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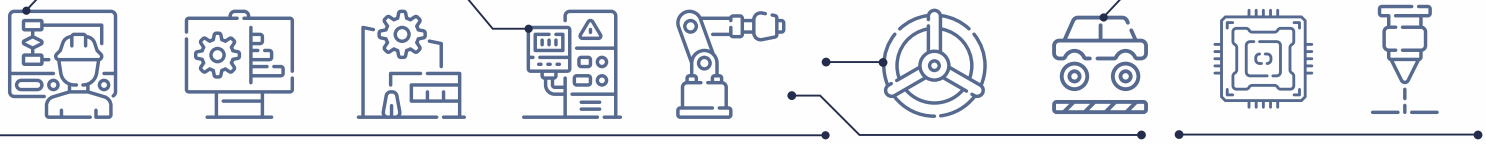
Your Automation expert



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koenig-pa GmbH

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About us

Our mission

We create innovative products and solutions for industrial automation to help our clients to develop and improve their business.

Brief history

The company was founded in 1986. At the beginning of its activity, the company specialized in providing engineering services for installation and adjusting of technological equipment in chemical production.

In 2004, the company developed a new software platform fastCenter for creating industrial automation systems. For more than 15 years of cooperation, more than a thousand technological lines for the production of printed circuit boards of our key customer Atotech Deutschland GmbH have been equipped with multifunctional systems SCADA based on the fastCenter platform for monitoring, data acquisition and control of technological processes.

Since 2004, koenig-pa GmbH is a member of the **EtherCAT Technology Group** (ETG) — an international association of developers and manufacturers, which use EtherCAT technology. koenig-pa GmbH has become one of the leading experts in this technology and has developed a line of software products to help developers to use EtherCAT in their solutions for automation and control systems.

In 2013, considering the growing role of robotics in major industries, as well as the high demand for independent software solutions, our company expanded the software product range with KPA Motion that implement motion control functions.

In 2018, the unique system, KPA Master Redundancy (patent No. US 10,102,163 B2), for protecting automated control systems from failures was developed. In case of a failure of the “active” master, the presence of “passive” masters in the EtherCAT network configuration allows to switch control to the “passive” master immediately without waiting for the end of the cycle and without losing data.

In 2020, our company introduced KPA Automation softPLC, a multi-tasking PLC programming environment based on the straton® PLC core. KPA Automation softPLC complies with PLCopen standards, supports ST, IL, FBD, SFC, LD programming languages in accordance with IEC 61131-3 standard and can be used on both small and industrial platforms with or without an operating system.

More than 500 customers in various countries of the world and various industries successfully use koenig-pa GmbH software products, solutions and electronic devices.

The company has an extensive network of resellers selling licensed koenig-pa GmbH software in such countries as China, India, Italy, South Korea, USA and Japan.

The existing partner program allows customers to use koenig-pa GmbH software products in the optimal way as a part of well-proven systems and solutions from our hardware partners.

Our expertise

From the first days of our business, we strive to ensure that our products are in line with the latest trends in IT and industrial automation. For more than 30 years, we have managed to accumulate profound knowledge and experience in the following fields:

- Development of software products for various operating systems: Windows, INtime, Linux, Xenomai, QNX, RTX64, VxWorks, Integrity, FreeRTOS, Nucleus, ITRON, and others.
- Creation of industrial automation systems using equipment from the leading manufacturers: Beckhoff, Siemens, Nordac, Lenze, Ancosys, and others.
- Working with various industrial buses and networks: EtherCAT, CAN, PROFIBUS, Modbus, TCP/IP, and others.
- Use of processors, SoCs, microcontrollers, DSPs and FPGAs from industry leaders: Altera, Analog Devices, Atmel, Freescale, Intel, Texas Instruments and Xilinx.

Highly qualified specialists of koenig-pa GmbH are involved in international projects of various fields, including process automation, embedded system development, servo drive production, robotics, electronics, automotive, energy, and much more.

Our quality management system meets ISO standards and covers all our products and services. All company processes, from a product order to technical support, are managed according to our quality management system.

KPA EtherCAT Master

EtherCAT network control

KPA EtherCAT Master is a software stack, which corresponds to all EtherCAT Technology Group stan-dards and has numerous features, which can be used for developing of cost-optimized and powerful PLC on almost any platform (such as arm/arm64 or x86/x64) to control EtherCAT I/O produced by any vendor.

Benefits and key features

- **Meets EtherCAT Technology Group (ETG) standards**

  KPA EtherCAT Master can be delivered as standard or customized feature packages. Two standard packages are available according ETG.1500 standard: Class A (Standard package) and Class B (Basic package). Moreover, koenig-pa GmbH introduces Premium package, which integrates various additional features for creating innovative applications.

- **Available for numerous operating systems, as well as OS-less systems**

  KPA EtherCAT Master is available for numerous operating systems, including Windows, INtime, RTX64, Linux, Xenomai, QNX, VxWorks, FreeRTOS, ITRON as well as OS-less systems. Upon request, koenig-pa GmbH experts can adjust support for any operating system.

- **Hardware extensions for Xilinx/Intel FPGA (Altera) and Texas Instruments PRUSS Sitara CPU**

  Availability of IP Cores for Xilinx and for Intel FPGA (Altera) FPGAs, PRUss co-program for Texas Instrument Sitara CPUs (AM47x and AM57x) increases productivity and data processing efficiency. Implementation for AM6x is available upon request.

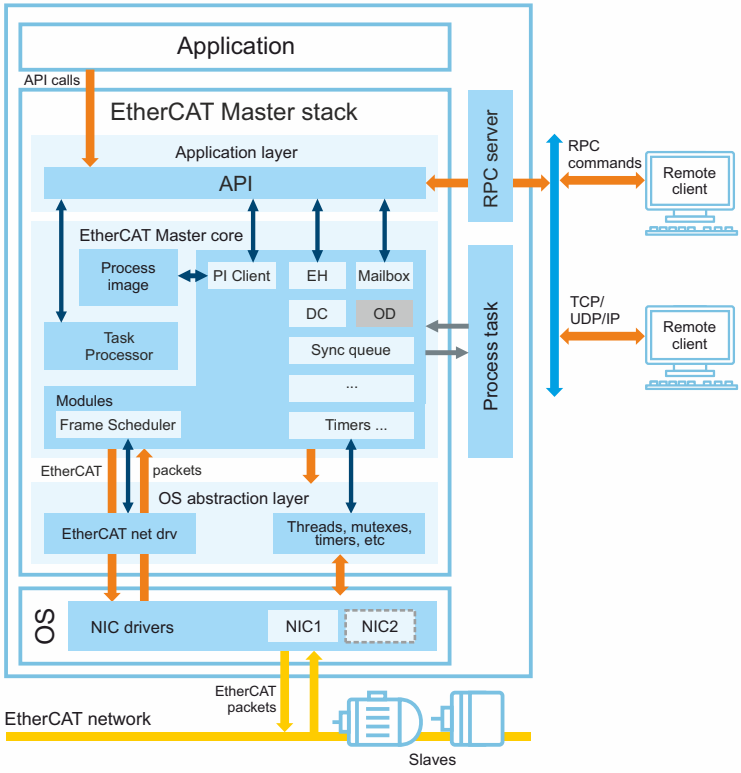
- **Auto Configuration**

  KPA EtherCAT Master can configure bus on the fly without EtherCAT configuration tools. The Autoconfigurator module allows a user application to select slave's configuration and to switch between different configurations of the slave, for example, between position control of a drive and velocity control, or between bus configurations with a different number of slaves.

- **Process image logging for data transferring into analytic tools**

  Process image (PI) logger allows to collect real-time data for transferring to other levels without influence on real-time behavior of the control system. Data can be transferred to MATLAB, LabView (TDMS format), and any other analytic tools. LabView full integration is provided by the partner of koenig-pa GmbH – Ackermann Automation GmbH. Moreover, koenig-pa GmbH has designed a special Python extension, which allows to aggregate data into a file of any format, for example a CSV-file, for its further processing.

KPA EtherCAT Master Stack Architecture



Feature packages

Features	Basic	Standard	Premium
Process Data Exchange	●	●	●
Network Configuration	●	●	●
Mailbox support	●	●	●
CoE	●	●	●
FoE	●	●	●
Synchronization with Distributed Clock (DC)	○	●	●
DC support	●	●	●
Time distribution (Slaves synchronization)	●	●	●
Slave-to-Slave Communication	●	●	●
Explicit Device Identification	—	●	●
EoE	—	●	●
SoE	—	●	●
AoE	—	●	●
VoE	—	●	●
Continuous Propagation Delay compensation	—	●	●
Sync window monitoring	—	●	●
Synchronization of Master with Slaves	—	●	●

Feature Packs	Basic	Standard	Premium
FP External Synchronization	—	○	○
FP Cable redundancy	○	○	●
FP Hot Connect	○	○	●
FP Mailbox Gateway	○	○	●
KPA Extensions			
Data logger	○	○	●
Frame logger	○	○	●
PI Snapshot	○	○	●
Events handler	○	●	●
PI logger	○	○	○
CAN DBC driver	○	○	○
VCOM driver	○	○	○
Autoconfigurator	○	○	○
KPA Master redundancy	○	○	○
Optimized drivers and HW Extensions	○	○	○
Hardware timed send	●	●	●

● Included in the delivery set
— Not included in the delivery set
○ May be included in the delivery set

Custom Development

koenig-pa GmbH offers specific software development for customers who require additional support for integrating EtherCAT capabilities into their applications or solutions.

KPA EtherCAT Slave

Software stack for device development facilitation

KPA EtherCAT Slave is a software stack, which is developed to run on microcontrollers, CPUs, or DSPs with or without any operating system (OS) and is especially designed to minimize time to market for companies that want to be a part of dynamically increasing EtherCAT market.

Benefits and key features

- **Meets EtherCAT standards**

  KPA EtherCAT Slave stack supports all features defined in EtherCAT standards. Each new version of the stack is verified with the latest released and all internal versions of the EtherCAT Conformance Test Tool (CTT) due to koenig-pa GmbH is a member of Technical Working Group Conformance.

- **Portability**

  KPA EtherCAT Slave stack may be presented as a software stack with embedded Hardware Abstraction Layer (typically implemented through OSAL and driver part), which can be used for simple support of any EtherCAT ASIC and communication interface (PDI) between ASIC and a microcontroller.

- **Optimized memory usage for embedded platforms**

  Used RAM size depends on application design and the size of the Object Dictionary (OD). For example, in case of static OD usage (a build based on source code):

  RAM size:
  - >= 3 KB for Basic package
  - >= 8 KB for Standard package

  ROM (flash) size:
  - >= 55 KB for Basic package
  - >= 64 KB for Standard package

  Moreover, to minimize a final size of the application, KPA EtherCAT Slave stack may be customized by editing the configuration file, for example, it is possible to deactivate Mailbox EoE, Mailbox VoE and Mailbox FoE.

- **Support**

  In comparison with non-commercial or open source EtherCAT slave stacks, koenig-pa GmbH offers support for 1 year.

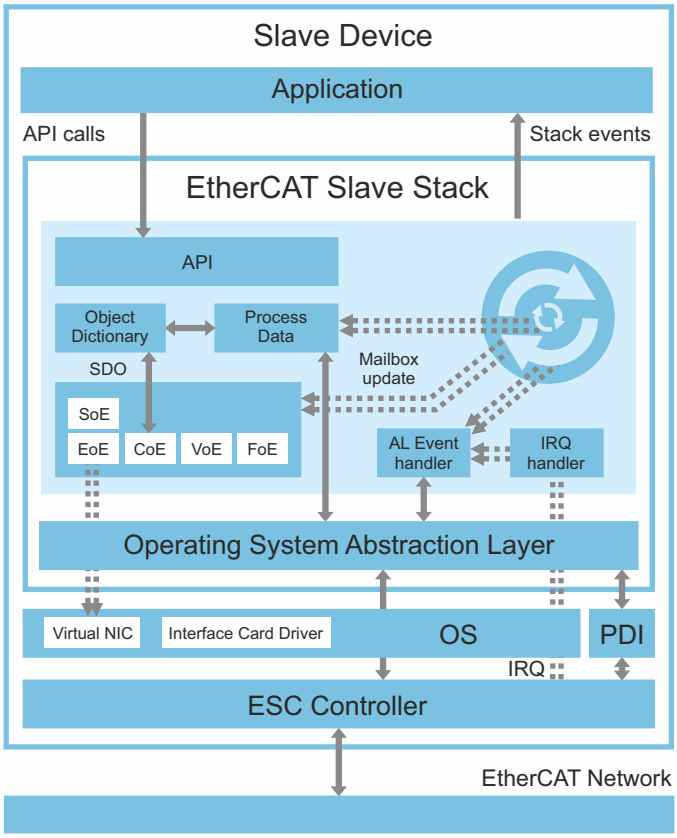
Feature packages

Standard

- Mailbox protocols: CoE, EoE, FoE, SoE, VoE
- Runtime generation and changing of the OD
- Adapted to operating system by using Operating System Abstraction Layer (OSAL)
- Virtual Ethernet card support for EoE (depending on OS)

Basic

- Mailbox protocol: CoE
- Static OD with pointer given from application
- With or without Interrupt Service Routines (ISR)



An EtherCAT Slave stack package may include a set of ready solutions for specific platforms and operating systems, such as:

Platforms:

- XMC4800 (Infineon)
- Microblaze (Xilinx)
- Sitara AM335x with ESC PRU (Texas Instruments)
- C2000 (Texas Instruments)
- STM32 (ST)
- NIOS II (Intel FPGA/Altera)

Operating systems:

- Linux (with/without RT-Preemption patch)
- Linux + Xenomai
- QNX
- No OS

KPA EtherCAT Studio

EtherCAT configuration tool

KPA EtherCAT Studio is a second generation of a user-friendly tool for EtherCAT bus configuration and diagnostics. This lightweight, high-performance standalone Windows application natively supports all the advanced features of KPA EtherCAT Master.

Benefits and key features

- **Meets EtherCAT Technology Group (ETG) standards**
  KPA EtherCAT Studio is compliant with EtherCAT Technology Group (ETG) standards and can create ENI (EtherCAT Network Information) files for EtherCAT masters from various vendors.

- **Extended Slaves Library**
  Slaves Library is a list of available ESI (EtherCAT Slave Information) files, which can be used to build up the project configuration. KPA EtherCAT Studio provides an opportunity to work with several Slaves Library collections, change an active collection by using a custom collection and manage Slaves Library view by setting user attributes for slaves.

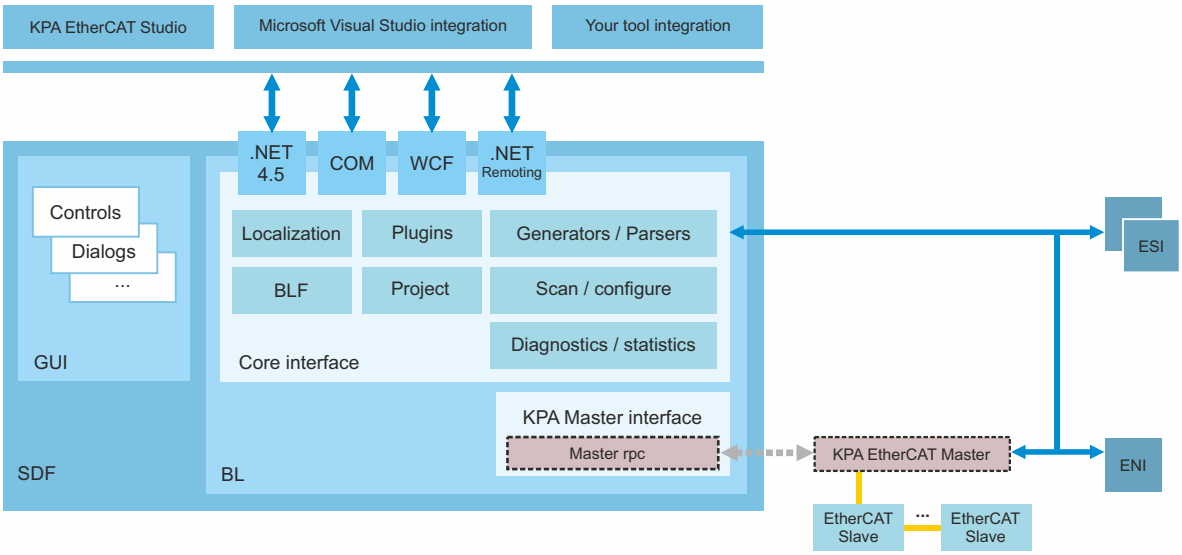
- **IO-Link device support**
  KPA EtherCAT Studio gives a possibility to configure IO-Link device directly within the plugin and use a built-in expandable library of supported IO-Link devices for quick and easy integration.

- **Available for integration**
  KPA EtherCAT Studio can be integrated into any custom application using SDF API (.NET, COM) or .NET Remoting.

- **Customizable branding options**
  With KPA EtherCAT Studio 2, branding data such as product names, logos, copyright information and contact details can be customized to meet specific brand needs..

- **Problem diagnostics**
  KPA EtherCAT Studio includes system problem diagnostics, which provides clear data interpretation for further successful problem solving.

Studio Development Framework architecture and integration



Feature packages

Features **Studio**	Studio 2	Studio 2 Trial
Attaching to Master	●	●
Automation Interface	●	—
Engineering Unit Mapping	●	●
Export uESI for Autoconfigurator	●	—
Scaling Signal Values	●	●
Slaves Library	●	●
Plug-ins for configuring specific devices		
CANopen Master/Slave (EL6751)	●	●
Profibus Slave (EL6731-0010)	●	●
Bridge terminals (EL6692/EL6695)	●	●
Modular Devices	●	●
Virtual Serial COM	●	●
MDP Profibus Master Gateway Profile 3100	○	○
IO-Link	○	○
Tools		
Studio/Emergency/Master Output	●	●
Topology Viewer	●	●
Snapshot Viewer	●	●
Chart Viewer	●	●
Watch Viewer	●	●
Process Image Viewer	●	●
S2S Communication Editor	●	●
EEPROM Editor	●	—
Sample Rate Editor	●	●
Fixed Process Image Editor	●	●
Dashboard	●	●
Dashboard customization	●	—
Diagnostic scanner	●	●
Motion Configuration Utility	●	●
Data logging tools	●	●
Comparing tools	●	●

Features **Common**	Studio 2	Studio 2 Trial
DC	●	●
Oversampling	●	●
Tasks/Sync Units	●	●
Power calculation via LVDS	●	●
Master		
Cable Redundancy	●	●
Cyclic Commands	●	●
ENI Export	●	●
External task	●	●
Master.Mailbox.AoE	●	●
Master.Mailbox.EoE	●	●
Master Watchdog	●	—
PI Alignment	●	●
Slave		
Configuring Init Commands	●	●
Direct EEPROM access	●	●
Direct Memory access	●	●
Explicit Identification	●	●
FMMU/SM	●	●
Slave.Mailbox.AoE	●	●
Slave.Mailbox.CoE	●	●
Slave.Mailbox.CoE Object Dictionary Writing	●	—
Slave.Mailbox.CoE Object Dictionary Exporting	●	●
Slave.Mailbox.EoE	●	●
Slave.Mailbox.FoE	●	●
Slave Watchdog	●	●
Hot Connect	●	●

● Included in the delivery set
— Not included in the delivery set
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KPA Master Redundancy (patented technology)

Network protection from control system failure

Inbuilt EtherCAT functionality of cable redundancy cannot protect the control system, where control application with EtherCAT master is launched, from restart, disconnection or failure.

KPA Master Redundancy is koenig-pa GmbH patented technology, which resolves mentioned problems and allows to stay operational even in synchronized environment.

Benefits and key features

- **Unique technology for network protection from control system failure**
  koenig-pa GmbH patented technology – Master Redundancy – provides unique fault tolerance to resist possible control system failures.

- **Support of any network topology**
  Master Redundancy supports a network of any topology, such as a ring, a star, and a daisy chain.

- **Unlimited number of control system units**
  Master Redundancy can be used for unlimited number of control system units. It is possible to enable multiple redundant masters without collision when two or more passive masters attempt to start the failover protocol.

- **Cost-effective solution**
  For stable system operation, there is no need to use expensive equipment such as a real-time Ethernet switch.

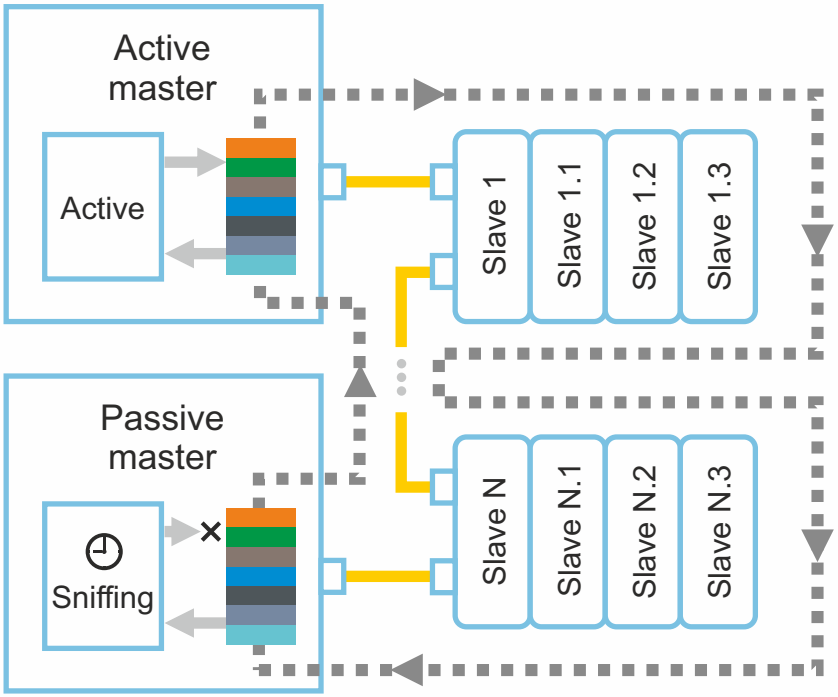
- **Prompt response to system failures**
  Redundant master can take the control immediately without any dedicated control device, additional signal lines or manual control.

- **Adaptation to any fieldbus system**
  Any fieldbus system using hop-to-hop serial master-to-slave communication principle.

Workflow

EtherCAT configuration with enabled Master Redundancy consists of an active master device and one or several passive masters.

Master is an agent, which cyclically creates a data telegram, fills it with requests, and sends it to the bus in strict time intervals. A data telegram is common to all slave devices connected to the bus, and it passes from one device to another.



This feature is extremely useful for fault tolerance: any device connected to the bus is fully aware of slave's activity and can transparently acquire, or sniff, the data, which is transferred between master and slaves. There is no need to modify any slave devices, to add any additional signals, or to change the transfer protocol.

During a normal operation, redundant master is passive, sniffs data, and doesn't enter its own telegrams. As all passive masters are consistent with the bus activity, they are ready to take place of active master anytime, when it fails.

When passive master is not getting a telegram he expects, he knows that the bus has no master anymore. There is no need to wait until the current cycle is over – redundant master can take control immediately, posting his own telegram. And this telegram will be correct and meaningful, because passive master was tracking the same changes with failed active master.

KPA Motion Control

Software for Motion Control

KPA Motion Control is a library used in software motion to turn any device to motion controller using position, velocity or torque control. KPA Motion Control is specially designed for automation industry, medicine, and other fields, where it is necessary to control the moving parts of equipment, for example, for numerical control (CNC) machines. KPA Motion Control is implemented according to PLCopen specifications.

Benefits and key features

- **3D-axis, synchronized axis and single-axis motion control**
  KPA Motion Control provides the opportunity to create custom applications for managing portal systems and 3D-axis motion with complex trajectories.

- **Time-optimal trajectory generation on the fly**
  Internal algorithms of KPA Motion Control allow to generate time-optimal trajectories at each motion cycle.

- **Jerk-limited**
  KPA Motion Control helps to reduce equipment wear, acoustic noise, and loads amplitude in motion.

- **Operating System Abstraction Layer**
  KPA Motion Control is compatible with various systems due to developed Operating System Abstraction Layer (OSAL).

- **Bus Abstraction Layer**
  Bus Abstraction Layer (BUSAL) allows to interact with drivers based on various profiles, such as CiA402/DS402, SERCOS and PROFIdrive.

- **Available for various CPUs**
  KPA Motion Control offers multi-thread processing for multi-core CPUs and is also optimized for low-end CPUs.

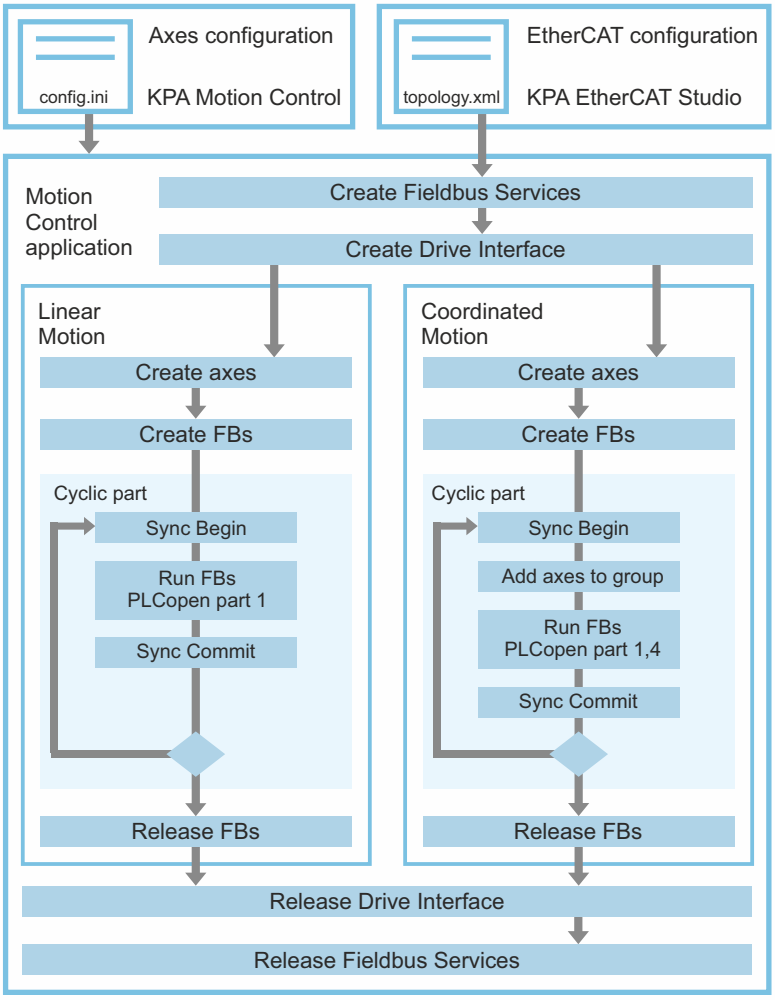
- **Native EtherCAT bus support**
  EtherCAT bus support is provided by a comprehensive own-developed master driver.

- **Meets industry standards**
  koenig-pa GmbH is a voting member of PLCopen Group. KPA Motion Control supports PLCopen specifications with additional extensions.

Workflow

KPA Motion Control is delivered as an archive, which includes documentation, header files, libraries and examples. Remote usage of product capabilities is provided by proxy development kit. KPA Motion Control allows to control drives using a non-real-time OS on the client side due to motion control performed in a real-time OS on the server side.

KPA Motion Control is complemented with Motion Configuration Utility – a plug-in of KPA EtherCAT Studio, which allows to create configuration, check it and generate configuration files for custom applications.



KPA Motion Proxy

KPA Motion Proxy is an add-on to KPA Motion Control that allows to transfer control logic of the real-time application to the non-real-time system. It means, that this add-on provides remote control of real-time motion application. The addition consists of two parts: client (works on non-real-time system) and server (works on real-time system). KPA Motion Proxy is a bridge for GUI interfaces which allows to increase application interactivity and to improve visualization of the application.

KPA Automation softPLC (based on straton® PLC core)

KPA Automation softPLC Embedded Tools
Software components for embedded platform

Focused on IEC 61131-3, KPA Automation softPLC technology is designed for all automation solutions, from machinery, controllers and drives manufacturers, to system integrators and machine builders. This technology is based on straton® PLC core and fulfils the 4 key requirements we apply to our products: Small, Smart, Simple and Speedy.

- **Simplify the configuration**
  KPA Automation softPLC Integrated Development Environment (IDE) includes a hardware device and fieldbus configuration tool for various kinds of networked I/Os or protocols, and enables to describe networks as configuration trees and to wire variables to the I/O channels of hardware devices.

- **Secure applications - Redundant System**
  All key application information is stored in one unique block of memory and all the redundancy mechanisms are available to make a hot restart of the application. A standard redundant implementation through Ethernet is delivered with PLC engine of KPA Automation softPLC, using a proprietary protocol over the link that needs no specific programming or configuration.

- **Reduce engineering time**
  KPA Automation softPLC project automation tool allows you to automate the import/export of information from your databases or other tools directly into the application (variable definitions and I/O configurations but also application programs generated automatically or copied from existing templates).

- **IEC 61131-3 standard programming**
  KPA Automation softPLC development environment is a set of powerful text and graphic editors for IEC 61131-3 languages: Sequential Function Chart (SFC), Function Block Diagram (FBD), Ladder Diagram (LD), Structured Text (ST) and Instruction List (IL).

- **Commissioning - Debugging**
  KPA Automation softPLC provides built-in simulation within the development environment in various modes of operation such as cycle by cycle, step by step, breakpoint and console mode.

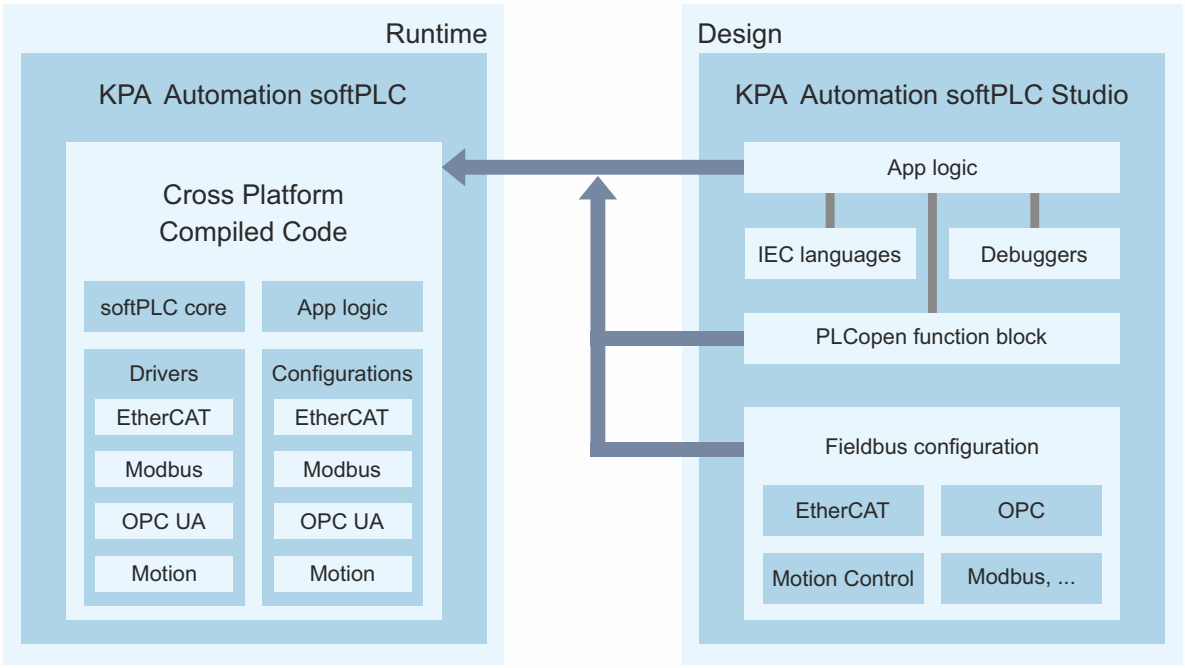
- **Softscope**
  An integrated scope using a real-time high-speed protocol can be configured to monitor key variables within the application to provide detailed debug information with high precision.

- **Distributed Application**
  PLC engine of KPA Automation softPLC permits real-time exchanging of data among different runtime systems through Ethernet. The event based protocol technology is used and it ensures high performance and very low network traffic at runtime.

- **Communication**

  KPA Automation softPLC supports a wide range of industry standard protocols for various sectors and application areas including automotive, building automation and energy: OPC UA (Server and Client), Modbus (Master and Slave, both TCP and serial), EtherCAT (Master and Slave), PROFINET Controller.

- **Solutions**
  - Energy
  - Motion Control and Drives
  - Science and Education
  - IEC 61131-3 embedded
  - Gateway
  - Fieldbuses
  - IoT connectivity



Custom Development

koenig-pa GmbH offers specific software development for customers who require additional support for integrating our products into their applications or solutions.

KPA Automation Control System

Hardware solutions

KPA Automation Control System is a compact system, equipped with energy-efficient CPUs and advanced SCADA software. This system is used for complex control tasks and is specially designed to save extra space and reduce the cost of maintenance.

Benefits and key features

- **High performance**

  KPA Automation Control System is equipped with Intel Core i5 CPUs for sophisticated control tasks.

- **Compact, cost-saving system**

  KPA Automation Control System is a compact single-block device thoroughly designed for saving space and reducing the cost of maintenance.

- **Windows 10 LTSB IoT pre-installed**

  KPA Automation Control System is a complex solution with pre-installed software and the operating system. koenig-pa GmbH ensures full compatibility with Windows 10 LTSB IoT.

- **Native EtherCAT bus support**

  EtherCAT bus support is provided by a comprehensive own-developed master driver.

- **Connection to various PLC**

  Data is transferred between PLC and KPA Automation Control System through OPC, Modbus TCP/IP, or custom TCP/IP protocols.

- **Advanced software package: HMI and PLC**

  A delivered package may include the following software:

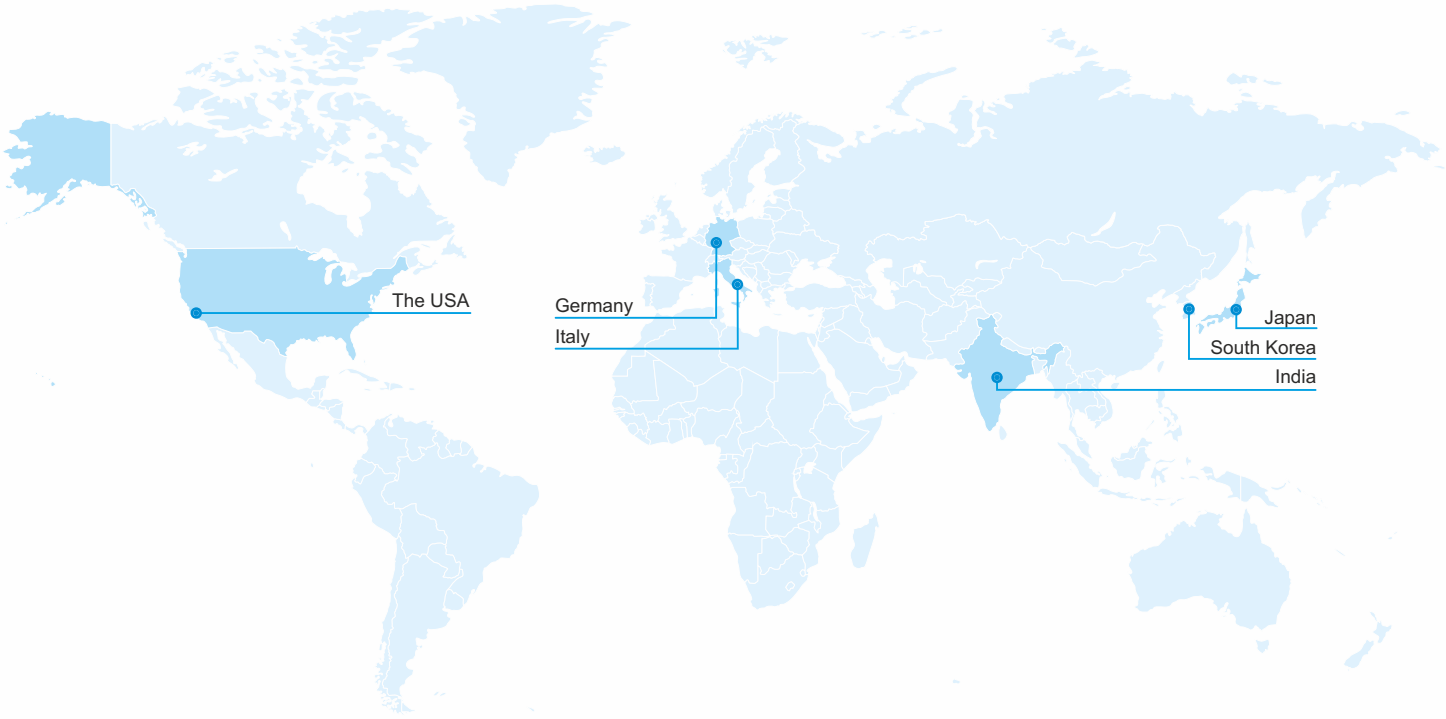
  - KPA Automation View – a powerful HMI solution with designer tools for programming appearance and behavior of each interface control. It provides access to unlimited tags through OPC UA, OPC DA Classic or custom TCP-based protocols.
  - KPA Automation softPLC – is a programming environment for developing PLC for real-time operation systems such as Linux, Xenomai, INtime, Windows. Focused on IEC 61131-3, KPA Automation softPLC technology is designed for all automation solutions, from machinery, controllers and drives manufacturers, to system integrators and machine builders.

Hardware specifications

Model	KPA Automation Control System Panel	KPA Automation Control System Box
CPU	i3 / i5 / i7 / Celeron / Atom	i3 / i5 / i7 / Celeron / Atom
RAM	4 / 8 / 16 GB	4 / 8 / 16 GB
Display controller	Embedded, Intel® integrated	Embedded, Intel® integrated
Storage	64 Gb SSD or higher	64 Gb SSD or higher
Networking	Multiple Intel® I210/I211 Ethernet Controller	Multiple Intel® I210/I211 Ethernet Controller
Interfaces	Various VGA, DVI, HDMI, USB 2.0/3.0, RS-232/485 (depending on part number)	Various VGA, DVI, HDMI, USB 2.0/3.0, RS-232/485 (depending on part number)
Display	Integrated 12/15/15.6/17/19/21”, max. resolutions 4K, 4:3/16:9, resistive or capacitive touch panel	Integrated 12/15/15.6/17/19/21”, max. resolutions 4K, 4:3/16:9, resistive or capacitive touch panel
Power source	9...30V DC	9...30V DC
Case protection	IP20...IP65	IP20...IP65
Cooling	Active or fanless	Active or fanless
Regulatory	FCC, CE, RoHS standard	FCC, CE, RoHS standard
Working conditions	Temperature: -20...60 °C, Relative humidity 0...90%, non-condensing	Temperature: -20...60 °C, Relative humidity 0...90%, non-condensing

koenig-pa GmbH
Im Talesgrund 9a
91207 Lauf a.d. Pegnitz
Germany
www.koenig-pa.de

Contact
email: sales@koenig-pa.de
tel.: +49 9128 725 330
tel.: +49 9123 960 5796



International Resellers

India
KPA India Solutions
tel.: +91 9923123255
nilesh.dagade@kpaindia.co.in
www.kpaindia.co.in

India
SAS Automation
tel.: 9850418036
support@sasnextgen.co.in
www.sasnextgen.co.in

Italy
Telestar
tel.: +39 0321 966 768
telestar@telestar-automation.it
www.telestar-automation.it

Japan
MICRONETcorp.
tel.: +81 299 90 1733
salesadmin@mnc.co.jp
www.mnc.co.jp

South Korea
JNS Global
tel.: +82 02 6083 4556
jnssales@jnsglobal.co.kr
www.jnsglobal.co.kr

United States
RADIC Technologies
tel.: +1 408 263 6500
sales@radictech.com
www.radictech.net