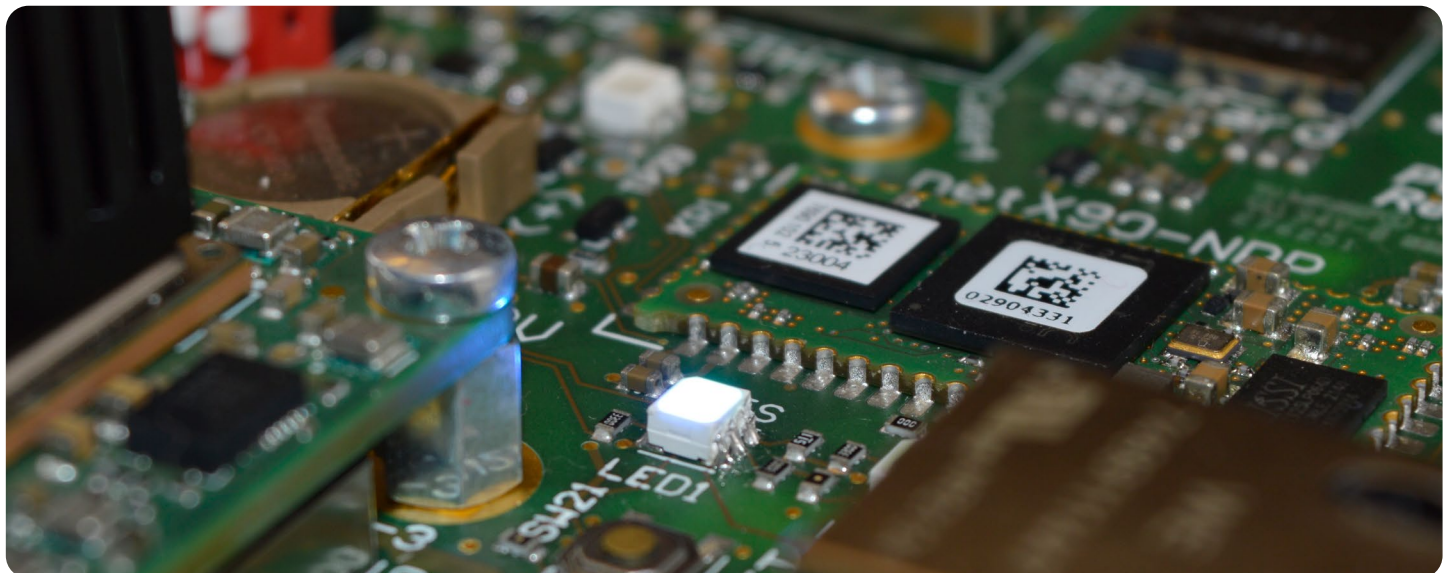
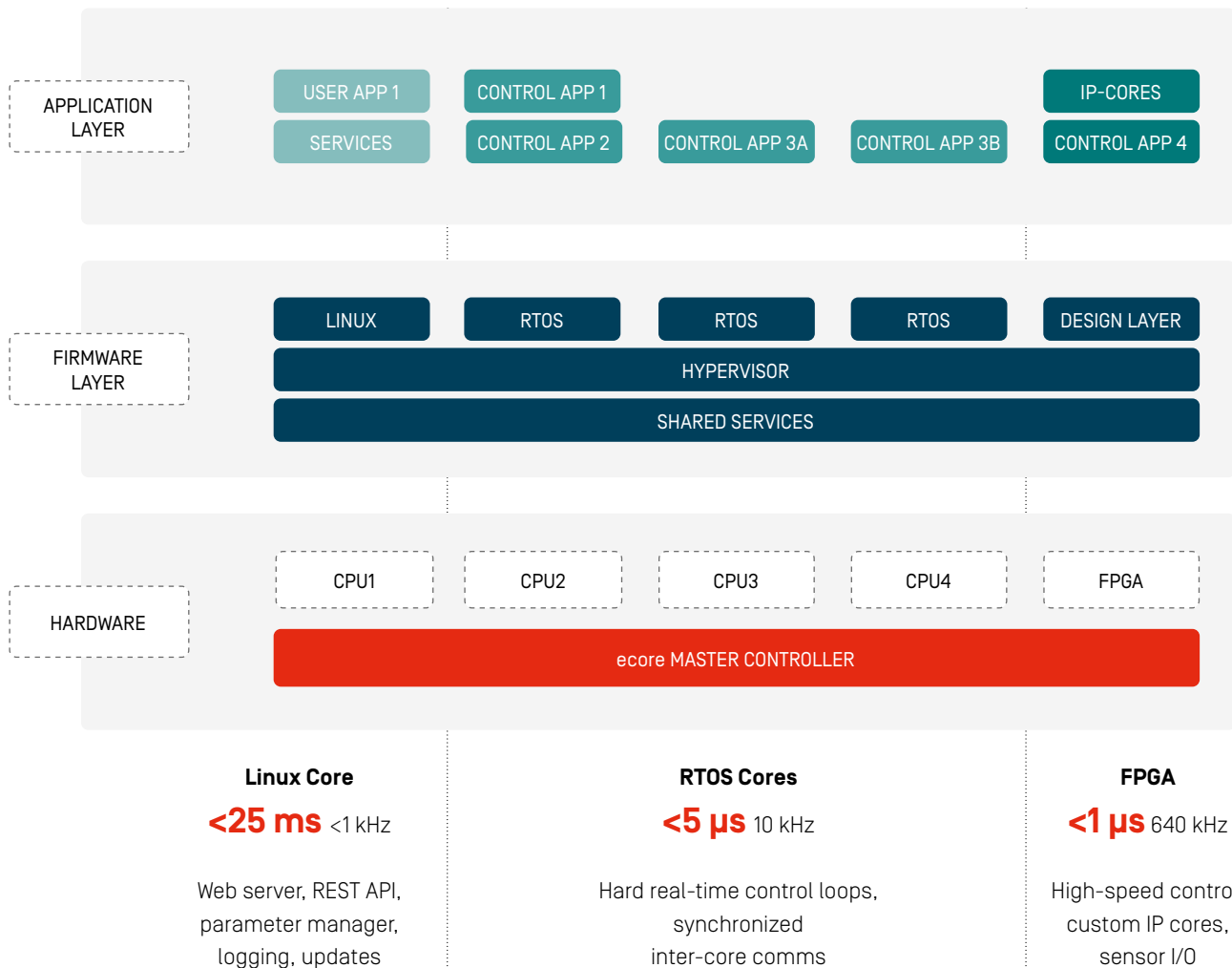


LiDAR / RADAR / SONAR

ARCHITECTURE

Master Controller Architecture

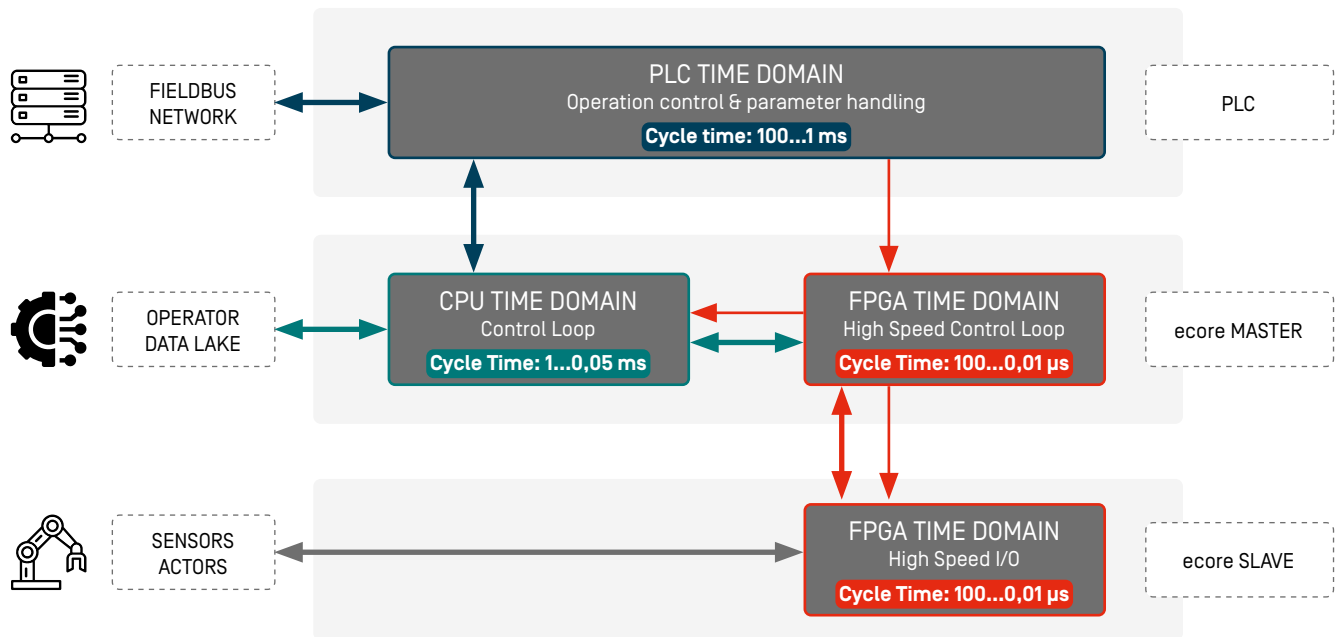
Control applications can run on the different CPUs as well as on the FPGA. Data exchange between applications is fully synchronized and handled by ecore. The workflow can be 100% model-based — no deeply embedded knowledge required.



TIME DOMAINS

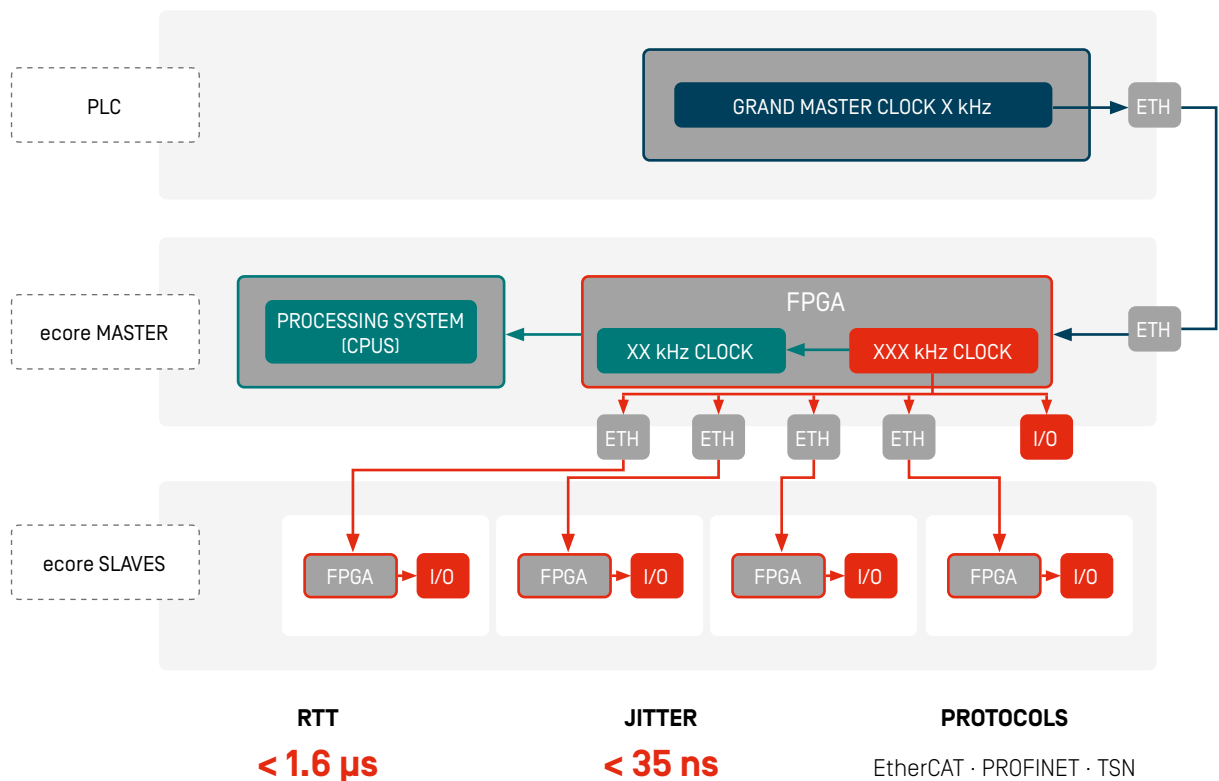
Data & Clock Synchronization

Control applications run within the CPU Time Domain or the FPGA Time Domain. Synchronized data exchange between CPU and FPGA, CPU and PLC, and Master and Slave is handled by ecore.



SYNCHRONIZATION ARCHITECTURE & TIME DOMAINS

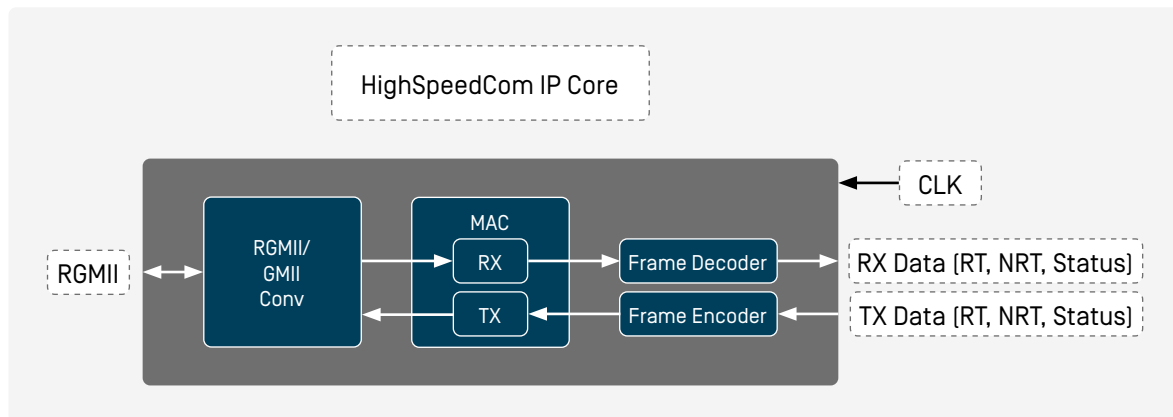
The Master-Slave interface can be paralleled with extremely low jitter and round-trip-time (RTT). All blocks can be synchronized to a grand master clock.



DISTRIBUTED SYSTEM

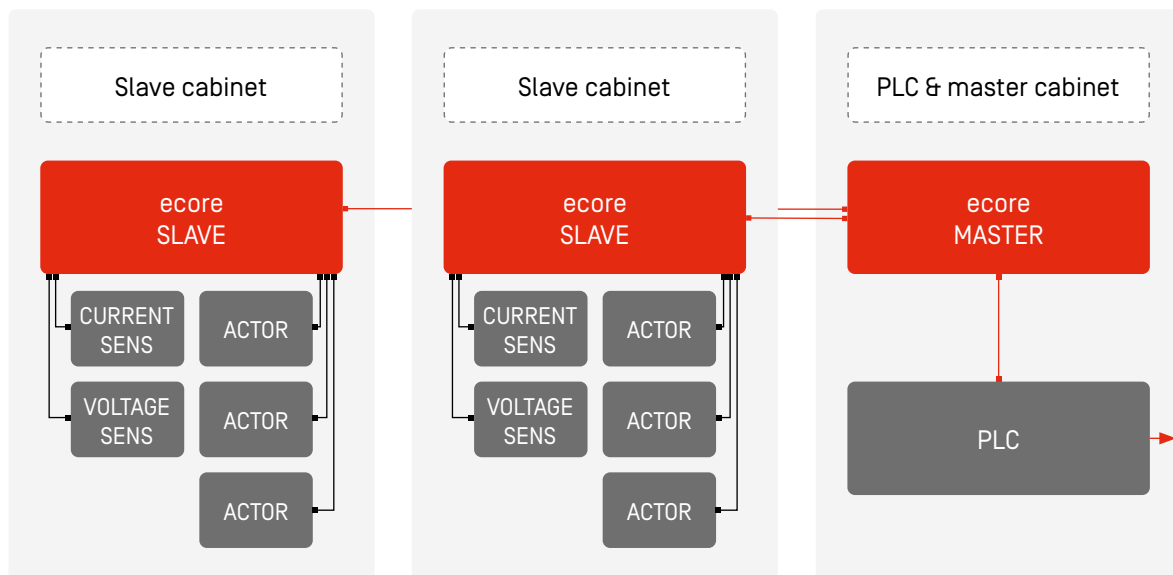
Master-Slave Real-time Communication

Communication between Master and Slaves is based on Gigabit Ethernet using a FPGA-based HighSpeedCom IP Core, enabling parallel and fully synchronized Slave-operation.



ecore scales to distributed systems through a Master-Slave architecture. The slave acts as the sensor/actor interface and can be placed close to the periphery — reducing cable lengths and EMC exposure for sensitive measurement signals.

Simplified Setup with an ecore Master and two ecore Slaves

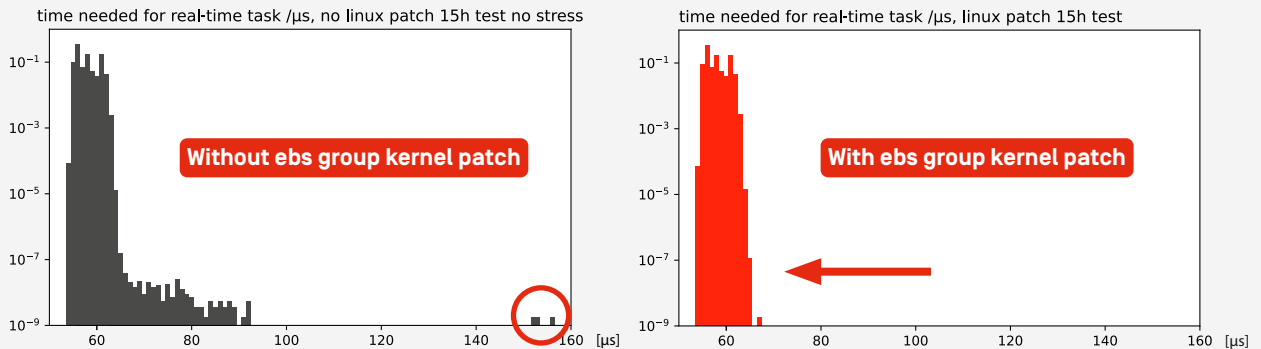


- **CAT6a cabling Shielded: Copper between Master and each Slave**
- **Up to 32 slaves: Per Master controller**
- **I/O examples: Gate drivers, current/voltage sensors, actuators**
- **Deterministic: Round-trip time < 1.6 μ s · jitter < 35 ns**

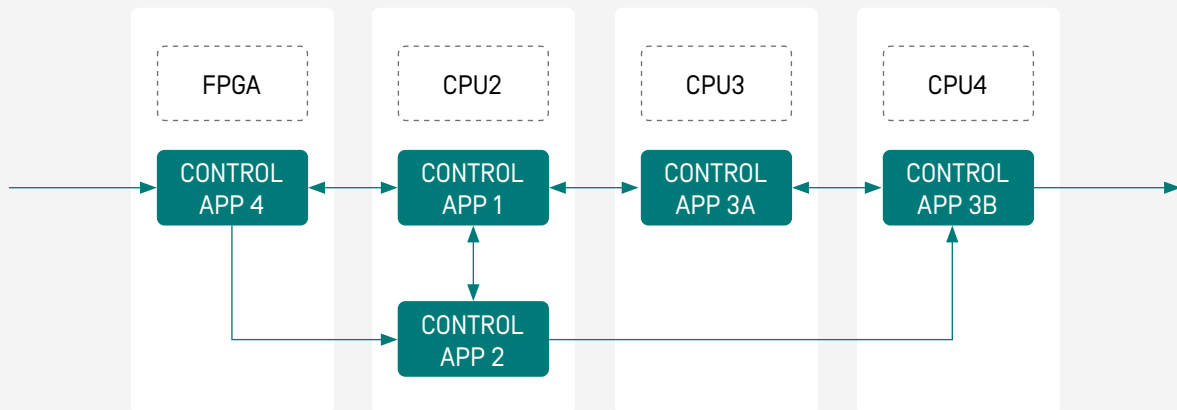
PERFORMANCE

10 kHz stable – proven

The ecore kernel patch — specially developed for the AMD® Zynq® UltraScale+™ — guarantees stable 10 kHz inter-core communication between the real-time cores. Verified using a complex industrial Simulink® control algorithm. With less complex algorithms, even higher sampling rates are achievable.



Example: synchronized control apps distributed across FPGA and three CPU cores.



Control apps can

- ...be developed 100% model based,
- ...be freely distributed over FPGA and the CPU cores,
- ...communicate to each other,
- ... run at user-defined cycle times and priorities,
- ... use system in- and outputs,
- ... easily be debugged, parametrized and monitored.

USPs

01

First integration of RTOS, Linux & FPGA

Configurable channels,
A/B updates,
hard real-time.

02

Simulink® Target for RTOS and FPGA

No VITIS® setup;
native blockset;
External Mode.

03

Full SW & HW flexibility

Source-controlled
by ebs group;
custom extensions.

Components, facts and benefits



Two systems, one device

Normally you have to choose: a system that handles precise timing, or one that handles connectivity and software. ecore runs both at once on the same chip, kept strictly separated so they cannot disturb each other. Your time-critical control runs untouched on dedicated cores, while a full modern operating system handles the network, the web interface and everything else. The separation is efficient enough to add less than a few microseconds of overhead.

Benefit: you get both capabilities on one device, with no second controller and no expensive test rig.



Control timing you can trust

ecore moves data between its processing cores up to 10,000 times every second, reliably and exactly on schedule. This is not a lab number. It was proven with a genuine, complex industrial control task running continuously. If your application is generated from Simulink, it drops straight in.

Benefit: your control loop works cycle after cycle, without dropping a cycle.



One trusted place for every setting

All of your system's parameters live in one authoritative place. You can change them from a web browser or from a higher-level machine controller, and they are stored safely so they survive a power cut. Every part of the system reads from the same source, so there is never any disagreement about the correct value.

Benefit: no scattered configuration files, no inconsistencies, and no unexpected behavior after a restart.



Always know what your system is doing

ecore constantly monitors temperature, power levels, memory and overall health, and gathers everything that happens, across both systems on the chip, into one clear time-ordered record. You can also tell it to

flag specific events that matter to you.

Benefit: when something needs attention, you see exactly what happened, where and why, instead of investigating after the fact.



Fails safe, every time

Independent safety monitors watch the entire system around the clock, on both the real-time side and the operating-system side. If anything stalls or misbehaves, ecore reacts safely and records the cause of the fault.

Benefit: you can run equipment unattended, knowing it will fail safe and tell you why.



Configure and monitor from any browser

A built-in, touch-friendly web interface lets you set up, monitor and control the device from day one: from a laptop, a tablet, or a panel on the machine. It also offers a clean programming interface, so it is ready to plug into your own software or a cloud / IoT platform.

Benefit: commission and operate the device immediately, and integrate it into your wider systems whenever you are ready.



Professional data capture, built in

ecore can turn your controller into a precise measurement tool. It records data at high speed without losing a single sample, captures exactly the events you care about, and exports in standard industry formats used for analyzing power and industrial systems, all without interrupting your running application.

Benefit: lab-grade data acquisition on the same device that runs your machine, with no separate measurement hardware to buy or wire up.



Trace your software down to the nanosecond

When you need to understand why something happened and exactly when, ecore can trace its own software as it runs. Instrumenting

your code costs only a couple of register writes, so it barely touches the system and never disturbs your real-time control. The trace streams off the device over standard Ethernet, with no debug probe and no special bench hardware, and every event is timestamped to 4 nanoseconds. You open the result in Perfetto, a familiar, interactive timeline tool, and see precisely what each core and task did, instant by instant.

Benefit: diagnose timing issues, latency and complex multi-core behavior by measurement instead of guesswork, even on a device running in the field.



Update safely, from anywhere

Software can be updated remotely and securely over the network or locally. Updates are all-or-nothing, so the device is never left half-updated. If an update ever fails, the device automatically rolls back to the last working version and keeps running. Strong security checks protect it against tampered or unauthorized software.

Benefit: maintain and improve devices in the field without on-site visits, and without the risk of bricking a machine.



Talks to real industrial hardware

ecore already knows how to communicate with real power-electronics components and industrial sensors and networks. The platform comes prepared for the connections industrial machines actually use, rather than leaving you to build that groundwork yourself.

Benefit: connect your converter, sensors and field network, instead of writing low-level drivers from scratch.



Quick to set up, easy to adapt

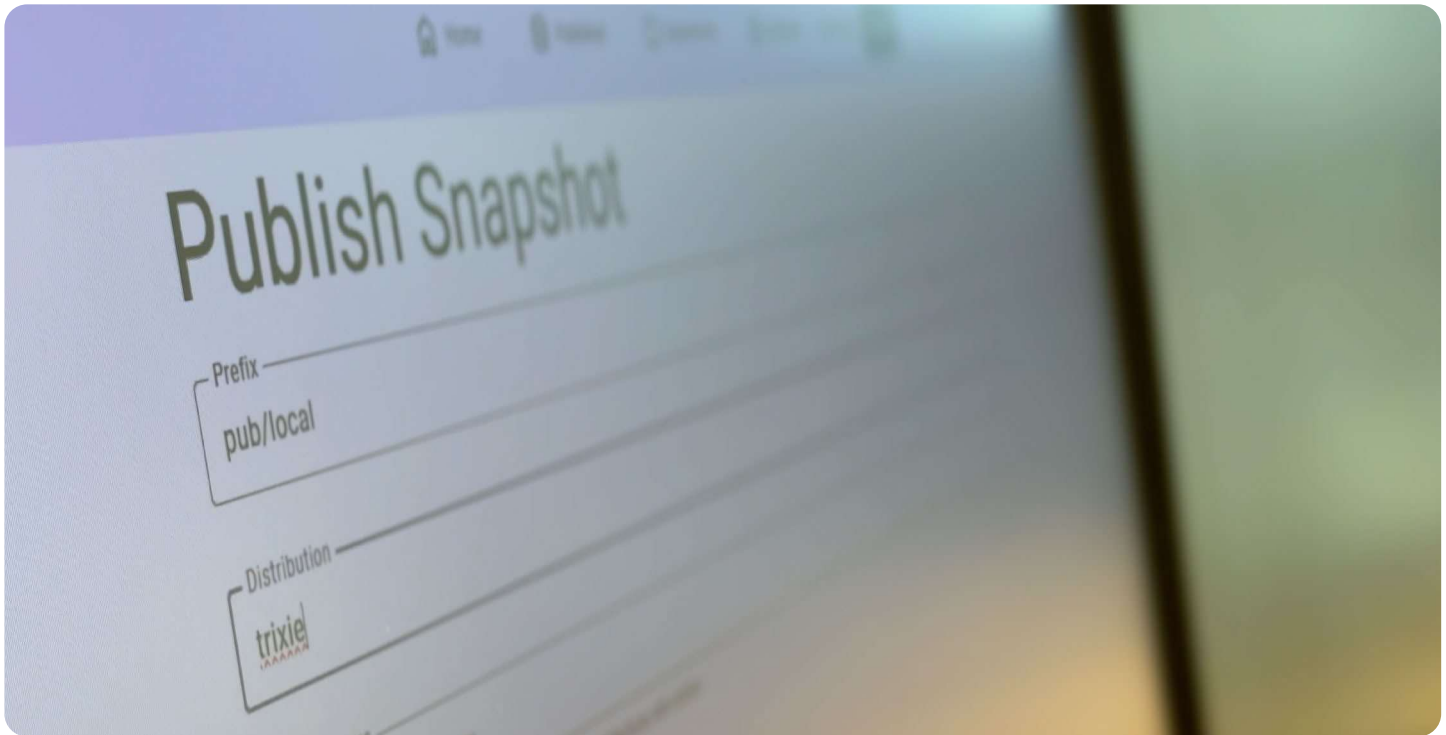
Setting up a controller like this by hand means juggling many large, fiddly configuration files, which is slow and easy to get wrong. ecore's configuration tools do that work for you, automatically and consistently, on both Windows and Linux. New product variants and prototypes come together in hours.

Benefit: your team spends its time on your product, not on repetitive setup, and every configuration is consistent and repeatable.

COMPANION TOOLS

ELKE & TRILOG

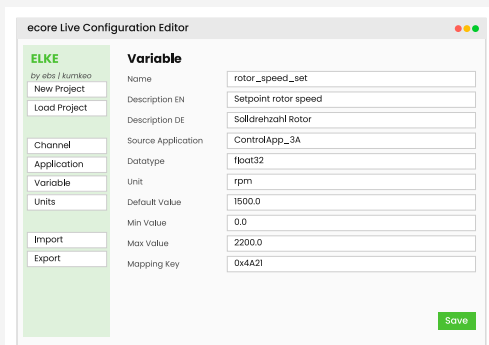
Two first-party tools close the loop between configuration and field data – both proven in industrial deployments.



ELKE

ecore Live Configuration Editor

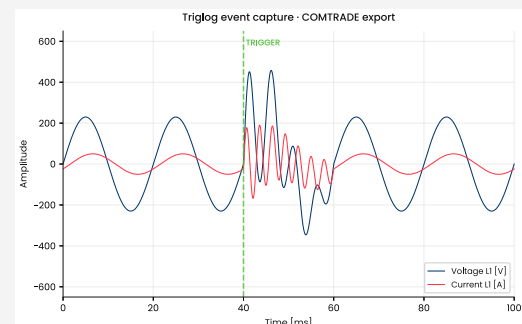
- Automated config – no manual file editing
- Reproducible configs across projects
- Faster project starts, fewer setup errors
- Cross-platform – Windows and Linux
- Field-tested with real users



TRIGLOG

Event-driven Data Acquisition

- 10 kHz sampling, no data loss
- Intelligent, event-driven triggering
- Direct COMTRADE export (IEEE standard)
- Multiple export formats
- Continuous real-time, no interruption



HARDWARE

ecore Master Controller v1

The ecore Master Controller is the production-ready hardware platform — usable as development board, test-bench controller, prototype, or batch production.

An AMD® Zynq® UltraScale+™ ZU9EG delivers the processing power, while three Gigabit Ethernet ports and eight expansion slots keep the system flexible for evolving requirements. Housed in a passively cooled industrial enclosure, it runs reliably without moving parts.



Technical specifications

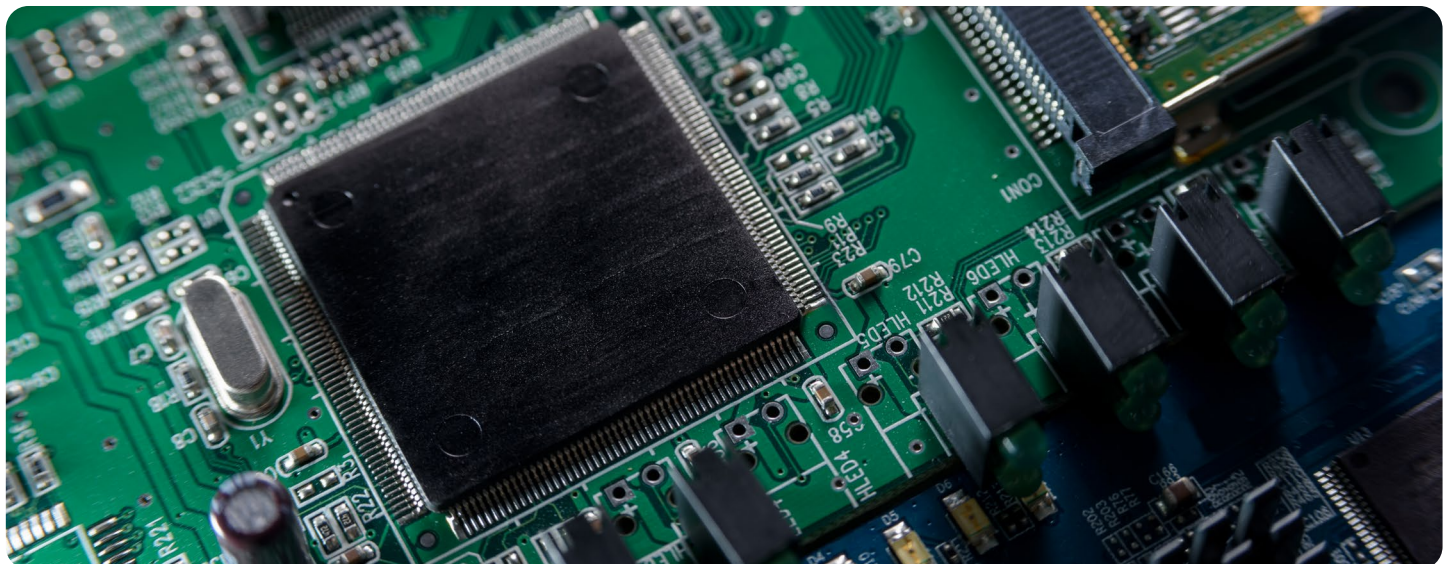
SoC	AMD® Zynq® UltraScale+™ ZU9EG
Memory	SD Card + eMMC
Power supply	24 V DC / 2 A
Network	3× Gigabit Ethernet, TSN-ready
Cooling	Passive (heatsink)
Temperature	Industrial range
Expansion	8× expansion slots
Mounting	DIN rail / cabinet mount

Software expansions

- SIMULINK® Target
- Real-Time Tracing
- PLL Sync
- Soft PLC

Hardware expansions

- Single GbE Copper
- Single GbE Optical
- Quad GbE Copper
- BiSS/EnDat Encoder



PORTFOLIO

Main products & expansion cards



ecore Software Reference Architecture

#4260629980169

Starter-Kit complete

Software Reference Architecture, Linux distribution, Simulink® Target, ELKE configurator, Triglog data acquisition.

Runs on all AMD® Zynq® UltraScale+™ MPSoCs.



ecore Master Controller V1

#4260629980152

Hardware platform

Industrial-grade housing, 8× expansion slots,

AMD® Zynq® UltraScale+™ ZU9EG SoC, passive cooling.



ecore Slave Controller V1

#4260629980176

Slave node

Distributed I/O interface, FPGA-driven, deterministic

Master synchronization, sensor/actor periphery.



ecore Evaluation Board V1

#4260629980183

Evaluation platform

Trenz Electronic SoM-compatible carrier (TE-0820/0821),

Hilscher netX 90 co-processor, full peripheral access.

Expansion cards for ecore Master Controller V1



Single GbE Copper

#4260629980312

RJ45 · 1 Gbit ·

TSN-capable acquisition



Quad GbE Copper

#4260629980336

4x RJ45 · 1 Gbit



Single GbE Optical

#4260629980329

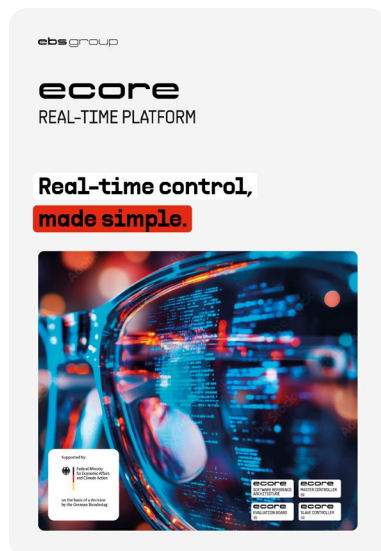
SFP · 1 Gbit · long-range



BiSS / EnDat Encoder

#4260629980343

Encoder interface



ecore.
Real-time control, made simple.

Have questions? We're happy to provide more information.
Visit ebs-group.io/ecore or send us an email –
our ecore team is ready to discuss your project.

bes@ebs-group.io

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