KPA EtherCAT Studio

KPA EtherCAT Studio is the second generation of a user-friendly tool for EtherCAT network engineering, installation, and diagnostics. This easy-to-use, lightweight, high-performance solution for EtherCAT based Masters provides a set of functions required to create and handle Master configurations and monitoring the EtherCAT network. It is integrable to other design environments to establish a common development workspace with enhanced functionality.

The offered functionalities of KPA EtherCAT Studio are competitive with products offered by other leading suppliers.

Key features

- Bus scanning and manual configuration
- Cable Redundancy
- Process data configuration
- Custom Process Image variables
- Hot Connect
- Explicit Device Identification
- DC Synchronization
- Mailbox protocols: AoE, CoE, EoE, FoE, SoE
- Slave-to-Slave communication
- Diagnostic traces and statistics
- Tools: Frame Logger, Data Logger, EEPROM Editor, S2S Editor etc.
- Plug-ins: Modular device profile, Gateways (CAN, Profibus)
- Brand labeling (BLF)
- Dashboard

KPA EtherCAT Studio product packages

KPA EtherCAT Studio can be delivered as a standard or customized feature package subject to customer's demands.

koenig-pa offers four types of packages: Basic, Standard, Premium, Full.

The Basic package includes defined minimum functionality. The Standard package propose widen set of features and additional tools (.NET Automation interface, EEPROM Editor, Process Image Editor, etc.). For the most demanding customers, koenig-pa offers Premium package, which includes several advanced features (Cable Redundancy, Power calculation, Hot Connect, etc.). And Full package, which includes all existing features (additional to Premium package it has MDP Profibus Master Gateway Profile 3100) and the ability to use the features developed in the future at no additional payment.

Features	Basic	Standard	Premium	Full[1]
Studio				
Scaling Signal Values	✓	✓	✓	✓
.NET Automation interface	−	✓	✓	✓

Features	Basic	Standard	Premium	Full[1]
Slaves Library	✓	✓	✓	✓
Project Access Limitation	–	–	✓	✓
Export uESI for Autoconfigurator	–	–	✓	✓
Engineering Unit Mapping	–	✓	✓	✓
Plug-ins for configuring specific devices				
CANopen Master/Slave (EL6751)	✓	✓	✓	✓
Profibus Master/Slave (EL6731)	✓	✓	✓	✓
Bridge terminals (EL6692/EL6695)	✓	✓	✓	✓
Modular Devices	–	✓	✓	✓
Virtual Serial COM	–	–	✓	✓
MDP Profibus Master Gateway Profile 3100	–	–	–	✓
Tools				
Topology Viewer	✓	✓	✓	✓
Snapshot Viewer	✓	✓	✓	✓
Chart Viewer	✓	✓	✓	✓
Diagnostic scanner	✓	✓	✓	✓
S2S Communication Editor	✓	✓	✓	✓
EEPROM Editor	–	✓	✓	✓
Comparing tools	–	–	✓	✓
Data logging tools	–	–	✓	✓
Fixed Process Image Editor	–	–	✓	✓
Sample Rate Editor	–	✓	✓	✓
Process Image Viewer	–	✓	✓	✓
Motion Configuration Utility	✓	✓	✓	✓
Master Output	–	✓	✓	✓
Emergency Output	✓	✓	✓	✓
Watch Viewer	✓	✓	✓	✓
Dashboard	✓	✓	✓	✓
Dashboard customization	–	–	✓	✓
Common				
DC	✓	✓	✓	✓
Tasks/Sync Units	✓	✓	✓	✓

Features	Basic	Standard	Premium	Full[1]
Power calculation via LVDS	–	–	✓	✓
Master				
Cyclic Commands	✓	✓	✓	✓
ENI Export	✓	✓	✓	✓
External task	✓	✓	✓	✓
PI Alignment	–	✓	✓	✓
Master Watchdog	–	✓	✓	✓
Master Mailbox. AoE	–	✓	✓	✓
Master Mailbox. EoE	–	✓	✓	✓
ENI Export. XSLT Scheme support	–	✓	✓	✓
Cable Redundancy	–	–	✓	✓
Slave				
Slave Mailbox. CoE	✓	✓	✓	✓
Slave Mailbox. FoE	✓	✓	✓	✓
Slave Watchdog	–	✓	✓	✓
Slave Mailbox. AoE	–	✓	✓	✓
Slave Mailbox. EoE	–	✓	✓	✓
Slave Mailbox. SoE	–	✓	✓	✓
Configuring Init Commands	–	✓	✓	✓
FMMU/SM	–	✓	✓	✓
Direct Memory access	–	✓	✓	✓
Direct EEPROM access	–	✓	✓	✓
Explicit identification	–	✓	✓	✓
Hot Connect	–	–	✓	✓

✓ - included in the delivery set
– - not included in the delivery set
Full[1] - this class includes all existing functionality at the time of a purchase, as well as all the functionality that will be developed in the future

KPA EtherCAT Studio Versions

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

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Features	KPA EtherCAT Studio 1	KPA EtherCAT Studio 2
Studio		
Scaling Signal Values	✓	✓
.NET Automation interface	–	✓
Slaves Library	✓	✓
Project Access Limitation	✓	–
Export uESI for Autoconfigurator	–	✓
Engineering Unit Mapping	✓	✓
Plug-ins for configuring specific devices		
CANopen Master/Slave (EL6751)	✓	✓
Profibus Master/Slave (EL6731)	✓	✓
Bridge terminals (EL6692/EL6695)	✓	✓
Modular Devices	✓	✓
Virtual Serial COM	✓	✓
MDP Profibus Master Gateway Profile 3100	✓	✓
Tools		
Topology Viewer	✓	✓
Snapshot Viewer	✓	✓
Chart Viewer	✓	✓
Diagnostic scanner	✓	✓
S2S Communication Editor	✓	✓
EEPROM Editor	✓	✓
Comparing tools	✓	✓
Data logging tools	✓	✓
Fixed Process Image Editor	✓	–
Sample Rate Editor	✓	–
Process Image Viewer	✓	✓
Motion Configuration Utility	✓	✓
Master Output	✓	✓
Emergency Output	✓	✓
Watch Viewer	✓	✓
Dashboard	–	✓
Dashboard customization	–	✓

Features	KPA EtherCAT Studio 1	KPA EtherCAT Studio 2
Common		
DC	✓	✓
Tasks/Sync Units	–	✓
Power calculation via LVDS	✓	✓
Master		
Cyclic Commands	✓	✓
ENI Export	✓	✓
External task	✓	✓
PI Alignment	✓	✓
Master Watchdog	✓	✓
Master Mailbox. AoE	✓	✓
Master Mailbox. EoE	✓	✓
ENI Export. XSLT Scheme support	✓	✓
Cable Redundancy	✓	✓
Slave		
Slave Mailbox. CoE	✓	✓
Slave Mailbox. FoE	✓	✓
Slave Watchdog	✓	✓
Slave Mailbox. AoE	✓	✓
Slave Mailbox. EoE	✓	✓
Slave Mailbox. SoE	✓	✓
Configuring Init Commands	✓	✓
FMMU/SM	✓	✓
Direct Memory access	✓	✓
Direct EEPROM access	✓	✓
Explicit identification	✓	✓
Hot Connect	✓	✓

✓ - included in the delivery set
− - not included in the delivery set

Core functionality

- Master configuration
- Slave configuration

![Konig logo](.konig)

- Slave library
- EtherCAT diagnostics
- KPA EhterCAT Studio development framework (SDF)

Features description

Scaling signal values

`studio 1` `studio 2`

It is a possibility to change a representation of signal's value. Scaling signal values is available for integer signals with 16- or 32-bit length. This attribute is used to specify the range of the input data.

.NET Automation interface

`studio 2`

This feature makes writing logic for automating tasks that do not require human involvement in project settings possible. It supports the fillowing technology: .NET API, COM API, .NET Remoting.

Slaves Library

`studio 1` `studio 2`

Slaves Library is a list of available ESI files which can be used to build up Project configuration. There is an opportunity to work with several Slaves Library collections, change active collection by using custom collection and manage Slaves Library view by setting user attributes for Slaves. It is possible to use as a source for the collection: KPA ESIs Storage, ESI file, ESIs folder, or Installed ESIs folder and save it as KPA ESIs Storage.

Configuring specific devices

`studio 1` `studio 2`

- EL6751:
  - CANopen Master plug-in - This plug-in allows the user to adapt CANopen Master configuration got by scanning CAN bus.
  - CAN Interface plug-in is intended to configure device in CAN Interface (raw CAN) mode to be used with/without CAN DBC driver on Master side. Data exchange through the driver can be done either through the specified signals (adding messages from a DBC file) or by sending/receiving unspecified messages via driver's queue.
- EL6731:
  - MDP plug-in for Profibus Master Gateway Profile 3100 - to configure a Slave supporting Profibus Master (3100) profile.
- EL6692/EL6695:
  - M2M plug-in - is intended to configure the both sides of the EtherCAT bridge terminal (Primary and Secondary).
- EL6731-0010:
  - Profibus Slave plugin - is intended to configure device for communication between EtherCAT and PROFIBUS.

Modular devices

`studio 1` `studio 2`

MDP Modules is intended to configure Slave supporting Modular Device Profile with modules specified in its ESI file.

Virtual Serial COM

`studio 1` `studio 2`

koenig-pa offers an easy way of data exchange with devices with serial interface (RS232/RS422/RS485).

KPA EtherCAT Master supports Virtual COM communication. It allows you to communicate with the serial device (connected via Serial to EtherCAT gateway device) from your Windows application via Virtual COM port. Master transmits data got from the serial terminal or the Virtual COM device to the recipient.

To set such communication KPA EtherCAT Master requires the KPA Virtual COM driver being installed in the Windows and the corresponding feature must present in Master's license. KPA Virtual COM driver is provided as a separate module and can be installed independently of Master. It is not required additional configuring with COM settings (baud rate, data bits, parity etc.).

MDP Profibus Master Gateway Profile 3100

`studio 1` `studio 2`

The Profibus Slave plugin is intended to configure EL6731-0010 for communication between EtherCAT® and PROFIBUS.

Topology Viewer

`studio 1` `studio 2`

Displays Network and Master configurations simultaneously. The tool displays Slaves' state. If there is a problem with Slave(s) in configuration, it also will be marked by a corresponding icon and the problems will be displayed in the Slave tooltip.

Snapshot Viewer

`studio 1` `studio 2`

Signal values are gathered during operation and stored to make a snapshot. The viewer then displays the snapshot. Taking snapshots reduces overall load on the system in order not to affect hard real-time performance.

Chart Viewer

`studio 1` `studio 2`

The tool allows monitoring multiple channels from one or several Slaves simultaneously.

Diagnostic Scanner

`studio 1` `studio 2`

The tool scans EtherCAT network and executes diagnostics for possible Slave and connection

problems.

S2S Communication Editor

studio 1 **studio** 2

The tool allows to map input process data of one device to output process data another device without wiring (via the Master). Copying of the data is handled by the Master stack.

EEPROM Editor

studio 1 **studio** 2

The tool allows to read EEPROM, to generate ESI from a binary file or directly from the Slave, view it by bits or in Hex Editor, to navigate through the EEPROM using quick access to certain parameter, to edit it. Besides working with read data, the user may create new EEPROM categories and add new data. Modified EEPROM can be saved to a binary file, ESI or directly to the Slave.

Comparing tools:

studio 1 **studio** 2

- **Projects Comparator** compares two projects. It is possible to compare the project opened in KPA EtherCAT Studio with a project loaded from a file, or just two projects from files. Found differences are highlighted with customizable colors.
- **ESI and EEPROM Comparator** enables comparison of EEPROM content acquired directly from a Slave device or provided in a binary file against the content of a file either assigned to the Salve or chosen by a user. Differences are highlighted with customizable colors; properties values are displayed.

Data logging tools:

studio 1 **studio** 2

- **Run-time Data Logger** (only for KPA EtherCAT Studio 2) manages the data logging on the Master side. The KPA EtherCAT Studio retrieves the stored data and enables building of charts for signals picked from a defined set.
- **Data Logger** manages the data logging on the Master side.
- **Frame logger** is the visualizator of time information on EtherCAT packets: duration of packet assembling, time of received frame parsing, time of setting frame to queue for sending, etc.

Fixed Process Image Editor

studio 1

The tool allows to assign an area in Process Image to a certain Sync Manager.

Sample Rate Editor

studio 1

The tool allows adjusting schedule settings (that is read by the Master) according to which frame data is updated.

Process Image Viewer

`studio 1` `studio 2`

The tool shows allocation of inputs and outputs in memory. Using this tab you can see location, type, length and offset size of a Signal (including alignment signals).

Motion Configuration Utility

`studio 1` `studio 2`

Motion Configuration Utility is intended to configure motion trajectory and generates an INI file with corresponding settings.

Master Output

`studio 1` `studio 2`

Master output displays raw Master traces that is got from Master.

Emergency Output

`studio 1` `studio 2`

Emergency Output displays messages which are sent by Slaves in case of emergency (transmitted via CoE emergency service).

Watch Viewer

`studio 1` `studio 2`

The tool allows to monitor changing of selected signals, that allows to control them in separate window.

Dashboard

`studio 2`

Dashboard displays bus Slaves properties and bus ports parameters. Ports searching includes diagnostic that allows to detect errors in the ports in online mode.

Dashboard customization

`studio 2`

Dashboard customization allows customers to set the appropriate appearance of Dashboard and add new Dashboard.

Distributed Clocks

`studio 1` `studio 2`

The feature enables synchronization of the Master and all Slave devices on the bus. It is configured on the both sides Master and Slaves.

Task/Sync Units

studio 2

Provides an opportunity to configure Process data update by using tasks and sync units and update particular blocks of Process image in certain time.

LVDS power capabilities

studio 1 **studio** 2

Monitoring of power supply and consumption of LVDS Slaves on the bus in order to avoid power lack issues in the configuration.

Cyclic commands

studio 1 **studio** 2

KPA EtherCAT Studio allows to configure and set the values of cyclic commands to send and receive data from bus.

There are three types of cyclic commands available for selection:

- Common logical read/write command
- Separate logical read and logical write commands
- Separate physical read and physical write commands

ENI Export

studio 1 **studio** 2

Creation of configuration file for Master (according to EtherCAT Technology Group (ETG) specification (ENI)).

Using KPA EtherCAT Studio it is possible to prepare Master configurations to be used in other systems (for example CODESYS).

KPA EtherCAT Studio provides the following types of Master configuration export:

- Export Master Configuration KPA creates an XML file, which can be imported for further usage by the Master, KPA extensions are included.
- Export Master Configuration ETG Standard creates an XML file according to the ETG specification.
- Export CODESYS PLC Configuration creates a file, which can be imported into CODESYS configuration (includes the Master module configuration).
- Export CODESYS PLC Configuration (Master module) creates a file, which can be imported into CODESYS configuration (without PLC configuration).
- Export encoded configuration creates an XML file in UTF-8 encoding.
- Export C header file creates a C header file with definitions of offsets and lengths of process image signals, which can be used to simplify procedure of process image usage while development of control application/PLC.
- Export C header file including Slave properties creates a C header file with definitions of offsets, lengths and types of signals and Slaves' properties (VendorID, ProductCode, etc.); also, can be used to simplify procedure of process image usage while development of control application/PLC.

- Export IEC61131-3 PLC POU (Program Organization Unit) creates a file, which can be imported into other Master configurations using software which supports IEC61131-3 standards (for example, Structured Text language).

- Export XML Format for IEC 61131-3 PLCopen creates a file, which can be imported into other Master configurations using software which supports IEC61131-3 PLCopen standard.

- Export Master Configuration (comments without CDATA) creates an XML file as Export Master Configuration KPA, but without CDATA in comments.

This feature allows export custom ENI files based on custom XLST scheme support.

External Task

studio 1 studio 2

KPA EtherCAT Studio allows running external tasks (specific applications) on Master side. Sawtooth application, which simulates saw-shaped signals on outputs to show a snapshots diagram. A signal from Slave's analog input is multiplied by a special factor and sent to output without wiring (through memory). The signal sent to output is shaped as a saw.

KPA EtherCAT Studio allows running external tasks (specific applications) on Master side to manage EtherCAT bus. External tasks are custom developed depending on customer needs.

Process Image alignment

studio 1 studio 2

KPA EtherCAT Studio allows to set different types of PI alignment depending on the configuration. Users can choose between the five options in the **Alignment mode** list:

- No alignment
- Bit alignment
- CODESYS (PowerPC) alignment
- CODESYS (PowerPC) with Bit-Byte alignment
- CODESYS (x86) alignment

The options listed above present the ways of addresses types alignment in Process Image as different PLC systems acquire different addressing modes. For example, a four-byte signal offset should start with a four-fold address value. Bit alignment enables grouping of one or more bit long signals into one or several sequential bytes.

Alignment is set on Process Image Tab, that allows the user to set variables' values, get a snapshot and watch the fluctuation of variables' value in Chart window. Process Image Tab allows to set and force or unforce variables' values, get a snapshot and watch the fluctuation of variables' value in Chart window.

Master Watchdog

studio 1 studio 2

Master watchdog enables and disables the Master watchdog function. If there is PLC program crash or it is hanging and no output value has been set within this timeout, a default or last value (depending on the signal's settings or Master settings) is set by Master to all outputs.

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Slave Watchdog

`studio 1` `studio 2`

The Slave's watchdogs are used for observing communication and returning to a safe state in case of an error. The ESCs (EtherCAT Slave Controller) support up to two internal watchdogs:

- **Sync Manager watchdog** (SM) is used for monitoring process data accesses by Master (e.g. Master read process data).
- **Process Data Interface watchdog** (PDI) is used for monitoring of firmware viability.

Cable Redundancy

`studio 1` `studio 2`

Cable redundancy makes possible several things that used to be bottle-necks of conventional field bus systems built up on closed ring principles, such as cable feedback for problem finding and system availability in case of cable break. If the ring is interrupted at some point, both branches can be still reached.

AoE

`studio 1` `studio 2`

ADS over EtherCAT (AoE) is a standard, client-server Mailbox protocol defined by the EtherCAT specification. It is used to build storage area networks (SANs) with low-cost, standard technologies.
AoE is routable and supports the contemporary handling of parallel services, and therefore is particularly suitable for the access to sub-networks via gateway devices (Master devices which are required to operate gateway Slave devices should therefore support AoE). Due to its routability, AoE is also defined as standard protocol for the communication between an EAP (EtherCAT Automation Protocol) network and single EtherCAT fieldbus segments.

Both Master and Slave stacks exist which support basic AoE services, enabling a light and fast implementation of this mailbox protocol in EtherCAT devices.

CoE

`studio 1` `studio 2`

Event driven standard of access to CANopen Object dictionary and exchange of CANopen Emergency and PDO/SDO messages. With the CoE protocol (CAN application protocol over EtherCAT), EtherCAT provides the same communication mechanisms as in CANopen®-Standard EN 50325-4: Object Dictionary, PDO Mapping (Process Data Objects) and SDO (Service Data Objects) even the network management is similar. This makes it possible to implement EtherCAT with minimal effort in devices that were previously outfitted with CANopen, and large portions of the CANopen Firmware are even reusable. Optionally, the legacy 8-byte PDO limitation can be waived, and it's also possible to use the enhanced bandwidth of EtherCAT to support the upload of the entire Object Dictionary. The device profiles, such as the drive profile CiA 402, can also be reused for EtherCAT.

EoE

`studio 1` `studio 2`

The EtherCAT technology is not only fully Ethernet-compatible, but the Ethernet over EtherCAT (EoE) protocol tolerates other Ethernet-based services and protocols on the same physical network. The term Ethernet is also frequently associated with data transfer in IT applications, which are based on a TCP/IP connection. Using the EoE protocol any Ethernet data traffic can be transported within the

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EtherCAT segment. The Ethernet frames are tunneled through the EtherCAT protocol, similarly to the internet protocols (e.g. TCP/IP, VPN, PPPoE (DSL), etc.), which makes the EtherCAT network completely transparent foe Ethernet devices.

The device with the Switchport property takes care of inserting TCP/IP fragments into the EtherCAT traffic and therefore prevents the network's real-time properties from being affected. Additionally, EtherCAT devices may also support Ethernet protocols (such as HTTP) and can therefore behave like a standard Ethernet node outside of the EtherCAT segment. The Master device acts as a Layer-2-switch that sends the frames via EoE to the corresponding nodes according to their MAC addresses. This way, all internet technologies, such as an integrated web server, E-mail, FTP transfer, etc. can also be implemented in an EtherCAT environment.

FoE

studio **1**   studio **2**

FoE (File Access over EtherCAT) is a mailbox protocol generally intended to transfer file data on an EtherCAT network in both directions, and as such it can be used in any state where the mailbox communication is active (PreOP, SafeOP, OP). The most common use case for FoE is to download a new firmware for update, when the Slave is in Bootstrap state.

EtherCAT provides the FoE protocol for simple file access. For example, the device runs in a boot loader state to support a firmware download to the host controller via the EtherCAT network. Standardizes firmware download to devices is therefore possible, even without the support of TCP/IP.

SoE

studio **1**   studio **2**

Servo drive profile over EtherCAT (SoE) communication services are used to access the IDNs of a SoE Slave. The SoE drive profile is a part of an extra Master application, not of the Master itself.

If the EtherCAT Slave supports the Servo Profile over EtherCAT (SoE) protocol the additional tab "SoE" appears in the Mailbox.

Servo drive profile over EtherCAT® (SoE) is a protocol of EtherCAT interface for IEC 61491 servo drive profile.

SoE allows to integrate devices based on IEC 61491 technologies in an EtherCAT bus. It is executed by getting access to the drive parameters and data that defined in IEC 61491. Non-cyclic data exchange is implemented by SoE protocol with help of the EtherCAT SoE Service Channel (SSC) (equivalent of the IEC61491 Service Channel). It allows to access to identifiers (IDN) and their elements.

Configuring Initialization commands

studio **1**   studio **2**

Init commands initialize and control processes of communication with a Slave (according to a specification). When a device is configured via Mailbox Initialization Commands, it is possible to set the Operational mode, speed of data exchange, a set of data for exchange, etc. Initialization commands is generated by KPA EtherCAT Studio and can be disabled, added or deleted by a customer.

Configuring FMMU/SM

studio **1**   studio **2**

4 Gb address space is one of the EtherCAT advantages. To use this space the process data of the

dedicated device must be mapped to the EtherCAT logical address space. This function is performed by FMMU (Fieldbus Memory Management Units).

On the other hand, the process data itself is located in the physical address space of the controller, access to which is controlled and synchronized by SyncManager (SM). Within the KPA EtherCAT Studio the corresponding technological "pillars" can be configured in the way required to the user.

Direct Memory access

`studio 1` `studio 2`

KPA EtherCAT Studio allow directly read and write memory register of EtherCAT Slave controller. Also the tool allows mapping memory registers to Process Image by adding new or using known registers. This allows to map registers to Process Image by adding new or using known registers.

Direct EEPROM access

`studio 1` `studio 2`

EEPROM Electrically Erasable Programmable Read Only Memory energy-independent Slave memory. The EtherCAT Slave Controller (ESC) loads its configuration data (e.g. PDI configuration) during start up from the Slave Information Interface (SII) which usually is implemented as EEPROM.

KPA EtherCAT Studio allows read and write data about Slave from or to EPROM and make changes to the Slave description by using EEPROM editor tool.

Hot Connect

`studio 1` `studio 2`

Hot Connect function allows 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.