

KPA EtherCAT Master

KPA EtherCAT Master is a comprehensive product for industrial automation specialists who intend to add high-speed communication capabilities to their applications and solutions. This software stack was ported to various real-time operating systems and hardware platforms, and its unique features facilitate better integration and performance increase.

Key Features

- Versatile functionality exceeding EtherCAT Technology Group (ETG) standard classes
- Available for numerous OS platforms, RTOS and OS-less systems
- Optimized for Xilinx, Intel FPGA (Altera) and others
- Master Redundancy for exceptional fault tolerance
- Online configuration including bus scan and automatic bus configuring
- Experienced team of support engineers ready to help with integration

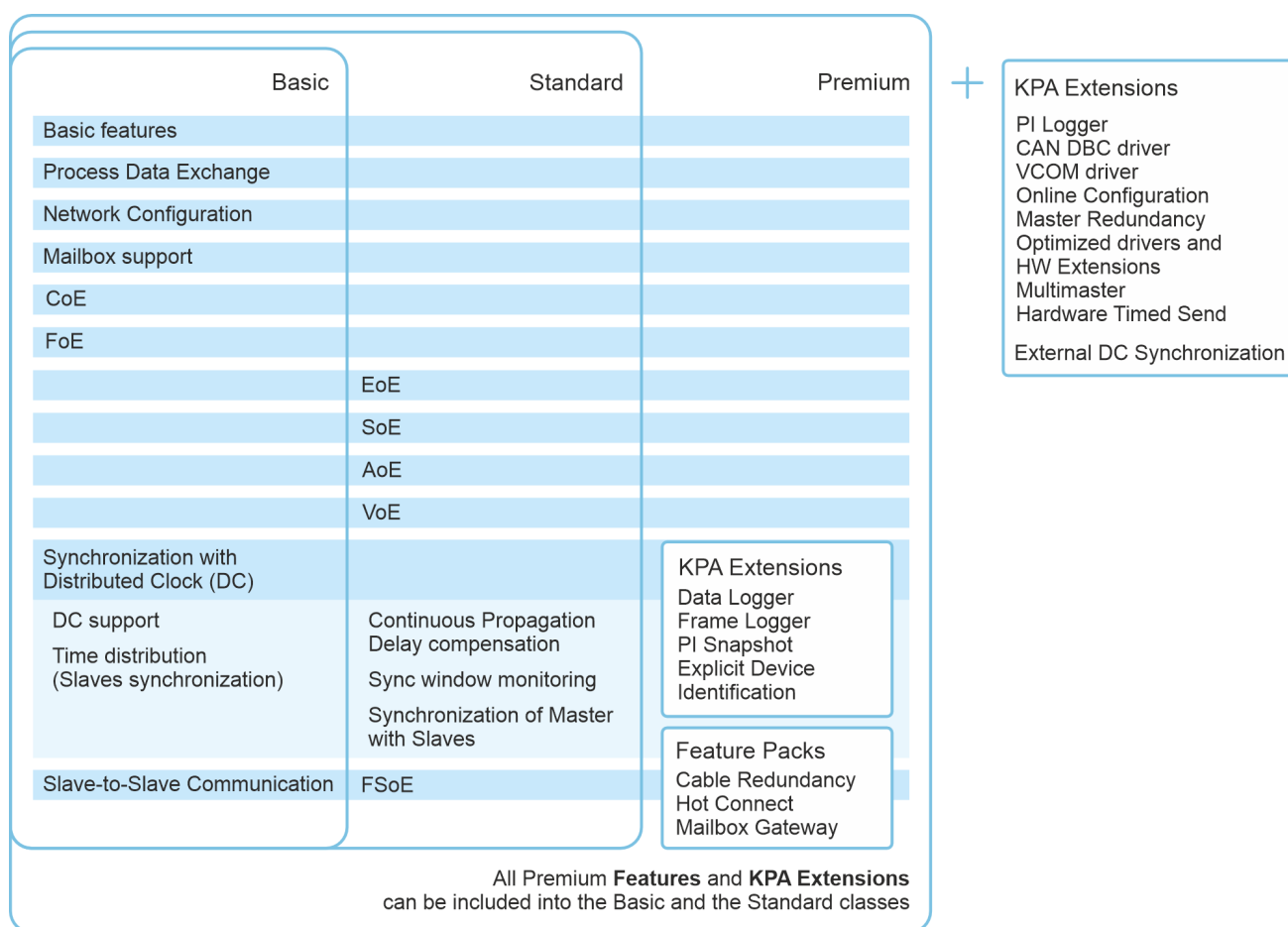


Figure 1. KPA EtherCAT Master Classes

Master Classes

KPA EtherCAT Master can be delivered as a standard or customized feature package subject to customer's demands. Two standard packages are available in accordance with ETG.1500 requirements: Class A (Standard package) and Class B (Basic package). Besides, for the most demanding customers, koenig-pa offers an additional type of package - Premium, which already includes several advanced features and extensions. And Full package, which includes all existing features and the ability to use the features developed in the future at no additional payment.

ETG Standards Compliant

KPA EtherCAT Master is designed according to EtherCAT Technology Group (ETG) standards and complies both ETG.1500 EtherCAT Master classes. Moreover, it introduces a new class, Premium, which integrates several additional features, opening unprecedented abilities to create innovative, feature-rich applications.

Master Versions

Depending on KPA EtherCAT Master version different features and extensions are available. All versions of the product are supported during the whole period of their use.

	Master 1.5	Master 1.6	Master 2.x
Data Logger			
Frame Logger			
Access rights			<i>Not available</i>
PI Snapshot			
CAN DBC driver			
<i>Not supported</i>		VCOM driver	
		Event handler	
		Multimaster	
			PI Logger
			Matlab TDMS (LabView) Python
			Online Configuration
			Web UI
			OPC UA
			Master Redundancy
			Hardware Timed Send
Optimized drivers			
RtE1000		TI AM335x BBB	<i>Not available</i>
Optimized HW Extensions			
Zynq IP Cores			TI AM57x PRU <i>Including Send scheduler</i>

Figure 2. EtherCAT Master Versions

Core Features

- Hard real-time capable in respective environments
- Single-threaded configuration for low-end systems
- Scalable, multi-threaded, multi-tasking configuration for high-end systems
- Asynchronous API and event-driven model for immediate reaction and effective system resources usage
- Multiple Process image clients for any number of PI clients with different rights and isolated internal buffer
- Extended Process Image for additional customization

Extensions

Extensions are advanced functional options (Feature Packs in terms of ETG) that can be purchased separately and added to any Class of KPA EtherCAT Master. Currently, the following extensions are available:

- Cable Redundancy (available in Premium by default)
- Hot Connect (available in Premium by default)
- Mailbox Gateway (available in Premium by default)
- Explicit Device Identification (available in Premium by default)
- Process Image Logger
- CAN DBC driver
- VCOM driver
- Master Redundancy
- Online Configuration
- Multimaster
- Hardware Timed Send
- External DC Synchronization

Cable Redundancy

EtherCAT system in Cable Redundancy mode can maintain the communication in case of a cable break or node failure. Therefore, we use a ring topology, which is normally operated in both directions.

Cable Redundancy mode is single-error tolerant, i.e. normal communication with the slaves will continue if the cable is interrupted in one place. When the communication is restored, the original communication direction is restored as well. If the communication is interrupted in more than one place, all connections have to be restored for normal communication.

To implement Cable redundancy feature, only a second Ethernet adapter is required on a target System.

Hot Connect

Hot Connect function allows user to connect additional devices flexibly. They can be optionally removed from or added to the data traffic before the start or during operation of the system. Such actions will not cause the damage of the overall functionality. This is called "flexible topology" or Hot Connect.

Mailbox Gateway

TCP/UDP Mailbox Gateway feature allows extra configuring a device by using a vendor's tool through the KPA EtherCAT Master without extra Ethernet connection or any other connection types.

For configuring the device vendors offer special tools requiring a separate Ethernet connection to the device. With connecting the tool to one NIC (network interface card) of master, user can configure the device via EtherCAT remotely. Master's internal routing of the Ethernet connection from the tool to the drive saves an extra wire and time.

Explicit Device Identification

EtherCAT technology allows slave addressing in different ways depending on device's possibility and user's needs. The use of EtherCAT Device identification is to identify an EtherCAT slave explicitly. This is necessary for the following use cases: Hot Connect applications, prevention against cable swapping. Also, the Device Identification value can be used optionally for unique addressing. For slaves supporting the Safety functionality Device Identification is mandatory even if one Safety slave is on the bus.

Three different mechanisms for setting the Device ID are used according to the specification ETG.1020 Protocol Enhancements: Requesting ID, Direct ID, Configured station alias. Explicit device identification is a modern way of the device identification. In most cases it is much more faster than identification via EEPROM Alias.

For details, please, refer to Master documentation.

Process Image Logger

This extension allows real time data collect for transfer to other levels. Process Image can be logged for further analysis. MATLAB integration and LabView-compatible (TDMS format) data logging are already implemented, with more applications and formats to come. This feature is extremely useful for throughput-sensitive data acquiring applications.

CAN DBC driver

CAN DBC driver converts information to a view specified at the DBC level, what allows user to apply them. It is intended for operating with CAN Gateways produced by BECKHOFF EL6751 (CAN DBC Driver) or KPA EtherCAT4CAN Gateway (4CAN DBC Driver).

VCOM driver

KPA offers an easy way of data exchange with devices with serial interface (RS232/RS422/RS485) when there is no a Serial COM port on the target PC. For example, to communicate with a QR-scanner, or various sensors to measure pressure/ temperature / humidity and so on.

The serial interface terminal is used as a normal Windows COM interface. Using this in conjunction with the KPA Virtual Serial COM driver and the KPA EtherCAT Master allows a user to communicate with a serial device from their Windows application through a Virtual COM port. Master transmits data got from the serial interface terminal to the application and back.

Online Configuration

Master provides a possibility to configure the bus on the fly. The Online Configurator module allows the user application to select slave's configuration (uESI) that will be applied. Then the module generates Master configuration file (ENI) with applied uESI. Further, this ENI will be used at Master work. The Online Configurator functionality may be used to switch between different configurations of the slave, e.g. position control of the drive and velocity control, or to switch between bus configurations with different number of slaves. Also, Online Configurator functionality can be integrated to the OPC UA /WebSocket communication.

Master Redundancy

Several EtherCAT Masters can co-exist in a network segment, providing backup for seamless EtherCAT operation during possible Master failures. It significantly increases reliability and fault tolerance while reducing downtime.

Optimized drivers and HW extensions

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.

Multimaster

Multimaster functionality allows user to control several EtherCAT® buses from the same target system simultaneously. Master API gives an opportunity to create several master instances inside one process (or several processes). Each master instance has its own handle, so resources such as network interfaces and timers are used without conflicts and there is no confusion when using API calls.

Hardware Timed Send

The function "Hardware Timed Send" enables the cyclic frame to be sent exactly at the beginning of the Master cycle without any delays. The hardware timed send function can only be activated if the target system has a hardware timer. With hardware-controlled sending enabled, the Master prepares the frames in advance before starting the cycle and transfers them to a hardware module (HW module) on the target. Therefore, when the cycle starts, the HW module just sends the prepared frames without delay.

The function "Timed send emulation" makes it possible to imitate the timed send functionality, when the target system does not include a hardware timer.

External DC Synchronization

In an EtherCAT system the distributed clocks concept (DC) is used for synchronization of local clocks in the EtherCAT components. Further information can be found in the separate documentation.

Measurement of one signal at one point in time can be evaluated based on another signal at the same point in time, and thus, these acquisitions need some type of synchronization scheme.

Along with local synchronization of a few production lines with the same source can also be implemented in the boundaries of one production line.

Custom Development

koenig-pa offers specific software development for customers who require additional support for integrating EtherCAT capabilities into their applications or solutions. Our company has extensive experience in fieldbuses, embedded systems, real-time operating environments, industrial automation solutions for various fields of application.

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koenig-pa GmbH Quality Management System is certified according to DIN EN ISO 9001:2015. Initial certification in 2008.
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