Cut the number
of electronic control units

ELMAR
REAL-TIME FRAMEWORK
developed by kumkeo

THE VERSATILE PLATFORM
FOR REAL-TIME APPLICATIONS

kumkeo

we.engineer

WOULD YOU LIKE TO DEVELOP
A NEW REAL-TIME-CAPABLE PRODUCT?

NEED TO QUICKLY MODIFY YOUR EXISTING SYSTEM?

Our versatile ELMAR platform is the ideal springboard for developing your new product or updating existing systems. Based on a prequalified evaluation board, the platform enables the fast development of prototypes through rapid prototyping. The ELMAR platform is equipped with a variety of features that enable you to promptly initiate realization.

While you focus on the development of your innovations, we support you in a consulting role throughout the entire product development cycle. At your request, we carry out application development through rapid prototyping and maintain the real-time framework on your behalf.

Dummy Application (software template)	Consulting / Development by kumkeo ▶	Customer Application(s) (software)
Real-time Framework (firmware)	Framework Maintenance carried out by kumkeo ▶	Real-time Framework (firmware)
Evaluation Board (hardware)	Consulting / Development by kumkeo ▶	Customized Series Hardware

Present ⦿ – – – – – – – – – – – – – – – ⚑ **Target**
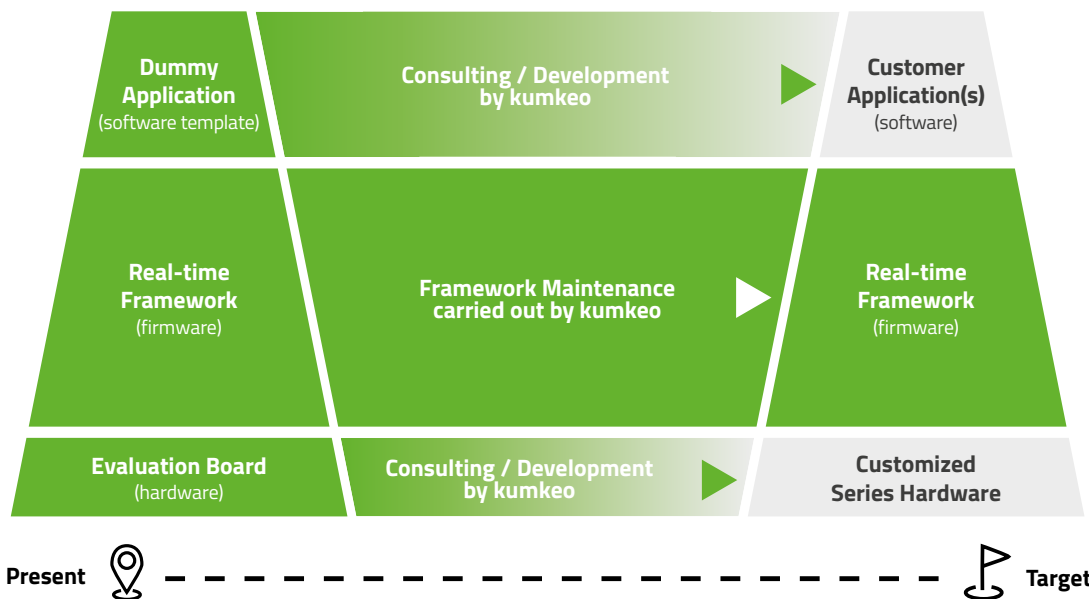
The ELMAR platform for real-time applications comprises:

- **Prequalified evaluation board**
- **Real-time framework**
- **Dummy application**

ELMAR
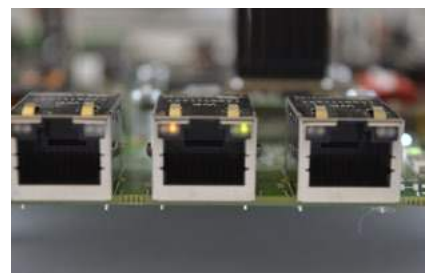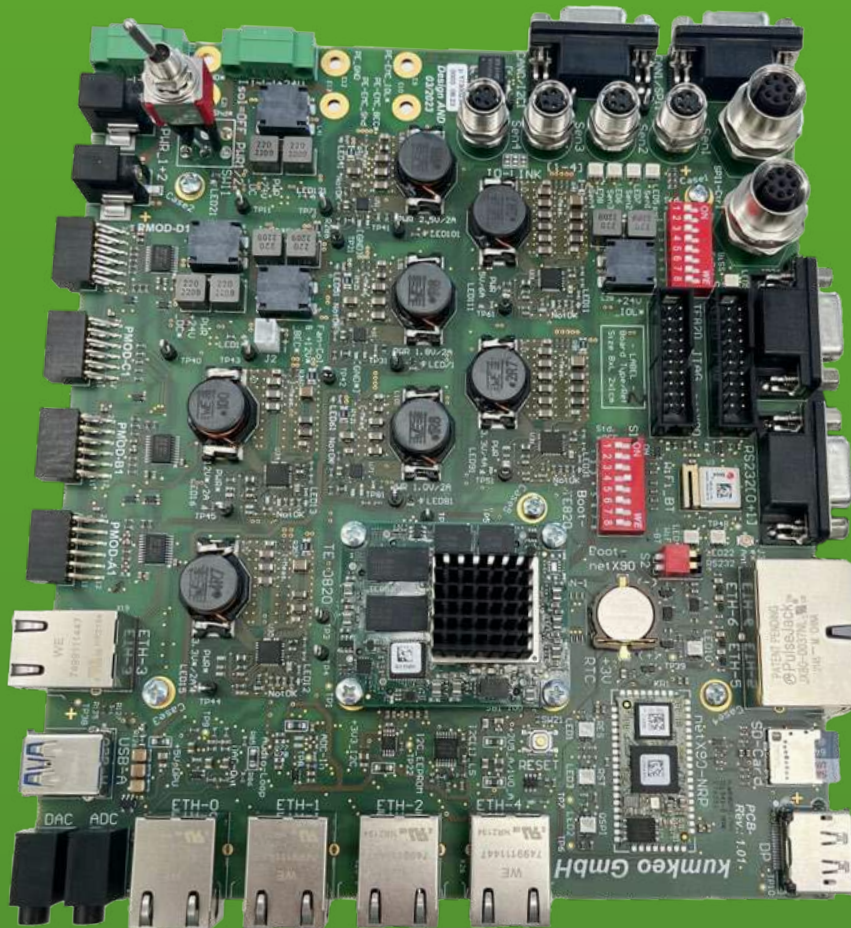REAL-TIME FRAMEWORK
developed by kumkeo

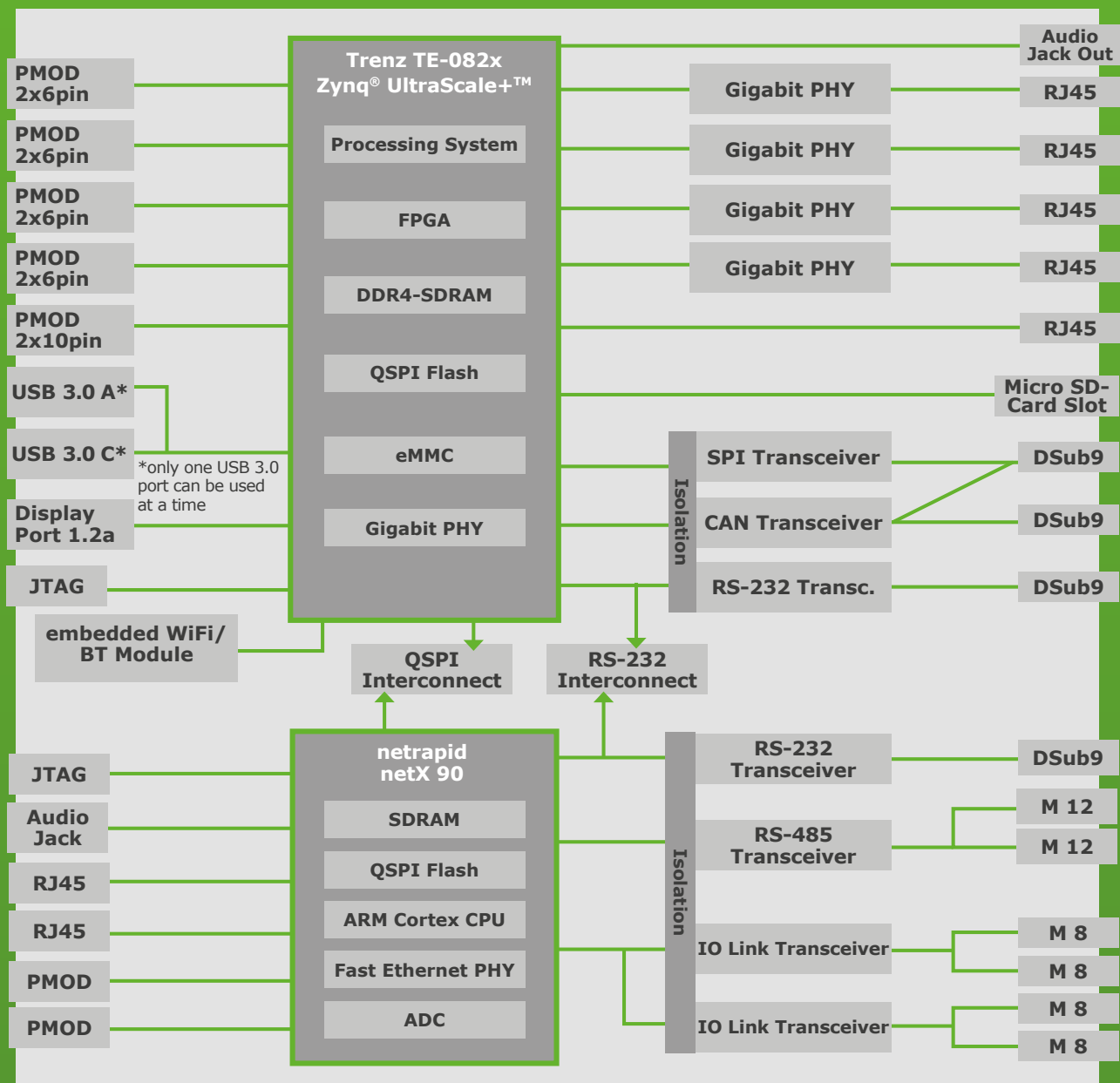Further information
kumkeo.de/en/elmar

PREQUALIFIED EVALUATION BOARD

The **prequalified evaluation board** offers you a flexible hardware platform on which to initiate development of the application. Taking center stage is an AMD® Zynq® UltraScale+TM MPSoC, which is available in various versions, depending on the requirements, and is pluggable via a carrier board. Available as a co-processor is the Hilscher netX 90 SoM, which supplements the board with field bus functions and sensor interfaces.

Prequalification and the expanded temperature range allow the evaluation board to be used for test benches and prototypes. Time gained up to completion of the specific hardware can be used for development and testing purposes. The evaluation board can also be used as a basis for specific hardware.

ELMAR
REAL-TIME FRAMEWORK

EVALUATION BOARD BLOCK DIAGRAM

	Trenz TE-082x Zynq® UltraScale+™		
PMOD 2x6pin	Processing System	Gigabit PHY	Audio Jack Out
PMOD 2x6pin		Gigabit PHY	RJ45
PMOD 2x6pin	FPGA	Gigabit PHY	RJ45
PMOD 2x6pin	DDR4-SDRAM	Gigabit PHY	RJ45
PMOD 2x10pin	QSPI Flash		RJ45

Diagram elements:

- PMOD 2x6pin
- PMOD 2x6pin
- PMOD 2x6pin
- PMOD 2x6pin
- PMOD 2x10pin
- USB 3.0 A*
- USB 3.0 C*
- Display Port 1.2a
- JTAG
- embedded WiFi/ BT Module

*only one USB 3.0 port can be used at a time

Trenz TE-082x Zynq® UltraScale+™
- Processing System
- FPGA
- DDR4-SDRAM
- QSPI Flash
- eMMC
- Gigabit PHY

- Gigabit PHY → RJ45 / Audio Jack Out
- Gigabit PHY → RJ45
- Gigabit PHY → RJ45
- Gigabit PHY → RJ45
- RJ45
- Micro SD-Card Slot

Isolation
- SPI Transceiver → DSub9
- CAN Transceiver → DSub9
- RS-232 Transc. → DSub9

- QSPI Interconnect
- RS-232 Interconnect

netrapid netX 90
- SDRAM
- QSPI Flash
- ARM Cortex CPU
- Fast Ethernet PHY
- ADC

- JTAG
- Audio Jack
- RJ45
- RJ45
- PMOD
- PMOD

Isolation
- RS-232 Transceiver → DSub9
- RS-485 Transceiver → M 12 / M 12
- IO Link Transceiver → M 8 / M 8
- IO Link Transceiver → M 8 / M 8

SELECTED EVALUATION BOARD FEATURES

- Compatible with Trenz Electronic TE-0820/0821 SoM Series*
  - Dual/Quad Core ARM® Cortex® A53
  - Dual Core ARM® Cortex® R5
  - Up to 4GB DDR4-RAM
  - FPGA up to 256K logic cells
- 5x Gigabit Ethernet
- PROFINET/TSN-ready
- Hilscher netX 90 co-processor
- Compliant with EMV standards*
- 10-layer PCB design
- Size: 200 x 170 x 20 mm

ELMAR
EVALUATION BOARD
>>> Block diagram

* See datasheet for evaluation board details

REALTIME FRAMEWORK

Our **real-time framework is a real-time architecture** for AMD® Zynq® UltraScale+TM MPSoCs that enables the operation of low latency regulating algorithms (optionally on the basis of Simulink®) parallel to embedded Linux distribution. A lightweight hypervisor ensures a distinct separation between Linux management and control on the basis of an RTOS.

Linux offers a web server, parameter administration, a firmware update mechanism and further features that simplify field administration of the board. In-house developed inter-core communication (ICC) provides synchronized communication between the ARM® cores for real-time applications.
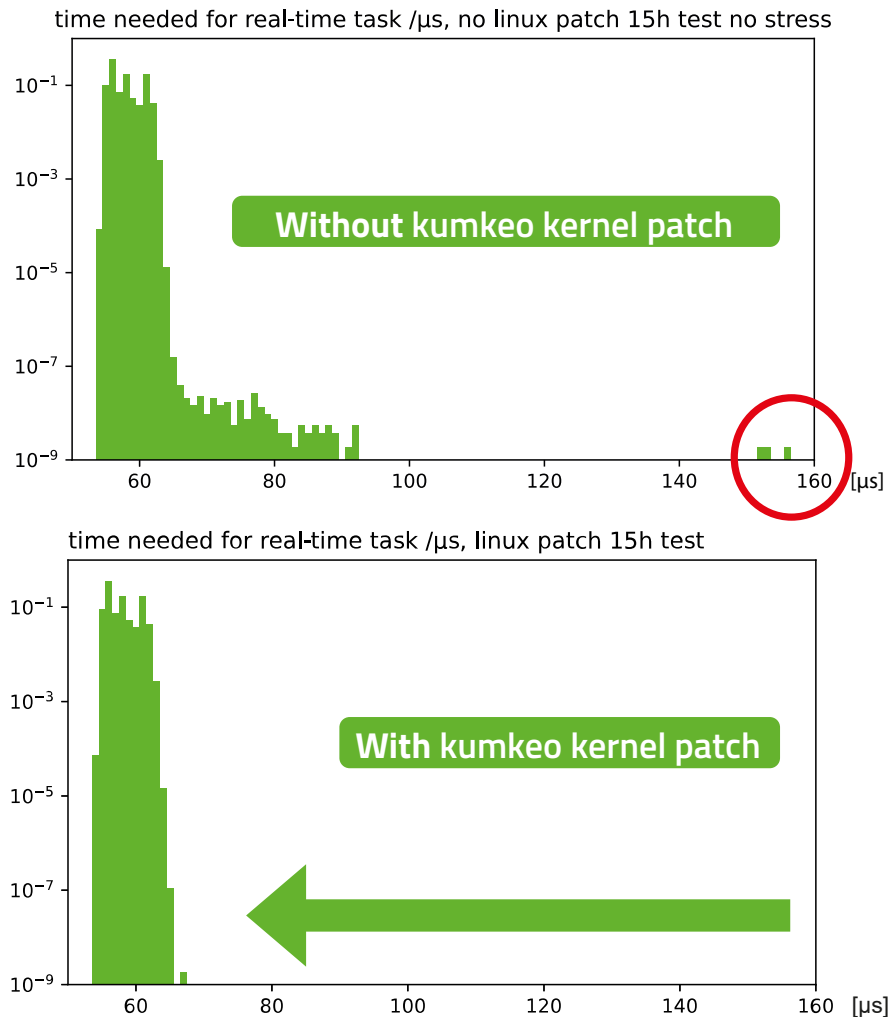
ARCHITECTURE BLOCK DIAGRAM
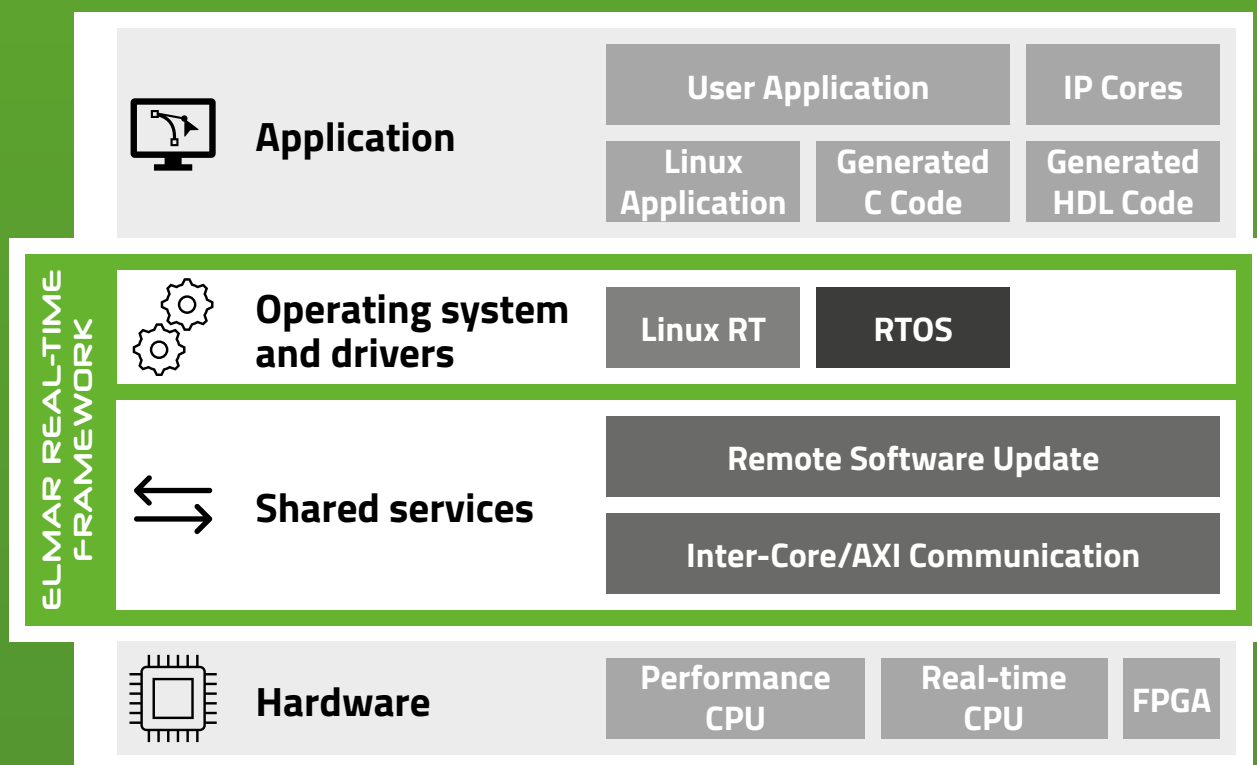
By applying our kernel patch, which has been specially developed for this platform,we can guarantee a stable 10 kHz frequency on the real-time cores. This is measured using a complex industrial Simulink® control algorithm.

PERFORMANCE

With our kernel patch specially designed for the AMD Zynq UltraScale+, we guarantee stable 10kHz inter-core communication between the real-time cores. This is verified using a complex industrial Simulink® control algorithm.

time needed for real-time task /µs, no linux patch 15h test no stress

Without kumkeo kernel patch

time needed for real-time task /µs, linux patch 15h test

With kumkeo kernel patch

DUMMY-APPLICATION

Configuration for your new application is already provided in the form of an example. This is ideal for using as a template.

ELMAR SCOPE OF SUPPLY AND SERVICES

The platform is available in the following versions:
- ELMAR complete
- ELMAR starter kit
- ELMAR smart
- ELMAR pure

ELMAR consequently tailores to your specific requirements. See ELMAR ordering information' for a more detailed supply and service description.

OVERVIEW OF SPECIFIC FEATURES

INTER-CORE COMMUNICATION MECHANISM

Synchronized communication of the process image between the ARM® cores on the basis of configurable and prioritization-capable channels.

VIRTUAL NETWORK AND PRIORITIZATION

Option to use a single IP interface outwardly for all ARM® cores. Prioritization according to EtherType via priority queues.

PARAMETER MANAGER

Centralized parameter management in Linux. Editable via web interface or primary controller. Persistent storage on SD card.

HW UND SW WATCHDOG

Configurable watchdog for real-time cores and Linux. Logging of reset reason.

CENTRALIZED LOGGING AND EVENT LOGGING

Central logging of all ARM® cores through syslog in Linux. Expandable to include configurable event messages.

REMOTE SOFTWARE UPDATE

Remote controllable A/B update mechanism; signing and encryption support. Automatic rollback in case of error.

SECURE BOOT

Optimal protection against compromised software through the use of Secure Boot.

WEBSERVER AND IoT SUPPORT

Provision of a web server and REST-API. Touch-optimized web interface for system information and configuration. Ready to connect to cloud/IoT platform.

SIMULINK®TARGET

Use of in-house Simulink® blockset to support the real-time cores. Complete integration into Simulink®; no need to use VITIS®. Supports external mode.

SCALABLE

Our framework runs on all versions of the AMD® Zynq® UltraScale+™ MPSoC series, e.g. AMD® KRIA boards.

CUSTOMER BENFITS

TURNKEY FRAMEWORK FOR INTEGRATING AN APPLICATION

Our real-time framework is immediately available and primed for integration of an application. The framework encompasses an example application that can be used as a template.

COMBINES THE BENEFITS OF BOTH ENVIRONMENTS (LINUX AND RTOS)

Isolation of Linux from the real-time cores through the use of a hypervisor means that the advantages of both operating systems can be exploited in parallel. Hypervisor latency is <3µs.

PREQUALIFIED AND DEPLOYABLE EVALUATION BOARD

Our evaluation board is immediately available and can be used as a development platform or within test benches, prototypes and small batch production, for example.

FRAMEWORK MAINTENANCE CARRIED OUT BY kumkeo

We continually enhance our real-time framework and make updates available in regular cycles. In the case of security patches, we provide a rapid response.

FOCUS ON CORE COMPETENCIES

While you concentrate on developing your application, we undertake the development of and any necessary adjustment to the real-time framework and also support you in a consulting role throughout the entire process.

EXPERIENCE GAINED THROUGH WORK IN THE FIELD

Our real-time framework is already in productive use in an automation technology sector industrial application and is currently being rolled out in series.

ELMAR
REAL-TIME FRAMEWORK
developed by kumkeo

**Our versatile and adaptable ELMAR platform is consequently the ideal starting point for developing your technical innovations.
We would be delighted to assist you in a consulting role within the scope of your product development process or provide support during development.**

kumkeo
Sector development partner specializing in consulting, project realization and product development.

TECHNICAL REQUIREMENTS FOR USING ELMAR

Depending on the respective scenario and application area, the requirements for using ELMAR are as follows:

- 24V DC power supply
- JTAG debugger (e.g. Olimex)
- RS-232 to USB adapter
- SD card with a capacity of at least 4GB
- Host computer with
  - administrator access to the SD card
  - configurable network interface for SSH access
  - Python 3.8 or later
  - 500GB free disk space
  - at least 16GB RAM

- AMD® VIVADO* (at least 2021.2)
- AMD® VITIS (at least 2021.2)
- Mathworks® MATLAB® Simulink® (at least 2021b) with the following toolboxes:
  - Simulink® Coder
  - Simulink® Embedded Coder
  - Simulink® HDL Coder
- Recommended: NTP server

*Note: Depending on the Zynq® UltraScale+TM MPSoC used, the free VIVADO Standard Edition may also be used.

ELMAR ORDERING INFORMATION

Item no.	Name	Scope
4260629980152	ELMAR complete	Evaluierungsboard Realtime Framework Dummy-Applikation
4260629980169	ELMAR starter-kit	ELMAR complete, zusätzlich mit: - 24VDC Netzteil inkl. Kabel - JTAG Debugger - RS-232 zu USB Adapter - SD Karte 8GB - CAT6 Ethernet-Kabel
4260629980176	ELMAR smart	Realtime Framework Dummy-Applikation
4260629980183	ELMAR pure	Evaluierungsboard

STILL HAVE QUESTIONS?

We would be delighted to provide you with further information. Please give us a call on +49 40 28467610 or send an email to service@kumkeo.de.

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