KEB

Solutions

MADE
IN
GERMANY

Control & Automation

KEB

KEB - Control & Automation

Index

LEGEND

 **RTE**

 **RUNTIME VISU**

 **CONNECT**

RTE: This is the core for PLC and Motion control functionality which schedule all the activities (communication, task, etc…).
This icon is next to the hardware where RTE is located.

HMI: This is the core for Visualization functionality which schedule all the activities (communication, task, etc…).
This icon is next to the hardware where HMI runtime is located.

COMBIVIS CONNECT: This is the core for remote connection functionality.
This icon is next to the hardware where COMBIVIS CONNECT runtime is located.

 **BASIC proposal**
Entry level functionality for KEB cpu

 **PRO proposal**
Middle level functionality for KEB cpu (CAM Curve, Electronic Gear, Phasing)

 **ADVANCED proposal**
Top level functionality for KEB cpu (CNC functionality, G-Code, wide range of Kinematics)

 **BASIC proposal**
Entry level functionality for KEB HMI

 **PRO proposal**
Middle level functionality for KEB HMI

 **ADVANCED proposal**
Top level functionality for KEB HMI

KEB - Know-How, Engineering, Benefit.

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People in motion.

Karl-Ernst Brinkmann started his own success story with six employees. Based on continuous growth, **KEB** has developed into a **medium sized company with 1,200 employees**. KEB has remained **an owner-managed company** in its second generation, which is a source of pride for us. Controlled growth for almost 40 years and a strong connection to our local communities, result in reliability and trust, as a supplier and an employer.

Long-time employees highlight the close connections within the company, suppliers, partners and customers. Throughout the year, **KEB and its staff develop mechanical and electronic products** focused on power transmission solutions. The long history of field experience working side by side with our customers is reflected in our product portfolio, **including controls**.

KEB has **nine subsidiarie**s and production sites **strategically located in Europe, North America and Asia**.

Locations utilize the same centralized data management and engineering design suites for hardware and software development. We are in good shape for the future. This is not the end of the story; it's just the beginning!

Generating power

The broad business orientation towards various areas of machine building and systems gives **KEB** a deep insight view into market needs and trends. In the past this was mainly based on drive solutions, where KEB today offers a wide range of products and supply to important brands in the world.

In addition to that, we built up the motivation to extend the portfolio with control and automation products. The development is driven by technical standards, where IPC technology and fast Ethernet communication via EtherCAT are core elements. From direct contacts with many customers, we got the requirements and specific input for future orientated and universal concepts and solutions.

Today creative technicians and engineers develop capable software and hardware, connected with a powerful engineering tool.

Increasing complexity of automation technology requires knowledgeable and reliable partner.
KEB has expertise needed to provide the ideal solution for your automation requirements and a team of specialists that helps for the daily job.

Our target is to provide our customers with a complete automation solution which offers maximum flexibility and economic efficiency.
Meeting our customers' needs, from customized products to large-scale series production, is our main focus.

Regenerating power

Factory automation

Building automation

eMotive

KEB - Know-How, Engineering, Benefit.
Product Overview

Drive technology for open- and closed-loop applications.
Based on multi-axis or stand-alone platforms, KEB products have been designed to fulfill the requirements of factory automation and other markets. Additionally, KEB has a full line of EMC and harmonic mitigation solutions.

Embedded and IPC control systems. Based on the latest Ethernet technology and programming standards, KEB products are IEC 61131-3 and PLCopen compliant. Thanks to these standards, fully hardware independent, scalable systems can be realised.

Remote IO solutions. A wide range of remote IO brings signals from the field to the CPU as fast as possible - thanks to EtherCAT's performance standards. High IO density and high output capacity versions provide needed space savings. With KEB Remote IO, you take advantage of remote installation without losing the comfort of the PLC memory location and program organisation.

Visit our web page to get the full picture of our basket and download all the information necessary: **www.keb.de**

Motor technology for asynchronous and synchronous motor applications. Induction and servo motors are available for 208/230 and 400/480 VAC class installations. Speed/position feedback devices (encoder, resolver, absolution, multi-turn, etc.) and electro-mechanical brake solutions are standard options. Special designs for specific industries add to the possibilities. KEB's control and motor knowledge bring the best performance to the application.

Gearbox technology focused on quality, endurance and efficiency. KEB offers four main designs paired to both induction (AC) and servo (PM) motors. With KEB's engineering team, the customer is assured the right gear and motor solution for the application.

Clutches and brakes made the KEB story possible. Markets change and so does the clutch and brake applications. KEB offers a wide range of specialised and customised clutches and brakes that are made to meet specific customer requirements. KEB's high quality and reliability have gained popularity in demanding industries such as automotive.

Factory automation overview

Factory automation requires controls.

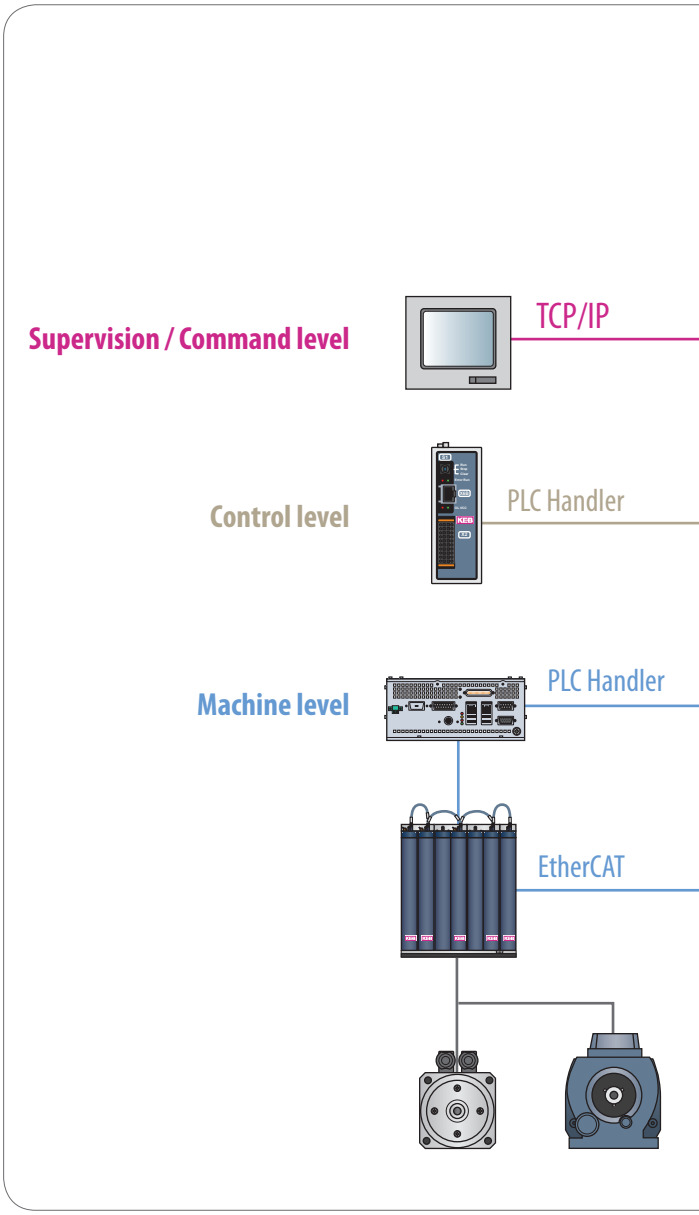
Factory automation requires controls. With controls, comes programming software. If not thought out, software can create limits; limits in hardware and limits in usability. KEB's solution for factory automation is based on the **COMBIVIS studio 6** Integrated Development Environment. **One package for all hardware, all tasks.**

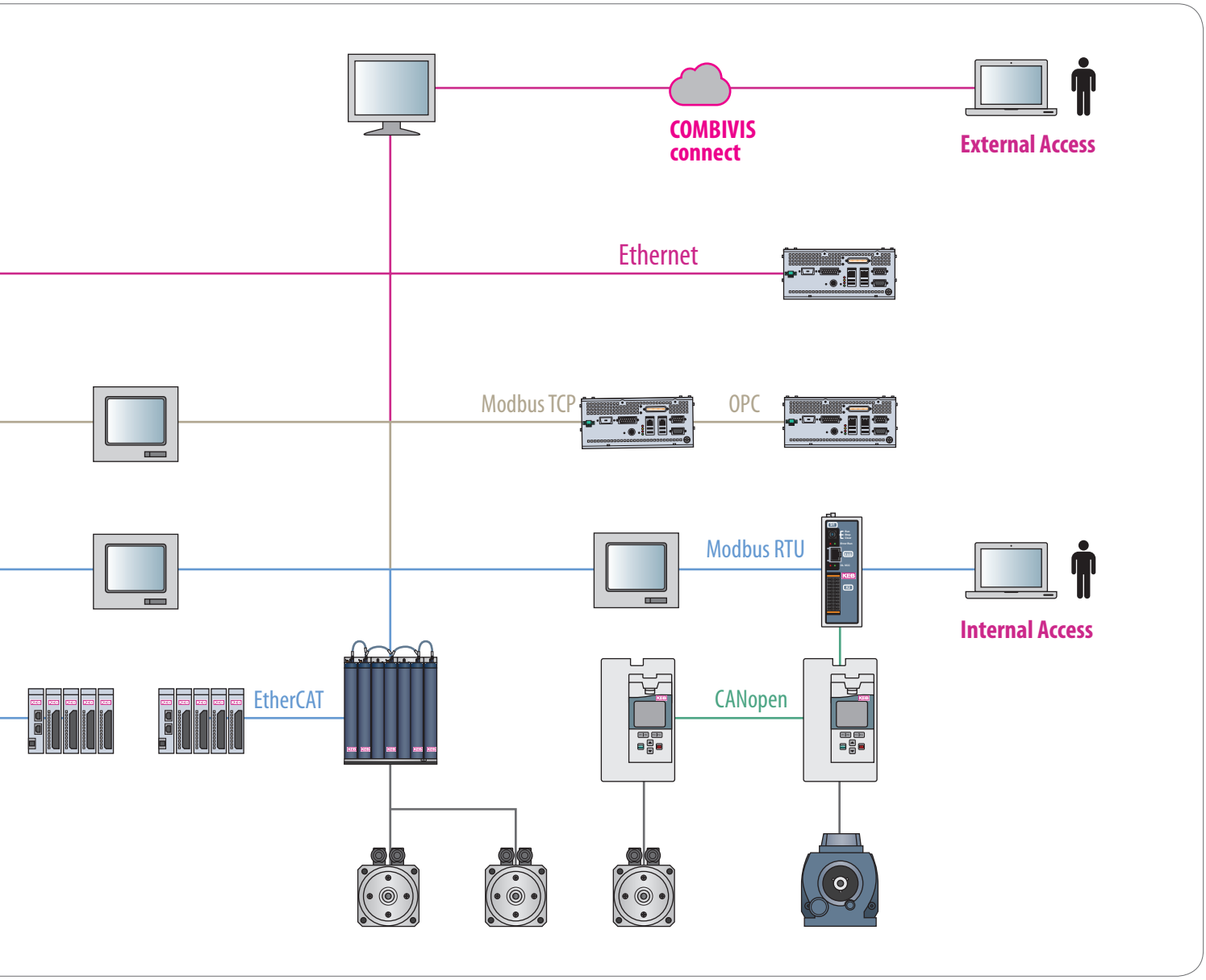
Uniquely suited for single- or multi-projects, **COMBIVIS studio 6 is ideal for a single machine or the complete plant**. Easy tools for data exchange between two control units (point to point data server) or several control units (broadcast data exchange) provide simple plant level integration.

Communication between top layer and device layer is based on **COMBIVIS studio 6** Gateway Server, which is equipped with an OPC Server. With an **Ethernet connection - hardwired or wireless**, data can be exchanged not just at the **local device level**, but at the plant and **remote-plant level**.

Real-time hardware is becoming the standard. With EtherCAT and KEB's hardware designs, real-time solutions are possible **from the smallest DIN mount** controller **to the highest performing panel IPC** with built in touch screen.

Thanks to an industrial PC architecture based on **standard operating** systems like **Windows**, KEB's solution is ready to **connect** and operate within **every part of factory automation**.




COMBIVIS
connect
External Access
Ethernet
Modbus TCP
OPC
Modbus RTU
Internal Access
EtherCAT
CANopen

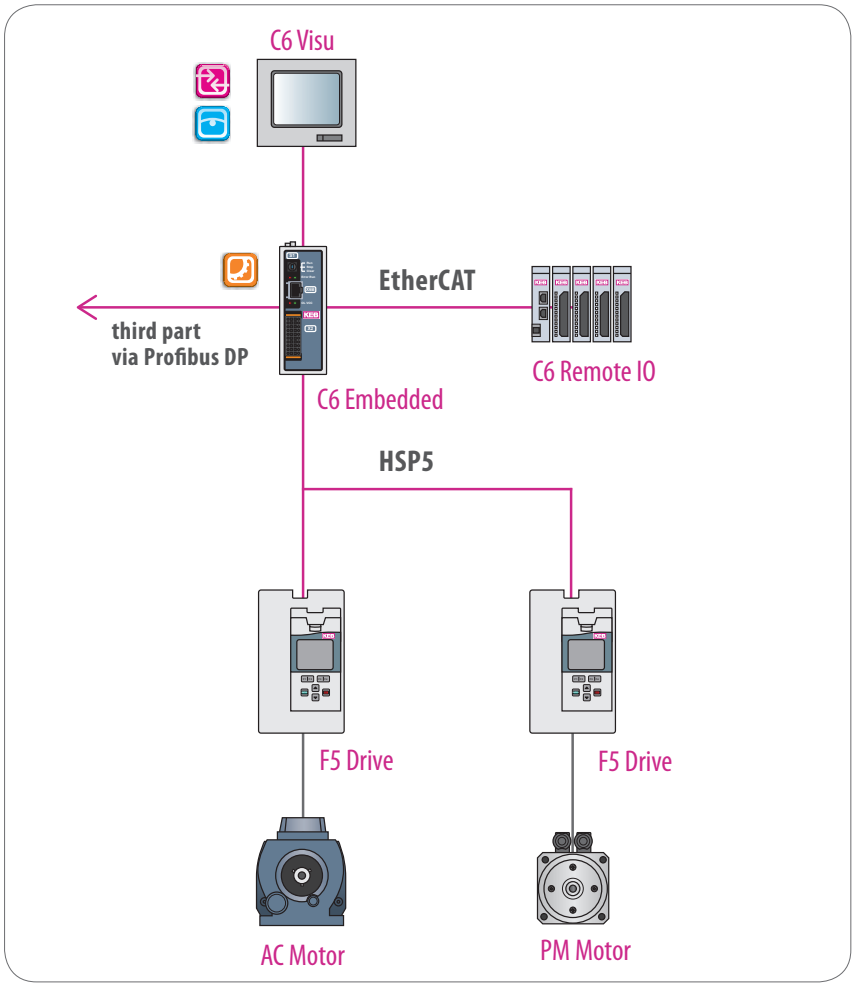
Hardware Solutions
Embedded Solutions

KEB began developing embedded mother boards based on RISC technology in the early 2000's with the goal of providing a **cost effective solution for performance machines**.

Since the beginning of the development, **KEB standardised on Ethernet-based motion control**. Ethernet hardware is well known and provides fast transfer of large volumes of data, perfect for motion control of slave devices.

KEB's **embedded solutions** are equipped with two, always available, axis communication protocols:

- **EtherCAT** as standard communication system which gives to the embedded CPU the right scalability of the motion project.
- **HSP5** is a synchronous protocol which goes straight to the KEB drives and makes the solution very cost attractive.

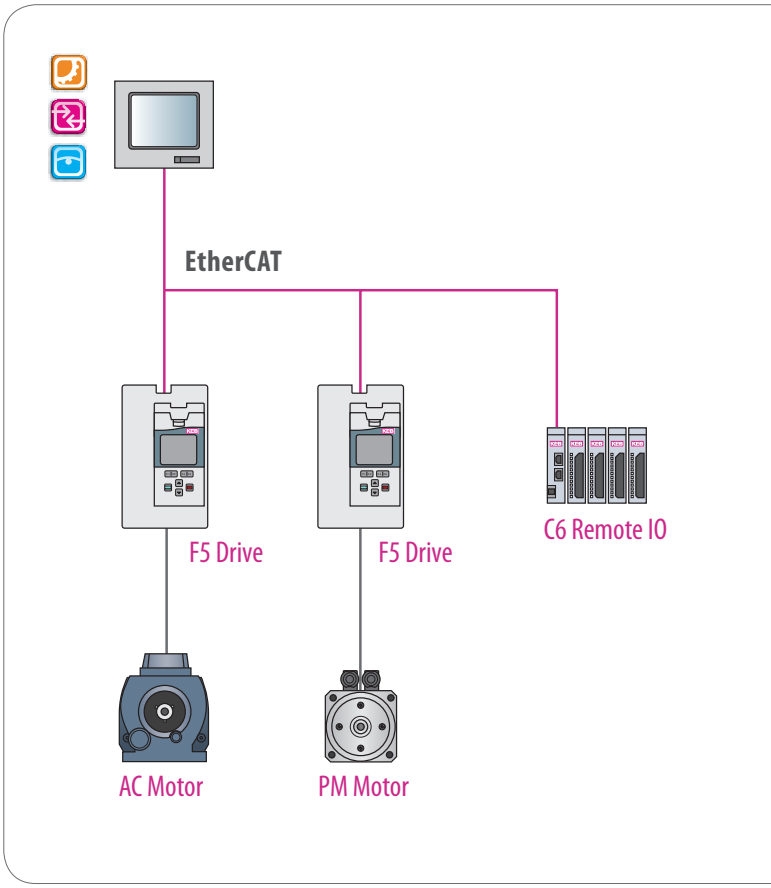


Fieldbus options like Profibus DP, CanOpen, Interbus and standard Modbus TCP make the embedded solution a logical sub-controller between PLC and KEB drives or other devices. This layout provides a **unique level of access to the drives** not available with just PLC - drive topologies. For example, drives that are replaced in the field can be **automatically programmed for immediate operation** without involving field service and support.

For **factory communication layers**, the embedded solution can exchange data with other KEB devices or third party items using an OPC server, PLC handler, Modbus TCP or Modbus RTU. **COMBIVIS studio 6 libraries** provide function blocks to easily implement these solutions.

Taking from the decades of experience of PLCs in automation, the embedded solutions are also equipped with such items as **retentive memories** and power supplies with voltage drop ride-through. Additionally, they improve the situation in other areas with **unrestricted task, registers and programs**.

With these design features, an embedded solution is a **perfect match for small to medium sized machines**.



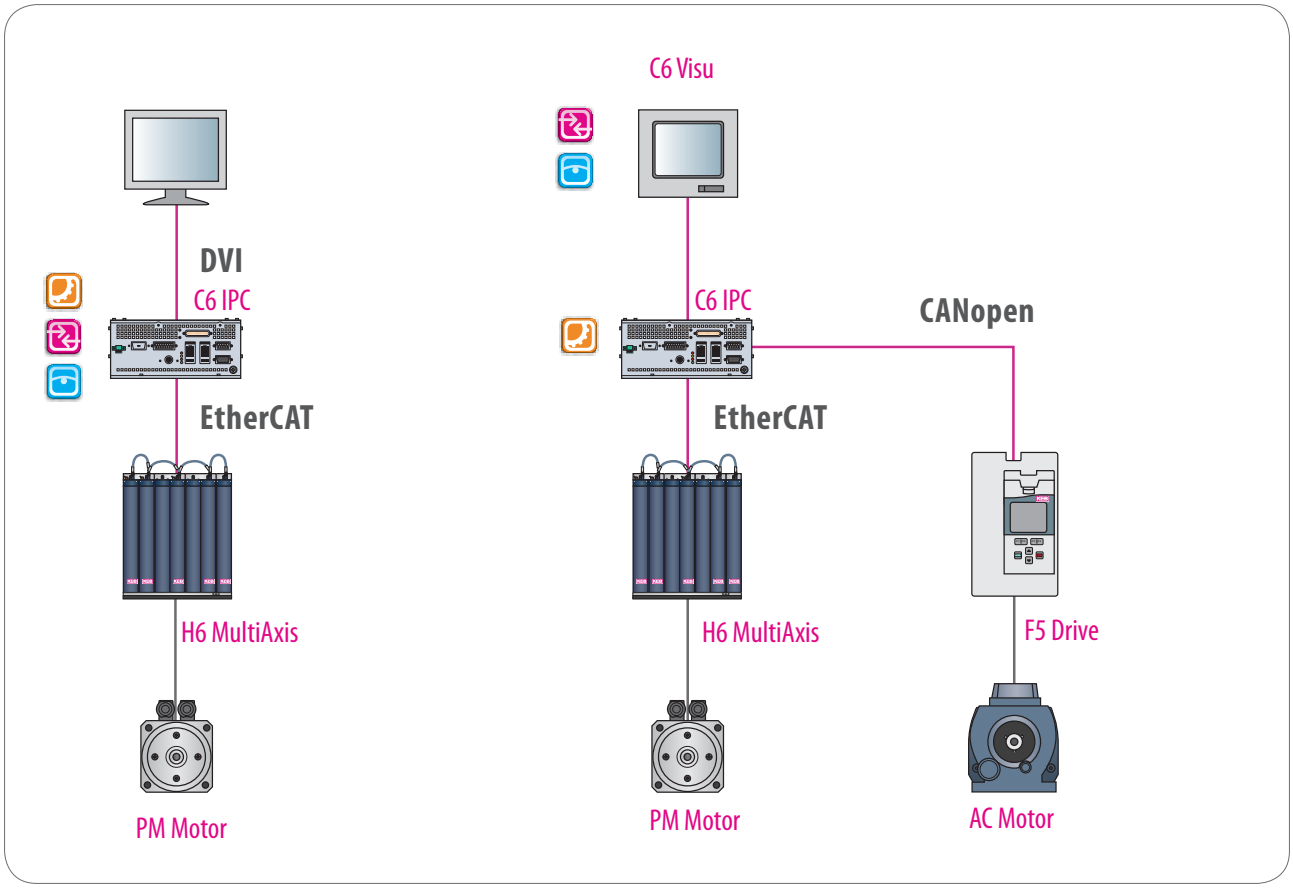
Hardware Solutions
IPC Solutions

KEB introduces the **IPC devices**, created in cooperation with partners, who are part of the KEB family with specific **know-how on all stages of development and production** of industrial controls and systems for visualisation.

Users can expect a **high level of performance** from these IPCs. Based on 64 bit microprocessors and Windows XP Embedded, the IPC solution runs in real time while providing traditional PC-style functionality with printer drivers, monitors, USB disks, camera systems, etc.

Ethernet based motion using EtherCAT paired with the KEB IPC solution results in the true **full performance of the Real-Time EtherCAT** fieldbus, proven in field installations around the world. **Bus limitations are a thing of the past.**

As with the embedded solution, it is also possible to use the IPC solution as a sub-controller between PLC and KEB drives or other devices. This layout provides a unique level of access to the drives not available with just PLC - drive topologies. For example, drives that are replaced in the field can be automatically programmed for immediate operation without involving field service and support.

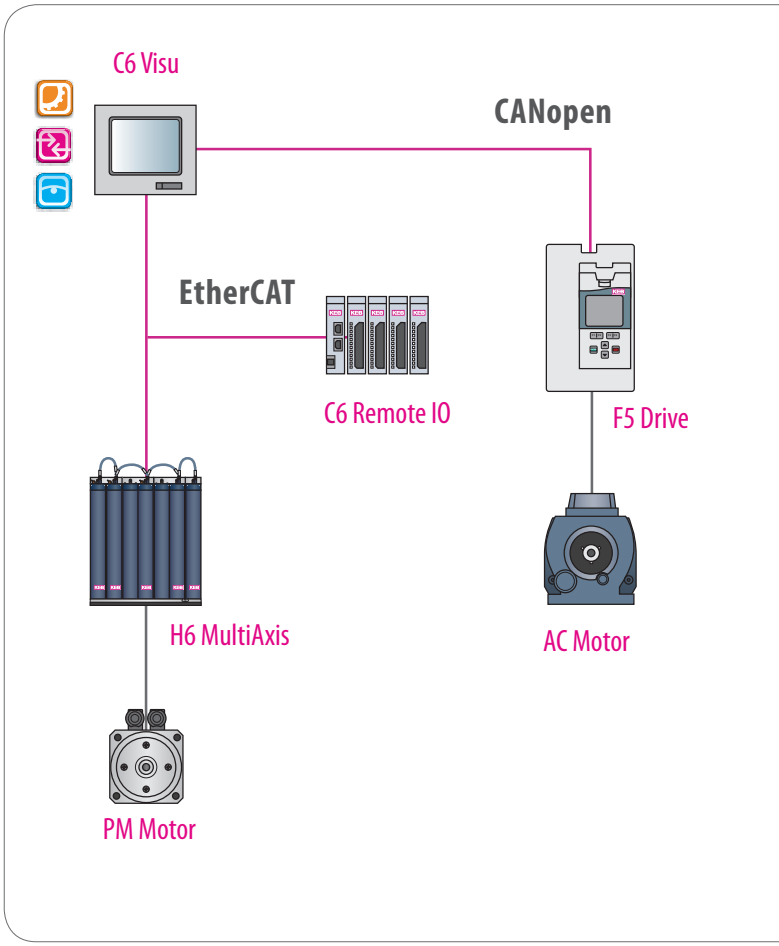


Fieldbus options like **Profibus DP, CanOpen** and others can be implemented via PCI and mini-PCI cards or with the on-board serial port.

For **factory communication** layers, the IPC solution can exchange data with other KEB devices or third party items using an OPC server, PLC handler, Modbus TCP or Modbus RTU. **COMBIVIS studio 6** libraries provide function blocks to easily implement these solutions.

Taking from the decades of experience of PLCs in automation, the IPC solutions are also equipped with such items as **retentive memories** and power supplies with voltage drop ride-through. Additionally, they improve the situation in other areas with **unrestricted task, registers and programs**.

With these design features, the **IPC solution is a perfect match for medium- to large-sized machines**.



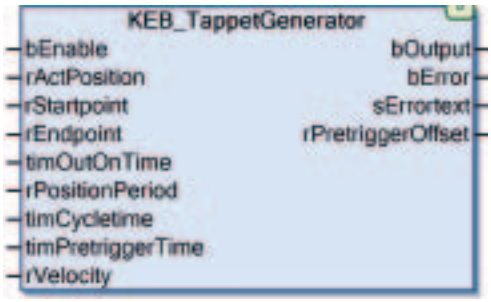
Software real time
BASIC

The KEB controls offering starts with the **BASIC solution.**

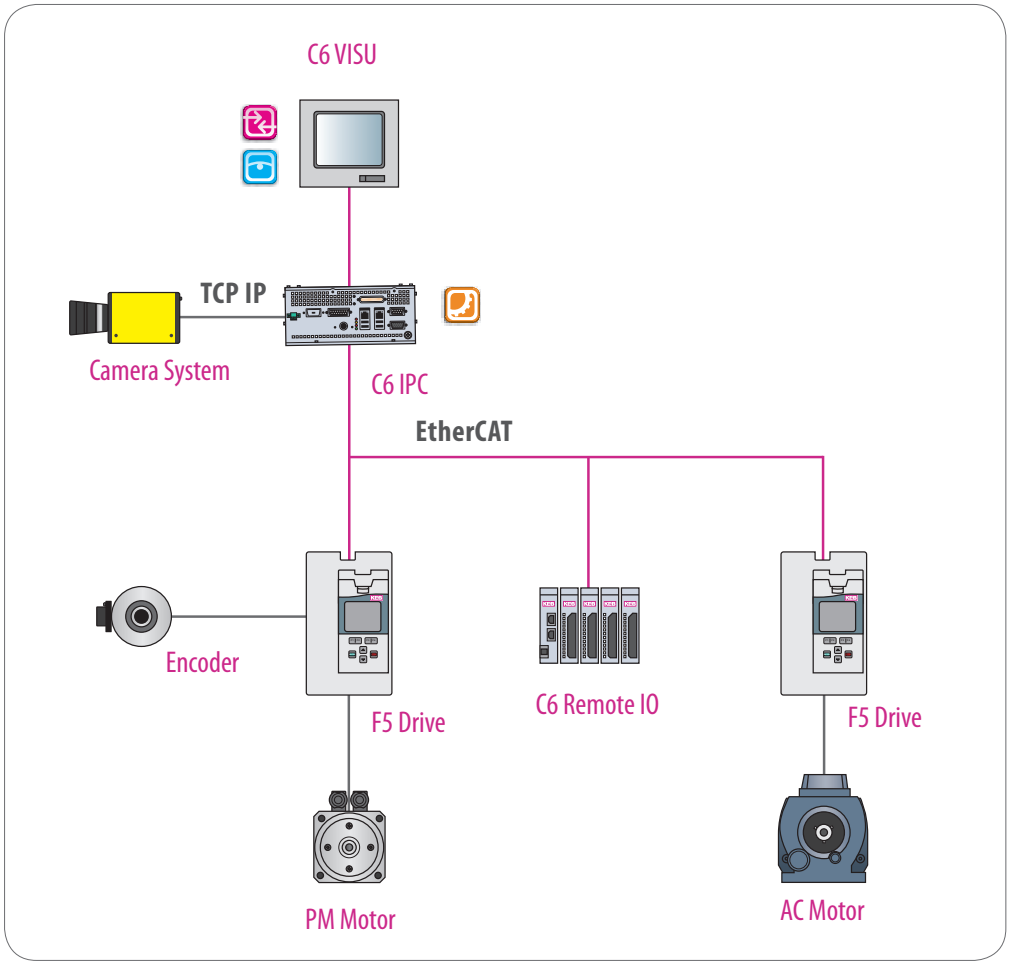
Based on the real-time system, the program **kernel guarantees deterministic behavior** with jitter values in the µs region. Thanks to this, a user can realise multitasking without program limitation.

Deterministic communication channels (EtherCAT, CANopen, HSP5) offer the possibility to use decentralised hardware such as KEB drives as remote IO points. Additionally, drive encoder positions can be used to create digital cam switches. **All of this can be realised without any additional hardware**.

The BASIC solution from KEB **is suitable for motion control where tasks are shared between controller and drives.**



Digital CAM disk



KEB_DriveAxis_Control

KEB_DriveOpenLoop_Control

The **KEB Drive Utility** library is very useful for closed- and open-loop drive control. Created in combination with the KEB drive technology, **the user has a simple function block interface** which makes programming motion easy.

This utility function block can run in cyclic or acyclic communication mode since the drive profiles are generated within the KEB drives.

Thanks to the KEB utility and **COMBIVIS studio 6**, **the axis information is available for use anywhere within the project**. Ready to use for

- point to point positioning
- speed mode
- speed and torque mode for open and closed loop ASCL (*) and SCL (**)
- motor managements.

(*) KEB specific drive firmware to handle AC motors with speed, torque control without encoder feedback.
(**) KEB specific drive firmware to handle PM motors (standard, torque and IPM) with speed, torque and position control without encoder feedback.

Software real time

PRO

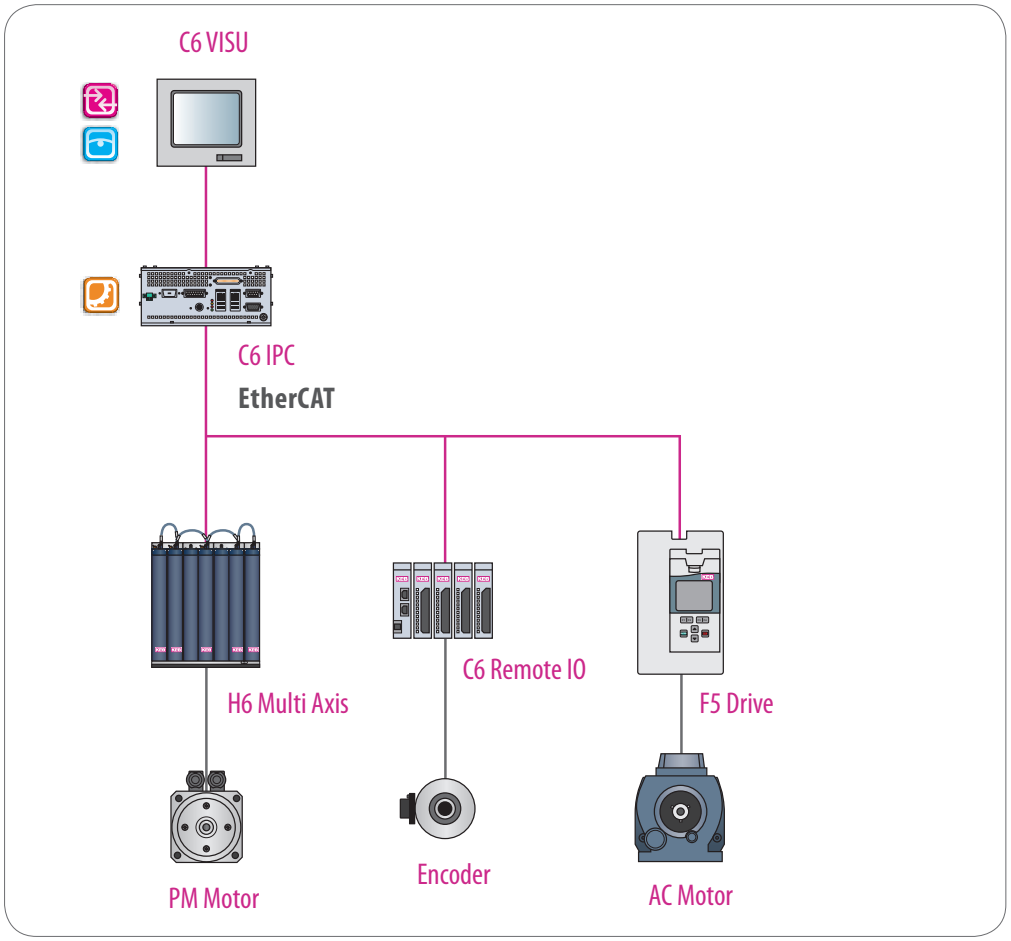
The **KEB PRO solution** provides a good mix between the performance needed to meet the customer's requirements and the cost.

Based on the **IEC 61131-3 programming standard** and the **PLC Open MC**, the user is investing in a solution for today and future machine development.

All control and interfacing with the drive devices are not brand-specific **commands, but commands as defined by the PLC Open** organisation.

This means maximum flexibility with regard to device choice and **code portability** even **with different automation hardware** platforms.

With the **PRO solutions**, the **system generates the motion profiles for all of the axes** using the deterministic communication bus. This means there are no limitations on the **number of profiles** and the profile, itself, can be switched in one motion cycle for the **fastest response possible**.

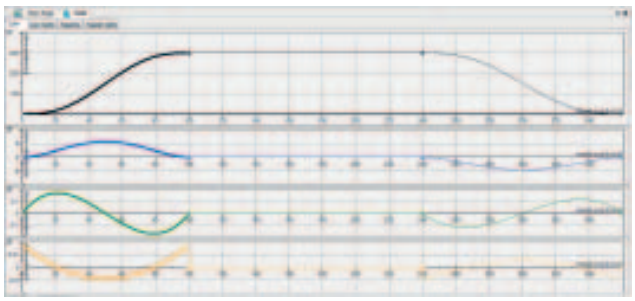


Expanding on the basic solution, the **PRO solution** has **more libraries and graphical tools** to setup advanced mechanical kinematics.

What the developer creates with these tools is handled within the PLC program, making it possible to change the machine setup using, for example, a C6 HMI. This allows the user to switch-over a machine from one product to another **with a touch of a button**.

Abstract drive interface is a technique used to create one program for different types of hardware (drives, axis, and hydraulic actuators) that a user can choose according to the specific needs of the machine.

Axis Configuration



CAM Editor

KEB Driver

External Actuator Configuration

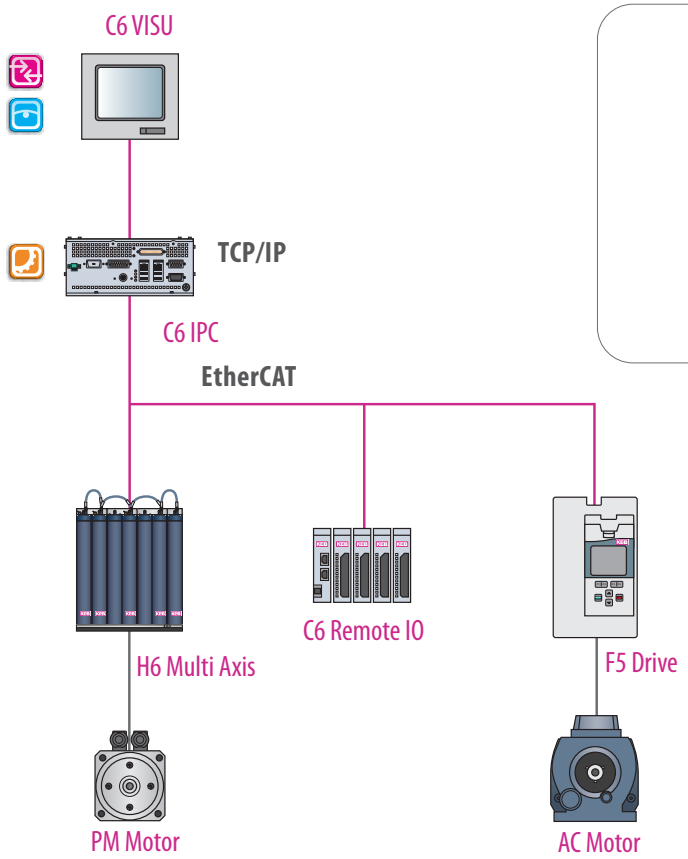
KEB_CamAxisControl

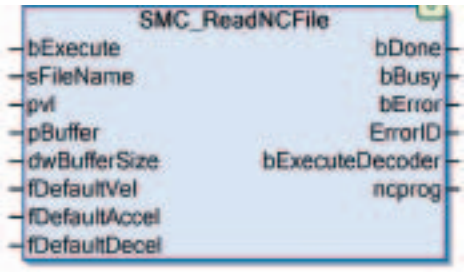
Software real time
ADVANCED A

The **ADVANCED solution** from KEB is the right choice for those who **CNC operation while keeping the standard PLC flexibility**. Expanding on the PRO solution, the **ADVANCED solution** includes the **CNC transformation libraries** and the **CNC language interpreter** based on DIN 66025 (**G-Code**).

The CNC library includes function blocks to use internally stored NC files from within the project or to load external NC files (ASCII / .txt files).

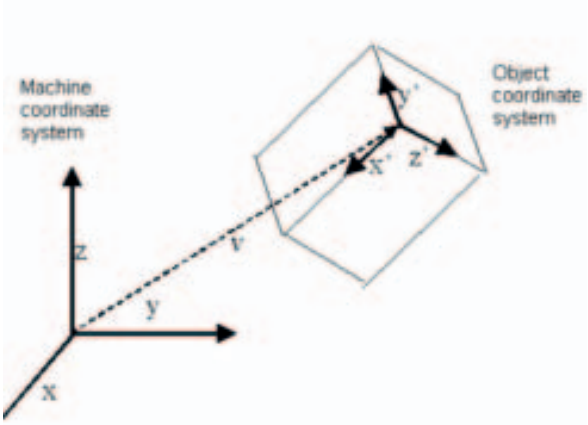
The combination of Industrial PC and **ADVANCED** functionality allow processing complicated tasks with **more than 30.000 ISO Code processing lines**.



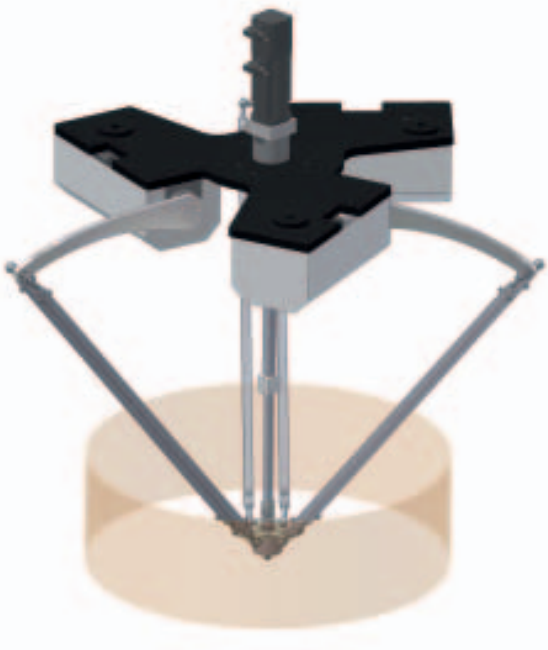


The power of this functionality can be seen when looking at CNC coordinate transformations. The CNC program is **translated to the real mechanical configuration in real-time for all of the points of the 3 dimensional Cartesian axes**.

The library CNC trafo is useful for companies who want to **integrate its own robot with different kinematics into the machine project**. By integrating the robot within the project, the external communication link between robot control and IPC is removed, **improving the machine performance and synchronisation.**



Coordinate transformation vector diagram


CNC Transformation_Library

With the **KEB ADVANCED solution**, the kinematics are not relevant anymore when writing the CNC program, allowing **the user to always chose the better mechanical and electronic power solution for the application**.

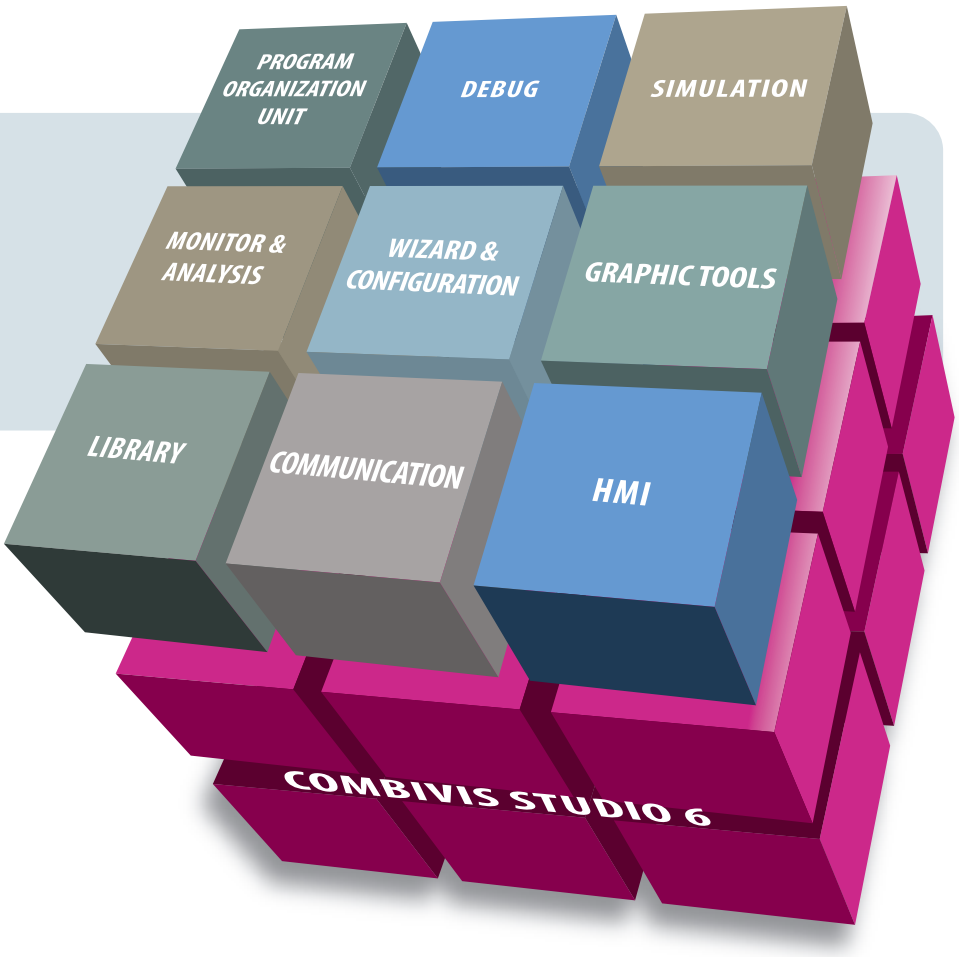
Kinematics supported:

- **Gantry systems**: (2 and 3 dimensional) with cutter, tool correction, stationary axis functions.
- **Scara Systems**: with 2 and 3 arms.
- **Parallel Systems**: Bipod and tripod.

Integrated development environment

COMBIVIS studio 6

CONTROL & AUTOMATION



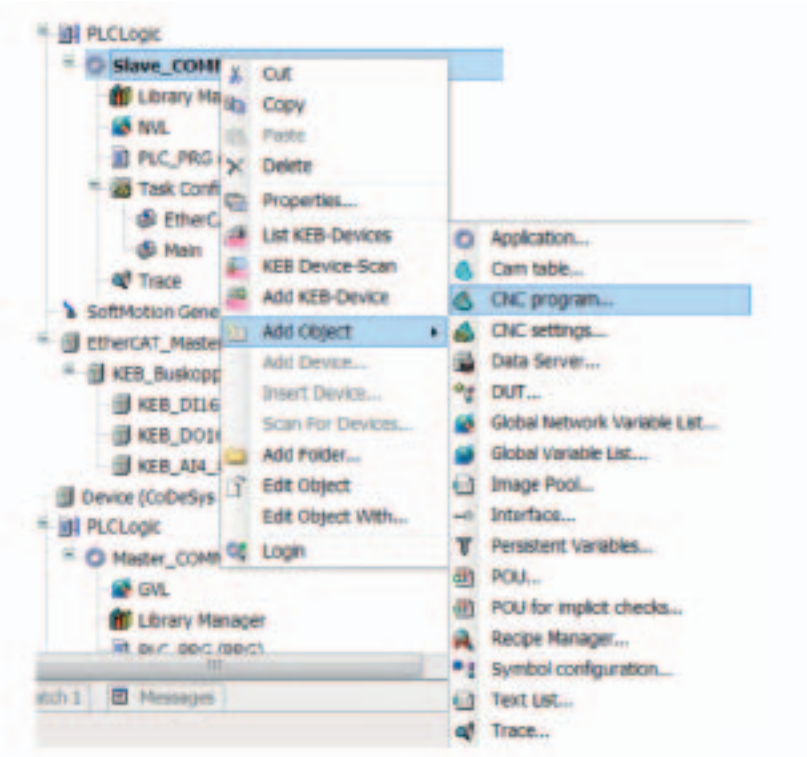
Integrated development environment
COMBIVIS studio 6

COMBIVIS studio 6 has been designed to **simplify complex programming tasks**.

Everything is available with a right-click of the mouse... to add objects; to access and modify the object properties.

KEB considered the investments in development customers must make when deciding to use the following standards:

- **NET framework** for a robust PC environment. Using the same PC software framework **as Microsoft's Visual Studio**, worldwide language support, standardised user interface, data access and web applications are already built in.
- **IEC 61131-3 programming** language compliant **for safe time investment**. Code can be developed and reused in all products which are compliant to the same standard.
- **PLC Open Motion Control** for motion standard. All compliant devices must support clearly defined motion function blocks providing hardware independence, **reduced training cost through knowledge reuse** and the' possibility to create **code that is truly hardware independent.**



COMBIVIS studio 6 Navigator

Designed for industrial automation, **COMBIVIS studio 6** has what the user wants when programming control systems.

The project **code running on the device is compiled** - it is not possible for someone to see the know-how behind the code. Source code can be archived, which locks the compiler and library version within the archive. Future edits will have the libraries and compiler version originally used - **no searching for the right library!** Archives can also be stored on the device **with password protection**. In the future, if a field technician connects the IDE, the project archive can be read out and opened, with the correct password, of course!

The IDE uses an **all-in-front project navigator** (only one tab on the editor), which allows **easy access to more than one device** and easily define the data exchange between them.

Folder creation to **organise all of the objects**, custom toolbars and keyboard shortcuts, standard Windows Find and Replace tools are just an example of how the **environment is programmer-friendly**.

COMBIVIS studio 6 Navigator

Integrated development environment
COMBIVIS studio 6

The development layer of **COMBIVIS studio 6 contains a lot of programming possibilities**, a complete online and offline functionality, compilers as well as additional components for configuration, visualisation etc.

All editors are specifically designed to **ensure optimal handling**. Ideas and **suggestions from experienced users were incorporated** in the development process.

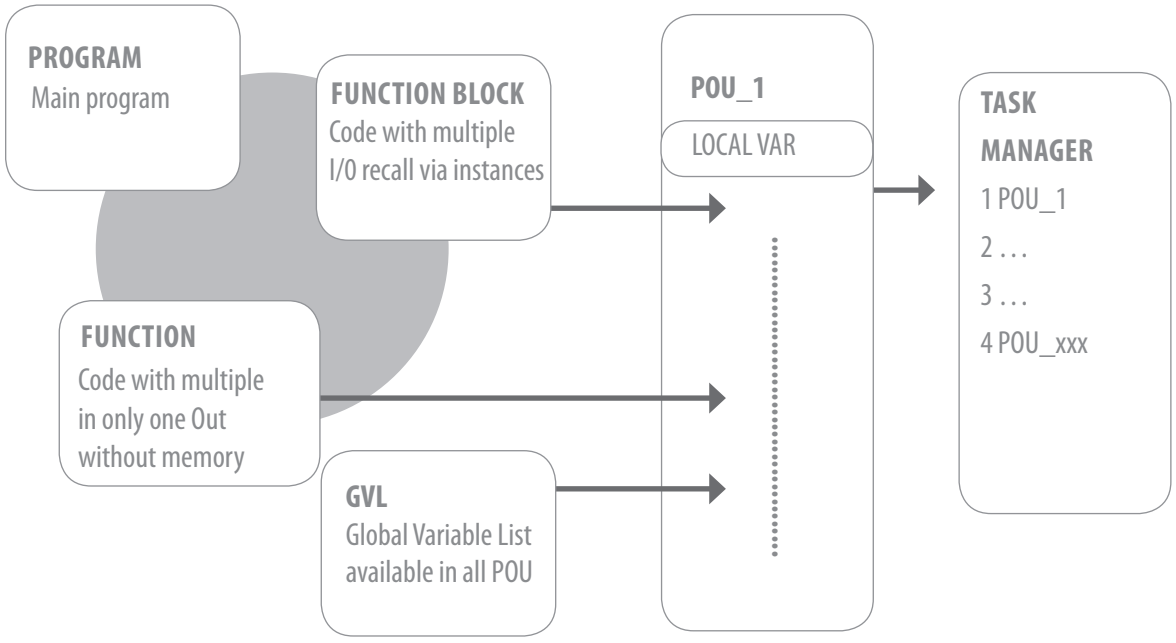
The user can choose up to **6 different programming languages** compliant with IEC 61131-3: Ladder Diagram (LD), Function Block Diagram (FBD), Instruction List (IL), Continuous Flow Chart (CFC), Sequential Flow Chart (SFC) and Structured Text (ST).

In both online or offline modes, **code can switch between LD, FBD and IL with a keystroke**; the code is automatically converted.
Actions and Methods functionality **are supported** and can be programmed in a different language than the parent POU.

Function blocks and commands can be entered directly or **dragged and dropped** from a toolbox. Additionally, COMBIVIS studio 6 offers an intelligent input assistant, auto-complete and extended **IntelliSense functionality**.

While developing the application, **context-sensitive commands** are available via mouse right-click or automatically **language constructs creation**.

There is **no POU limits within the IDE**; only the hardware resources itself define the limit.

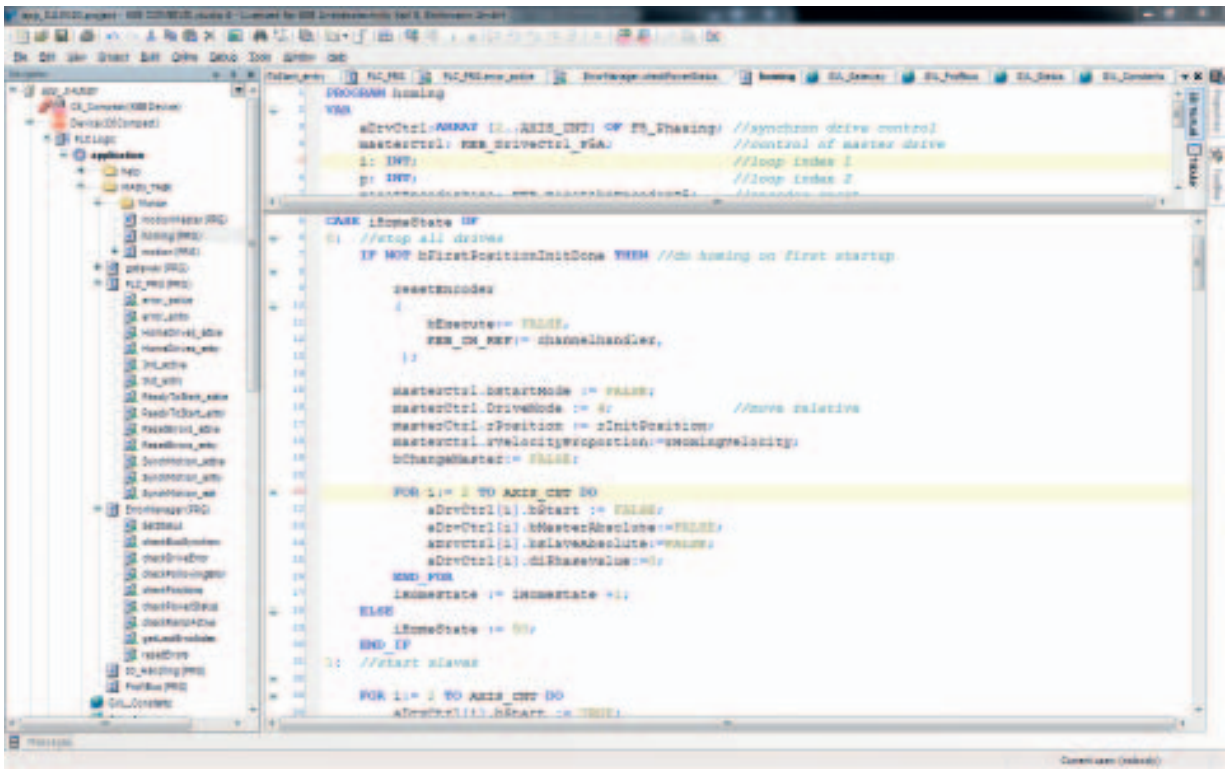


Part of the IEC 61131-3 concept

Structured Text(ST)

The high-level language construct of **Structured Text (ST)** make it especially suitable for programming loops, state machines and procedural processes. **For programmers who already know languages such as 'C', 'PASCAL' and 'BASIC'**, will immediately feel comfortable with ST.

The ST Editor offers a series of features well-known from other high-level language tools. For example, if you start typing an IF code block, the editor automatically adds the required END_IF and indents the codes space inside the block, ready for the next line of code. Later, if the cursor is placed on the IF keyword, the mating END_IF is automatically highlighted, **easing the programming of long, nested conditions**. Additionally, code blocks can be folded and unfolded simply by clicking the "-" or "+" symbols just to the left of the initial statement.



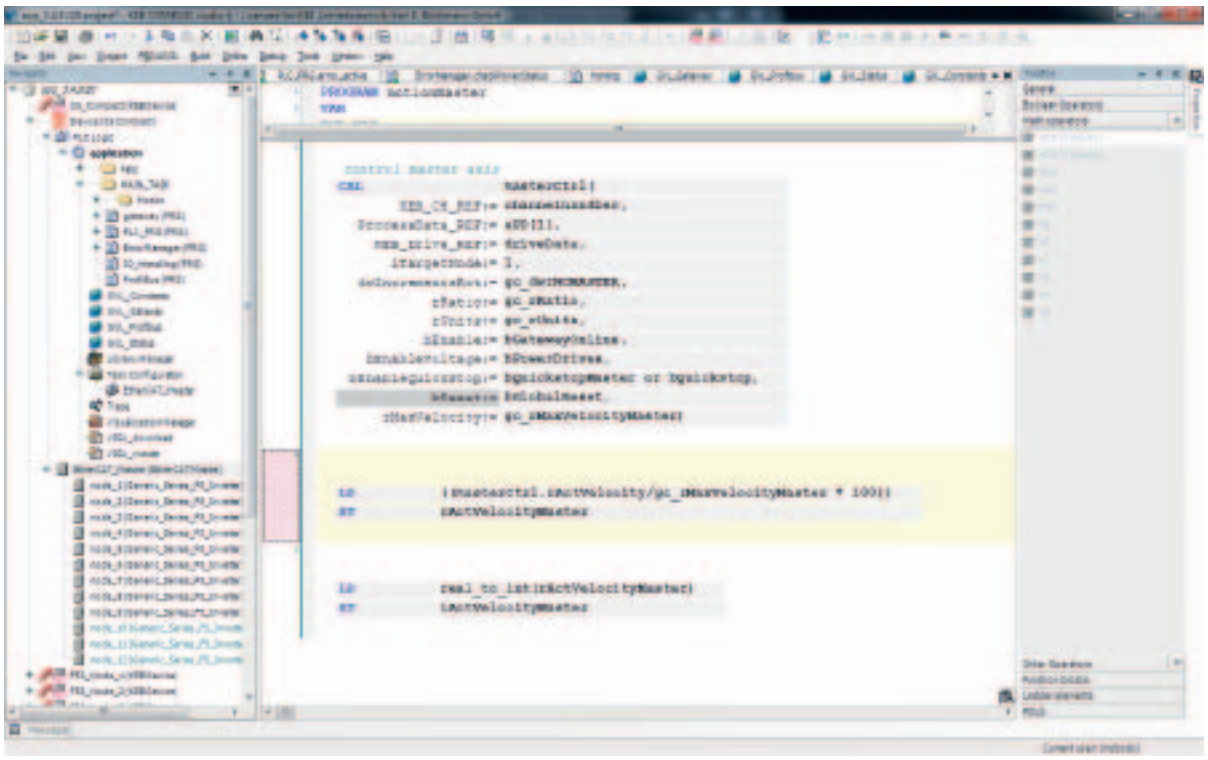
COMBIVIS studio 6 ST editor

Integrated development environment

COMBIVIS studio 6

Instruction List (IL)

The **Instruction List (IL)** programming language is available as part of the IEC61131-3 programming standard. **This language is familiar to many, as it has been used since the early days of automation**. It is a simple language based on an accumulator - load - store model. Each operation is primarily based on first loading a value into the accumulator with the LD command, and then calling the desired operation. The result of the operation is written into the accumulator and can be saved into a variable with the ST command. The IL editor supports all IEC 61131-3 operators whether or not the operations have one or several inputs and outputs. As with the other standard languages, comments, negations, jumps and set/reset commands are available.



COMBIVIS studio 6 IL editor

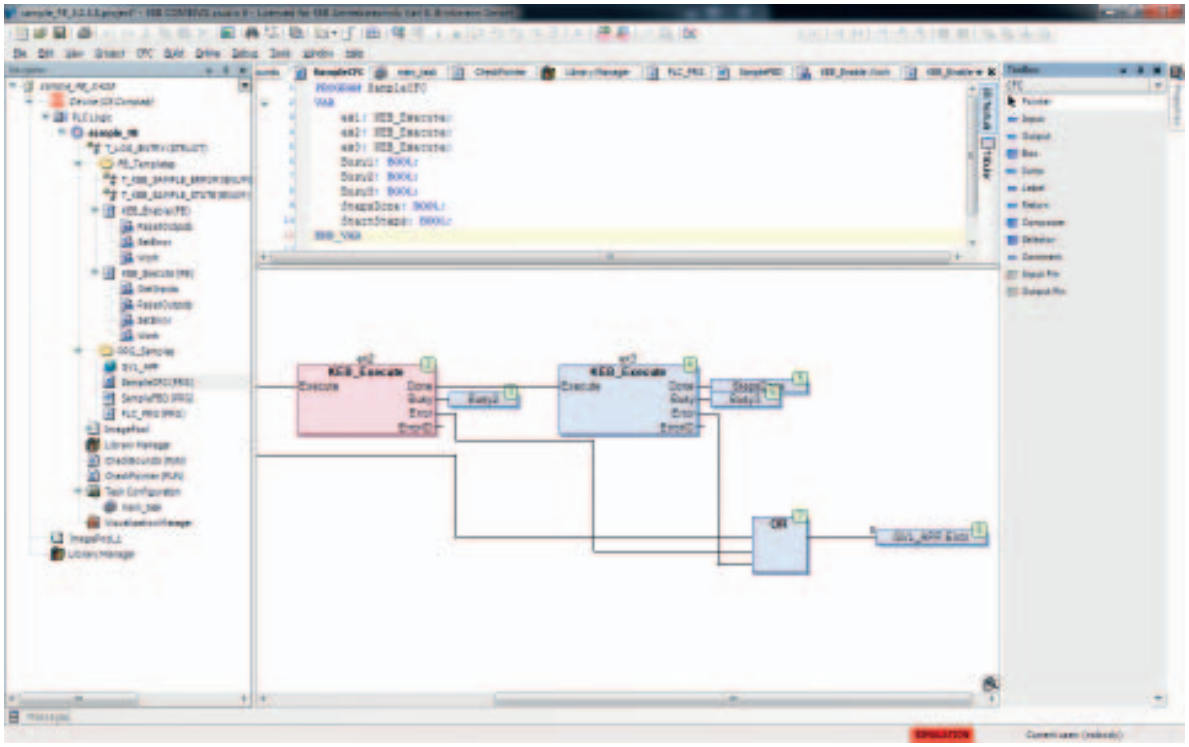
Continuos Function Chart (CFC)

Continuous Function Chart (CFC) is simply a different implementation of the Function Block Diagram (FBD). Compared to other rung-based editors, the **CFC editor allows the user to program continuous connections - i.e. feedback loops**. The connections between inputs, operators and outputs are not automatically created; they must be drawn by the programmer.

In order to have full control of the program, the execution **sequence can be changed**. This is visualised by small green numbers in the upper right-hand corner of each function block.

The **toolbox contains common tools** such as comments, set/reset outputs, negation and jumps.

This graphic language offers the developer the possibility to **graphically map the code in any shape** that is the most pleasing to the eye. **Automatic instance recognition** and **connection between pre-selected pins** is also available.



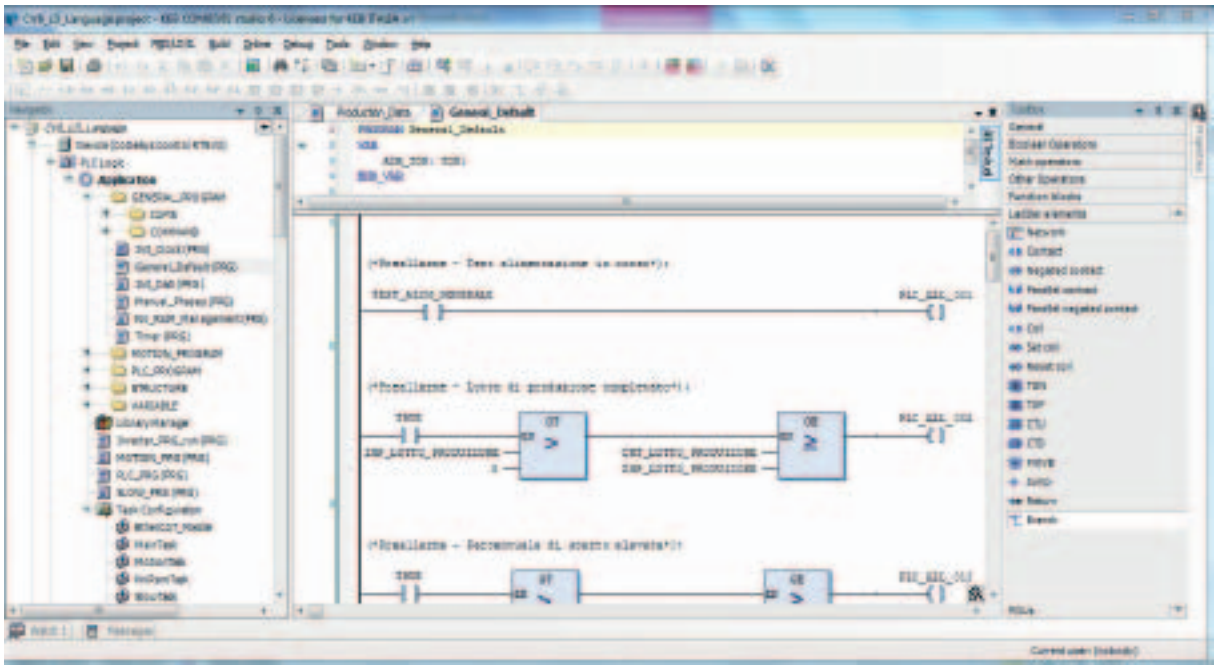
COMBIVIS studio 6 CFC editor

Integrated development environment

COMBIVIS studio 6

Ladder Diagram (LD)

Also known as ladder logic or relay logic, **Ladder Diagram (LD) shows the code in the style of an electrical circuit**. It is very popular with PLC programmers because it gives an **easy to follow image of contacts and relays**. Boolean expressions are represented by connecting relay contacts to coils from the "power rail" on the left to the "common rail" on the right. A function rich toolbox divided into Boolean operators, math operators, logic operators, etc. **gives the programmer the chance to use the KEB control like a PLC** but with the power of a Programmable Automation Control.



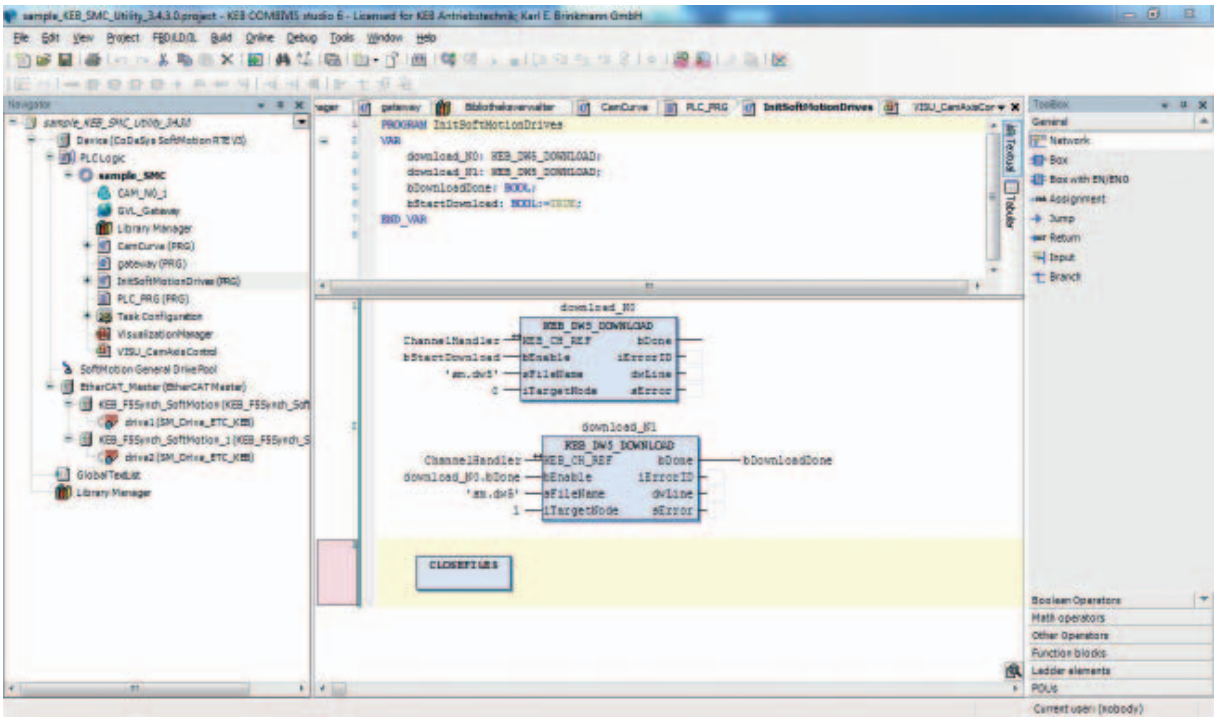
COMBIVIS studio 6 LD editor

Function Block Diagram (FBD)

The **Function Block Diagram (FBD)** graphic editor is a **mix between a rung-style ladder diagram and a concise function block schematic**. When a new element is inserted, the connection lines are automatically drawn. The FBD toolbox provides **drag and drop programming**.

Inputs can be defined as rising- or falling-edge detected or negated without adding additional function blocks. Output supports set, reset and jump configurations.

Just like the LD editor, an enable (EN/ENO) input can be added to the function block so that the function block only executes when desired.

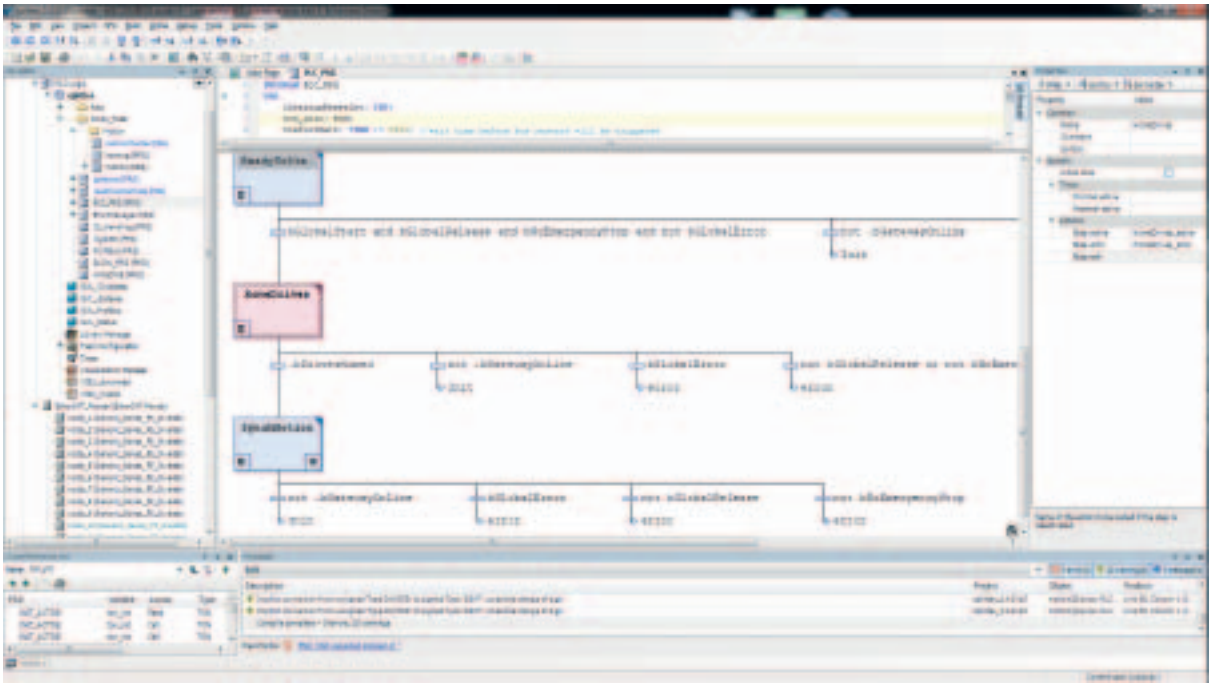


COMBIVIS studio 6 FBD editor

Integrated development environment
COMBIVIS studio 6
Sequential Function Chart (SFC)

Sequential Function Chart (SFC) is a **graphical language in the style of a flow chart**. Sequential tasks can be broken down and represented as individual steps or blocks of program code. Actions defined within the step are executed as long as the step is active (once per program scan). Transition conditions can be defined to be triggered during the transition from one step to another. Several steps can be executed in parallel or in alternate branches. The programming language between step and transition could be select independently.

The SFC editor **supports all qualifiers defined by the IEC standard** for controlling how actions are executed.



COMBIVIS studio 6 SFC editor

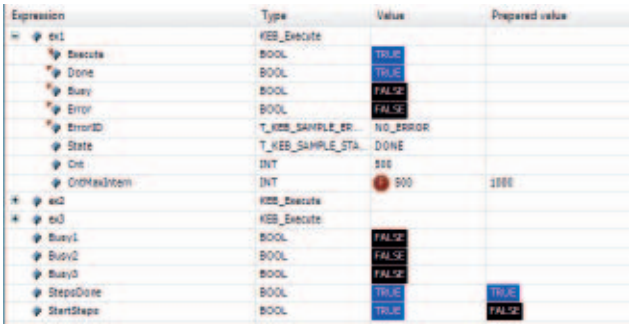
Debug Tools

The **importance of debugging tools** is well known to KEB which has been developing application functions for over two decades. COMBIVIS studio 6 not only provides convenient programming tools, but also offers many **helpful tools** when it comes to **debugging and commission applications** - often the major part of the engineering process.

Once the programmer is logged into the controller and in online mode, all of the features described below are available:

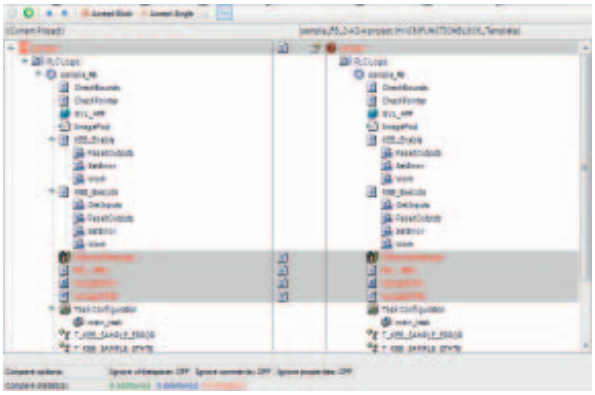
- Forcing variable &/or online change
- Breakpoints
- Cross reference
- Flow control
- Compare project (also available in offline mode)

Flow control provides visual cues to see what part of the **code is currently being executed**.

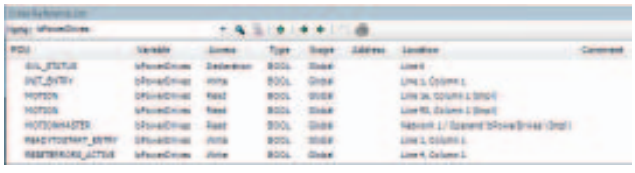


Forcing Variables

FlowControl



Project Compare



Cross Reference List

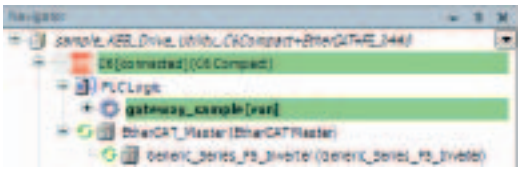
With **cross reference list**, variables can be shown with their IEC address, type, location(s) and usage(s). Double-click on a listing **to jump to the actual source code** at that location. The cross reference list can also be printed out for future reference or documentation.

Integrated development environment
COMBIVIS studio 6
Monitors Function

Extending the debug tools, **COMBIVIS studio 6** includes **easy-handling features** for every part of the solution, such as the main **PLC code, communication systems and axis setup and behavior**.

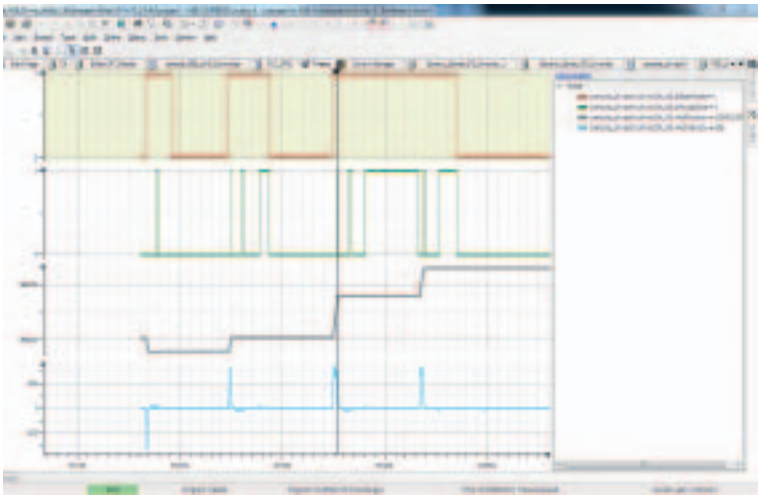
The **device editor** provides dialogs for the configuration of the devices in the device tree. The device editor can be opened by double-clicking on a device in the Navigator window. As soon as the connection to the device has been established, **several configuration and diagnostic functions are available** via tabs on the device dialogue window. **Deposit and manage files**, display **log system messages**, **PLC settings**, define users, user groups and access rights.

Up to four **Watch windows** can be used to monitor or to change selected variables, **allowing the programmer to monitor any POU** while still having access to critical variables for debugging.



Device Editor

Watch Window

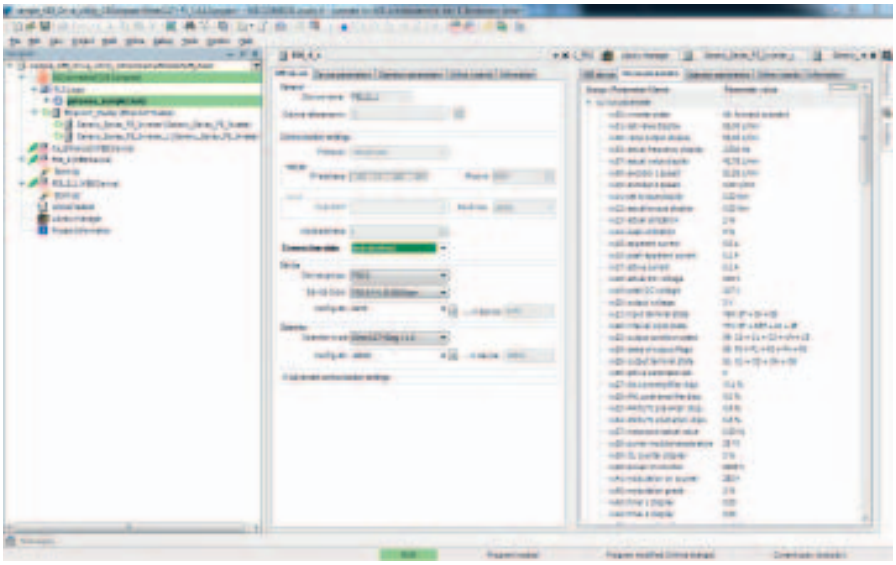


Trace Edior

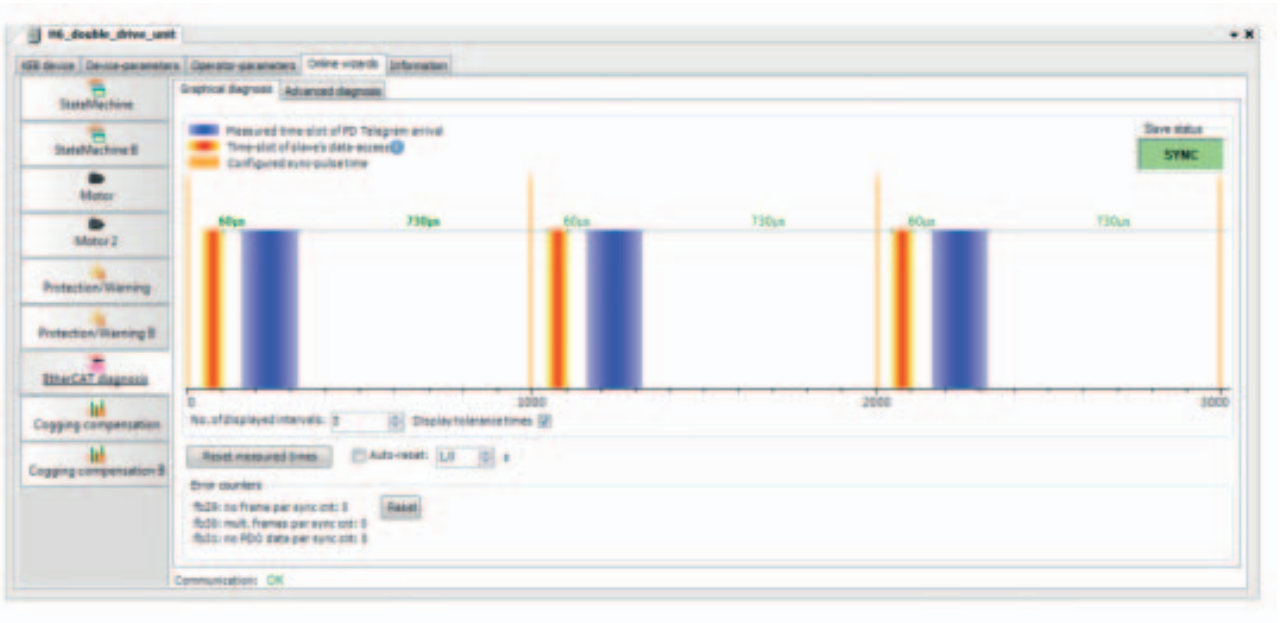
The **trace editor** is a sort of **digital storage oscilloscope** (DSO) or logic analyser directly **integrated in COMBIVIS studio 6**. The systems can sample the variable values of an application, store them in a ring buffer and then visualise their progression in the trace editor window. The user can use **more than one trace in parallel** and configure the sampling process in the trace configuration. **Any variable within the application can be traced**. When needed, the sample time can be slowed to show trends. **An event trigger can be defined to capture** pre- and post-event variable states. Triggers can be based on rising-edge, falling-edge or even variable levels (equal, less than, greater than). Finally, the visualisation can be customised to the user's liking.

The **possibility to reach every KEB axis from the same programming platform** allows the programmer to configure all devices whether directly connected or even when using remote connections.

The drive plug-in modules include **a list of features and wizards** to help with the commissioning process. In the case of the **bus analysis**, the EtherCAT real-time communication performance is displayed to verify timing margins.



Drive Parameter

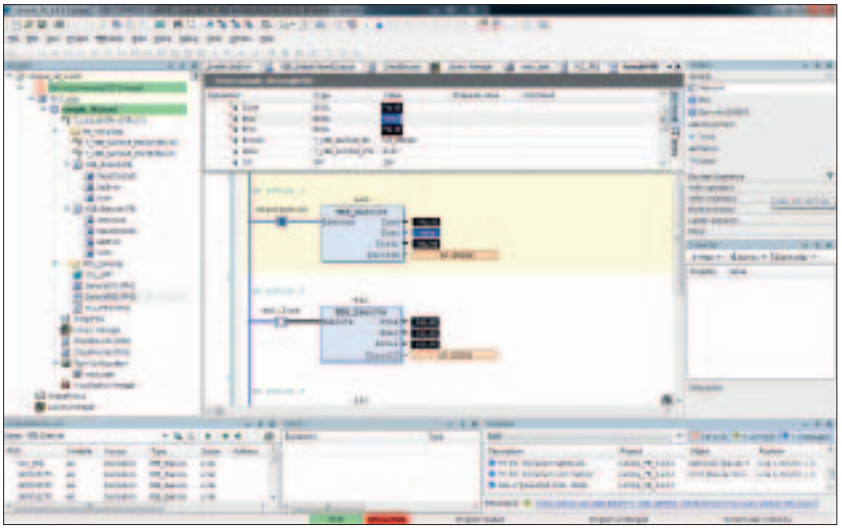


Motion Bus Analysis

Integrated development environment
COMBIVIS studio 6
Simulation

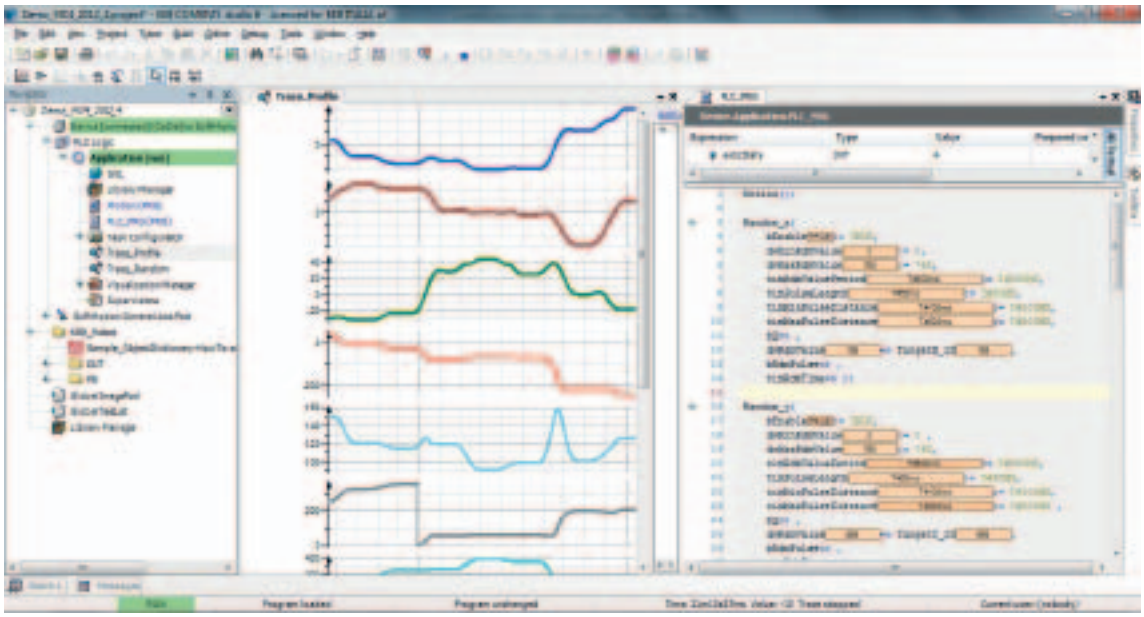
Many developers want to prepare a project in the office, where the real hardware is not available, then go into the field to run the machine, focusing on performance testing, not code debugging. For this reason **COMBIVIS studio 6 includes more than one simulator**.

One simulation is for the PLC logic (menu Online | Simulation). This gives the programmer the capability to **force variables and verify the source code behavior**.



Simulator

COMBIVIS studio 6 also offers advance tools to **simulate the axis movement on the same PC where the IDE is located**, giving the programmer the possibility to not only verify the PLC logic, but also the machine behavior - even if the motor and communication system is not connected.

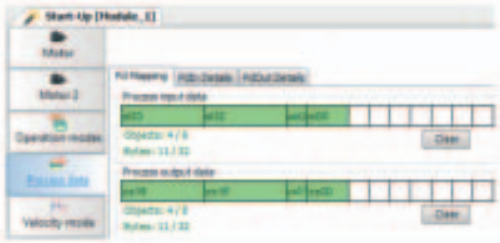


Windows Simulator

Wizard

Wizards are a part of COMBIVIS studio 6. They can be divided into online and offline types. One such wizard is the **Motor Startup** wizard, which can access the **KEB motor database** or third-party generated databases (even programmer generated databases). **Third-party databases** can be easily shared with other **COMBIVIS studio 6** users.

The programmer can also create a complete process data mapping configuration using the **Process data Startup wizard.**

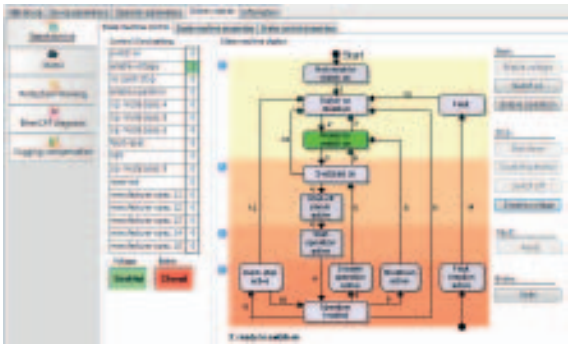


Drive Communication Mapping

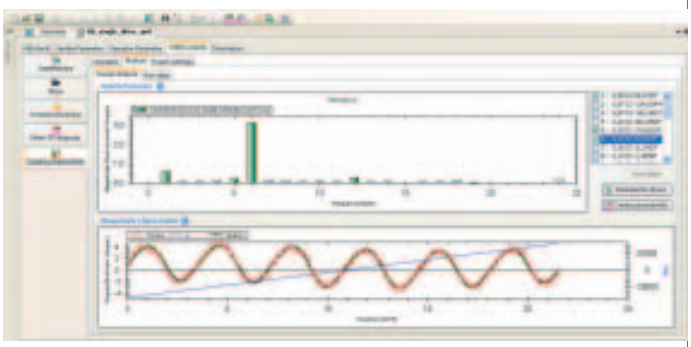
As part of the online wizard, the **drive operating state machine** is available for manual adjustment, for situations that require **axis movement without completed PLC code**.

Motor Configurator

The **anti-cogging wizard** is an example of **KEB experience with motion control**. In many cases, permanent magnet motors exhibit shaft cogging due to the internal construction and magnet alignment which transfer through to the control loop and create instabilities or reduced accuracy. The anti-cogging wizard **allows the user to eliminate permanent magnet motor cogging**.



Drive Startup Wizard



Anticogging Wizard

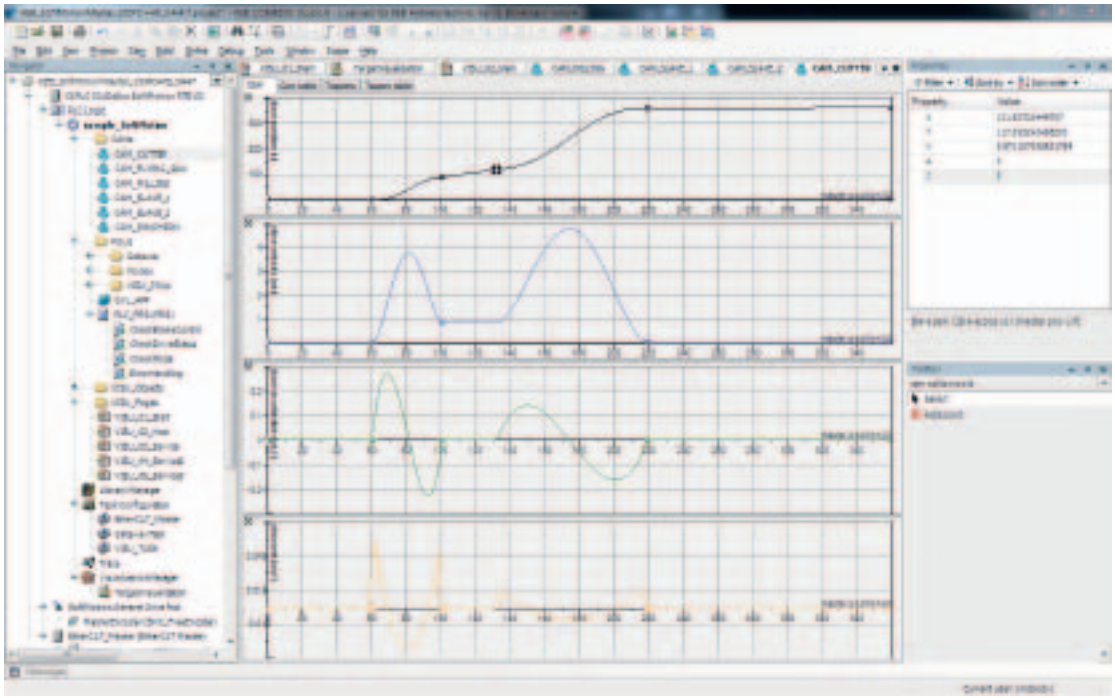
Integrated development environment

COMBIVIS studio 6

CAM-Editor P A

The graphic editor which **COMBIVIS studio 6** provide to the user is a powerful tools for **Cam Profile generator** and **digital Cam disk handling**. System designers will enjoy the layout choices available - from the **linear or spline** interpolator to the **loss compensation for the cam disk switch**.

Cam profiles are **stored in table form** and can be **switched in real-time** using IEC function blocks. This allows the designers to store large numbers of cam profiles within the controller and accessible via HMI.



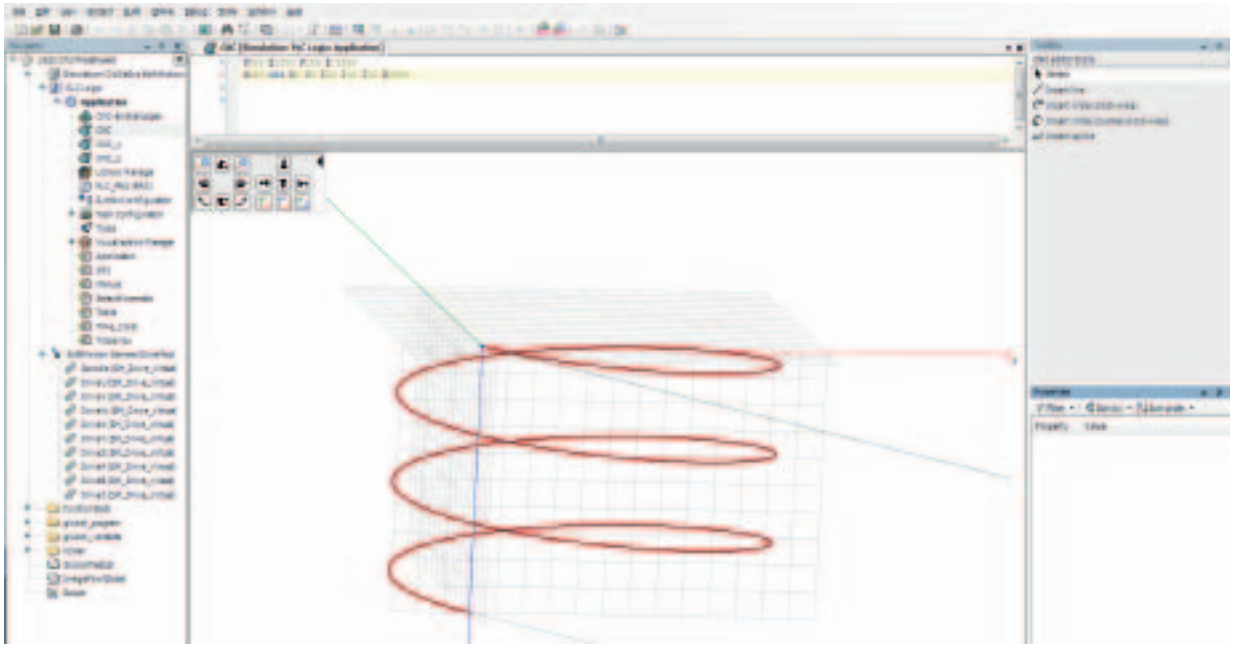
CNC-Editor A

For customers who need a **3D motion tool**, COMBIVIS studio 6 includes a **CNC Editor**, compliant with **DIN 66025**. With the KEB solution, manufacturing companies can use well known **G-Code** part files or TXT - DXF CAD files to control the motion profile.

The KEB system can handle the G-Code path either as part of the compiled code or **process an external file which is buffered**.

The buffered file can be changed in real-time for situations where long processes are required.

Aiding in the design, a wide range of utilities can be used to avoid loops, calculate round and smooth paths, working with 3rd or 5th order polynomials, limit speed, 3D scaling, rotating and split.



Open Solution

Open Solution

The **device repository** is an easy way to handle and connect different devices from **KEB** or other **third party** device manufacturers.

To add a device to an existing project, simply right-click and choose "add device".

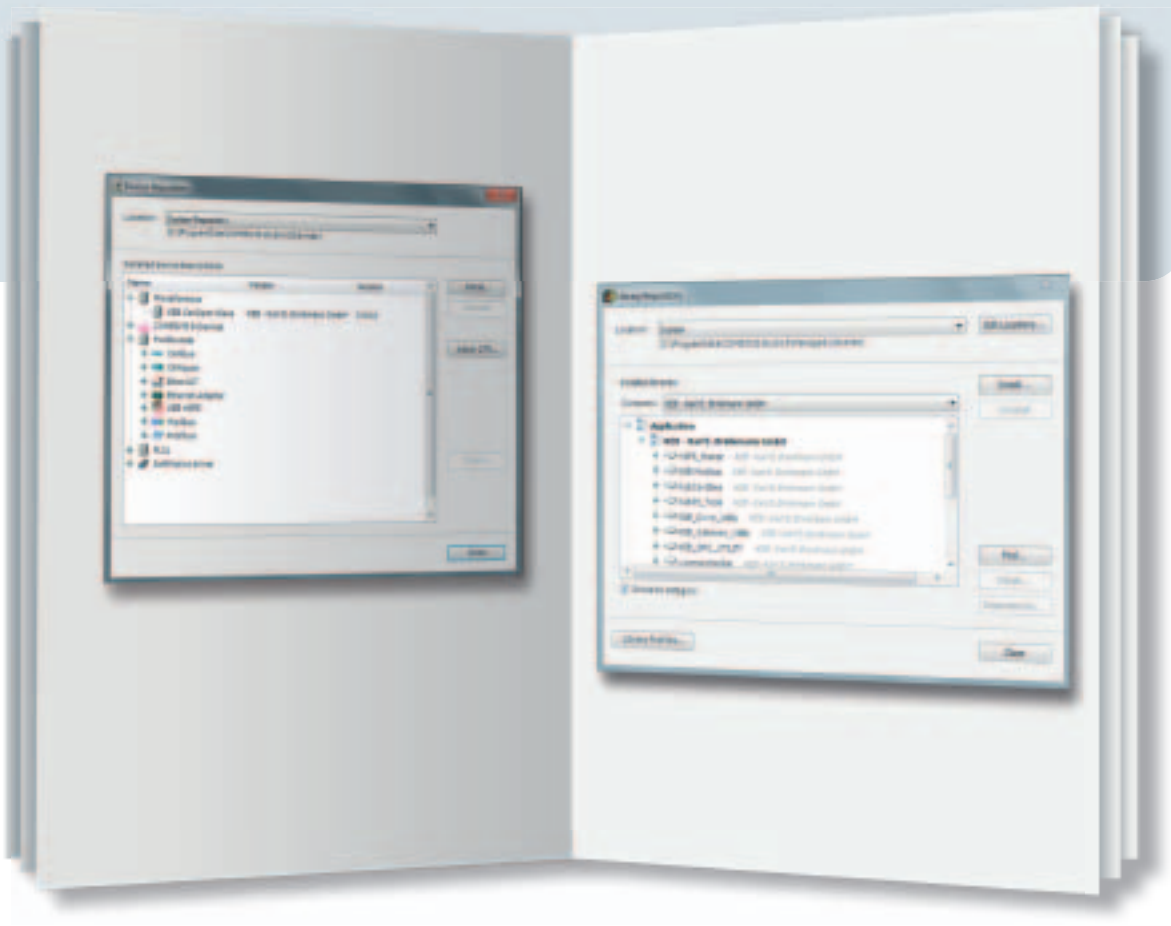
A large number of **libraries** are included within COMBIVIS studio 6.

The programmer can call on **KEB's experience** by using the available **KEB libraries**, while also having the possibility of creating a **personal library** that can be shared with other programmers. Library can be summarised in the following group:

- PLC & Drive Utility
- Application Utility (*)
- Communication Utility

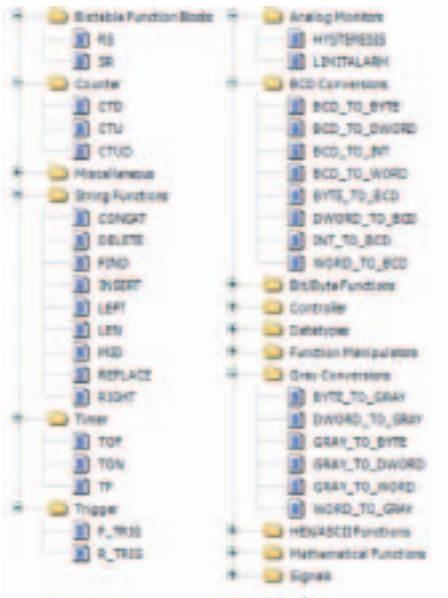
(*) many libraries developed for a specific sector can be used in others application (e.g. PID, Torque winder, etc…)

CONTROL & AUTOMATION



Open Solution

PLC & Drives Utilities



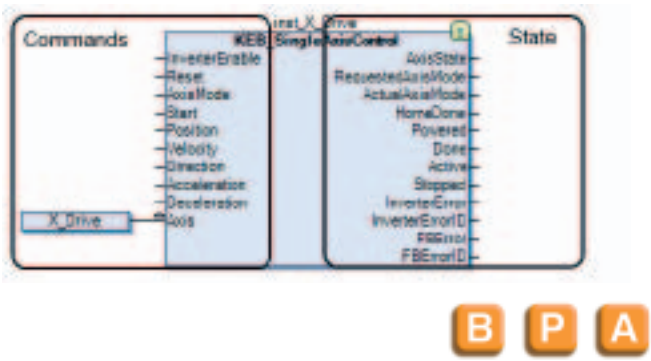
COMBIVIS studio 6 provides **all the functionality** necessary to handle any type **of logic or algorithm** required by providing libraries, functions and function blocks for both PLC and motion control tasks.

The **combination of pre-loaded** functions **and the open platform** guarantees the programmer no limit in PLC functionality.

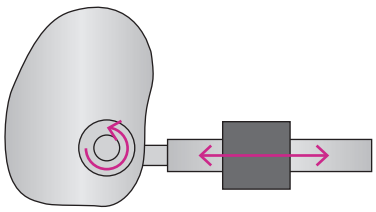
The **Standard library** contains common items such as timers, counters and triggers.
The Utility library contains additional items such as signal manipulation, PID controls, format conversions and other tools.

A part of the **COMBIVIS studio 6 library** has been created to support developers who need to **easily apply motion to axis drives** without "reinventing the wheel." KEB has developed several motion function blocks specifically for KEB drives.

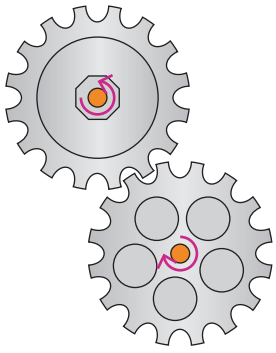
With the KEB Drive Utility library, project **development time is reduced**. Axis control solutions from simple velocity or positioning modes up to more complex synchronised motion tasks such as caming, gearing or phasing are provided. Thanks to the combination of IEC 61131-3 and Intellsense, the programmer can attach an axis, select the motion behavior and monitor the axis status **all within one function block**.



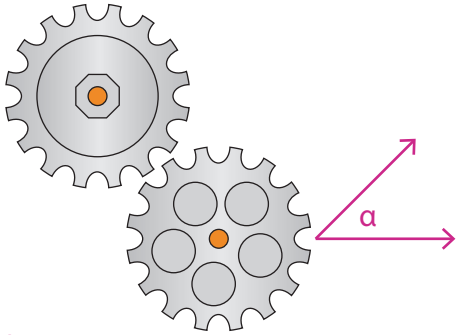
B P A



CAM Profile



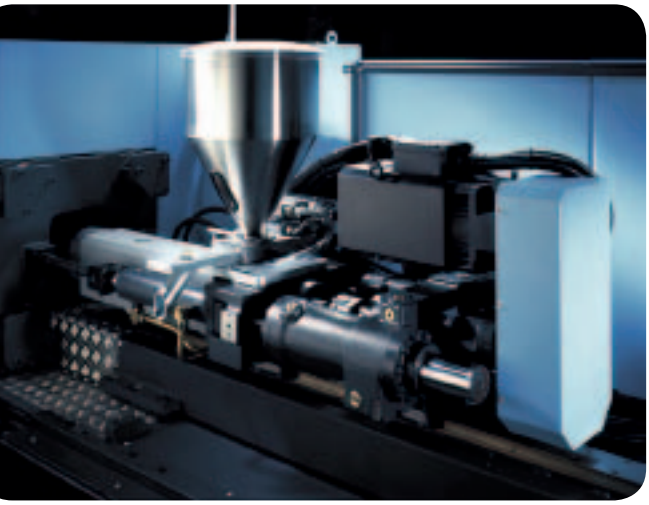
Gearing

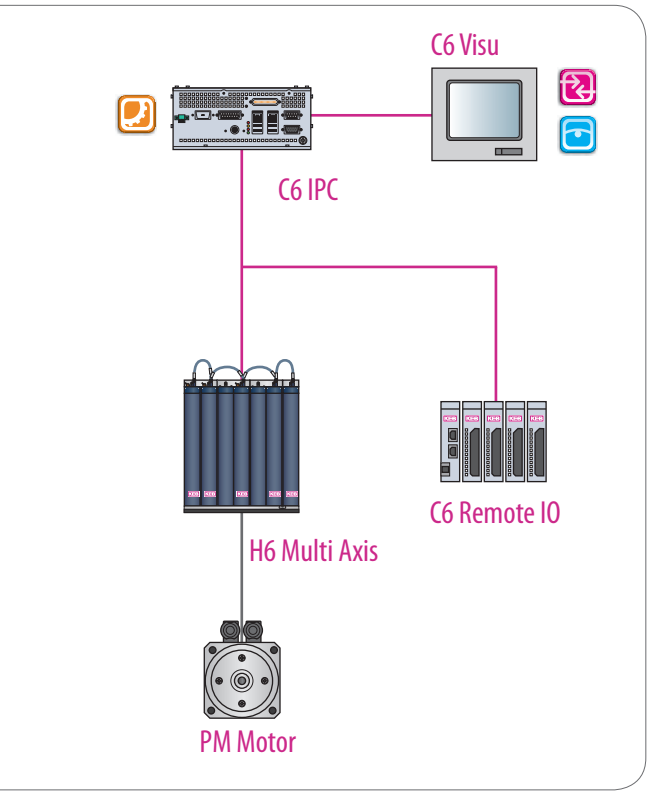


Phasing

Application utilities

Plastics and forming technologies

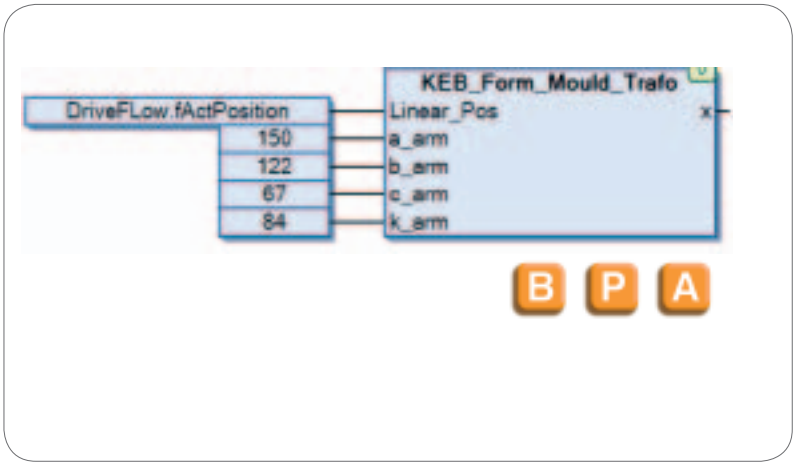


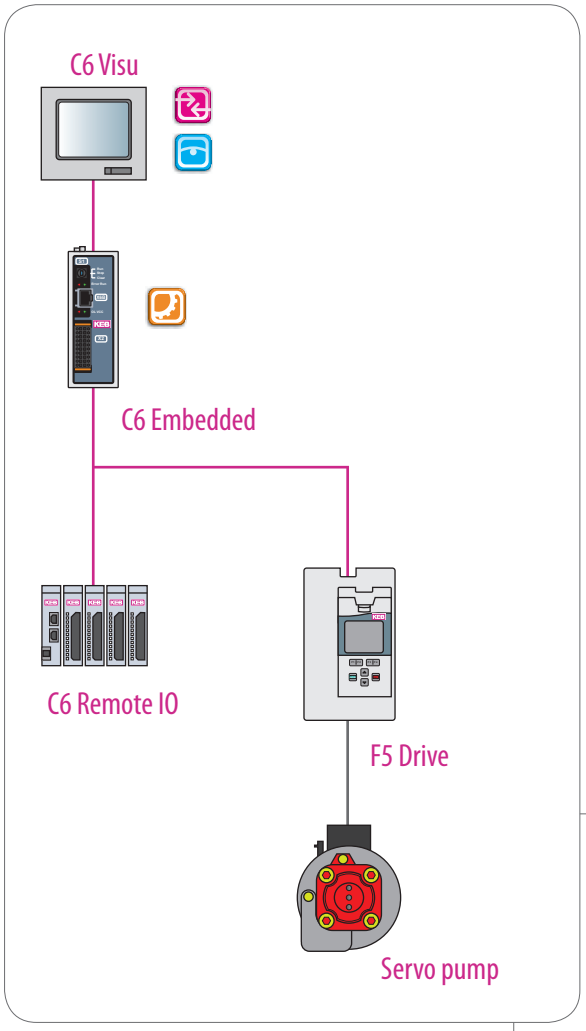


For many years, **KEB** has been an **important player in plastics technologies**, blow molding, forming and injection molding machines. In these markets KEB can provide **standard and customised solutions** to meet the specific application requirements.
Thanks to the **KEB application team**, high performance and efficiency, optimised process, reduction of life cycle cost and higher productivity are the benchmark **for successful machine concepts**.

The next few pages provide a small summary of various parts of the KEB know-how.

The need to speak the **end customer's language** has lead KEB to create specific kinematic function blocks for the injection molding and forming machines.
With these libraries, **the end customer doesn't need to worry** about the nonlinear transmission and its relationship with the physical position of the mold.

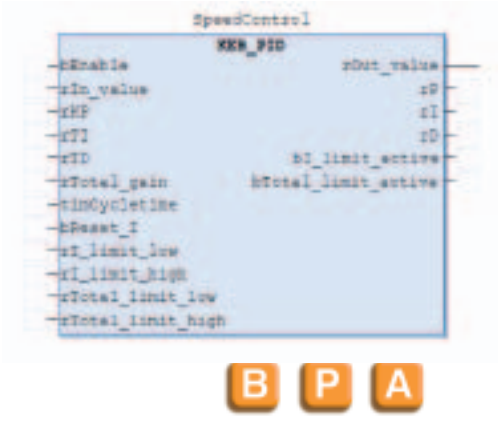




Thanks to the **optimised motor control** made by KEB drive and **specific PID control** gives the chance to realise **Servo hydraulic pumps** solution on the direction of energy saving and high accuracy.

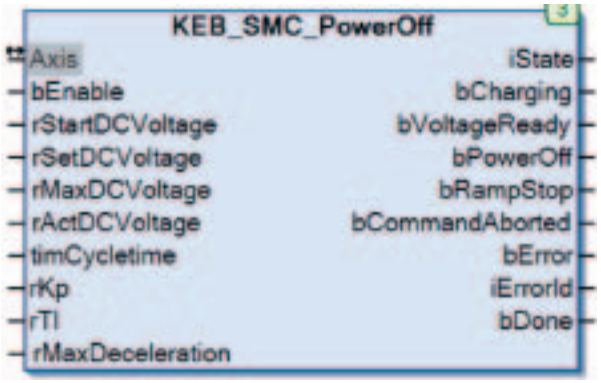
With KEB solution the user can generate **the right pressure set point profile** which depend by the movement and force required; the deviation with the pressure feedback generate the speed reference for the drive which runs the motor connected to the servo pump.

The KEB PID function qualifies the performance of the movement and the right behavior on the full range of set point pressure; in the field, **the system can provide 40% energy savings and double production rates**.

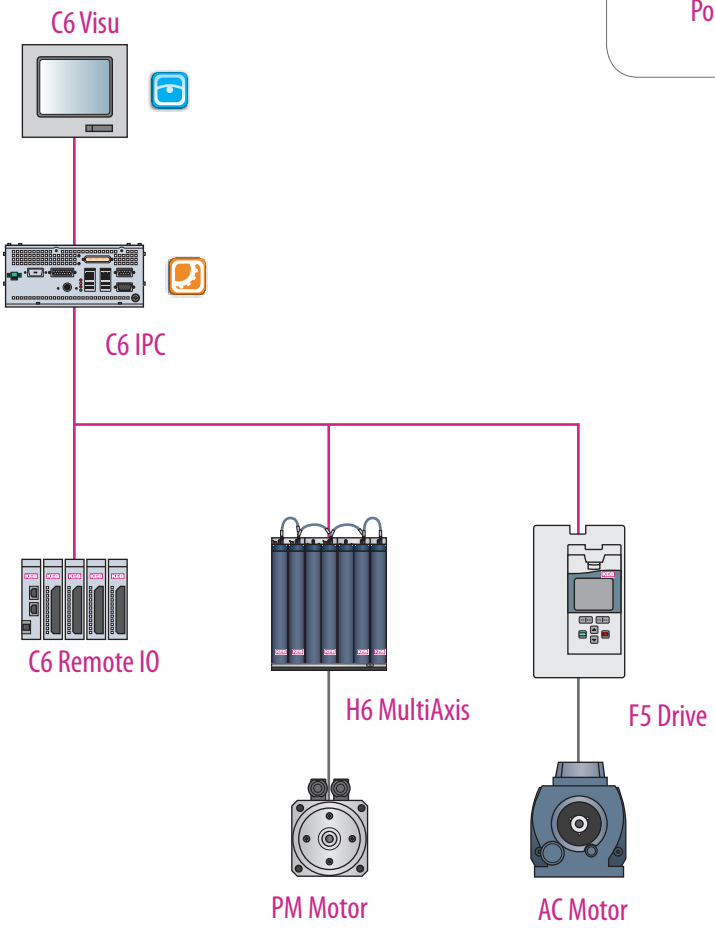


Application Utilities
Textile

The KEB application for the **textile industry continuously improves** the power design and control functionality year after year, guaranteeing the textile **industry high productivity, long life and reduction of down time**.

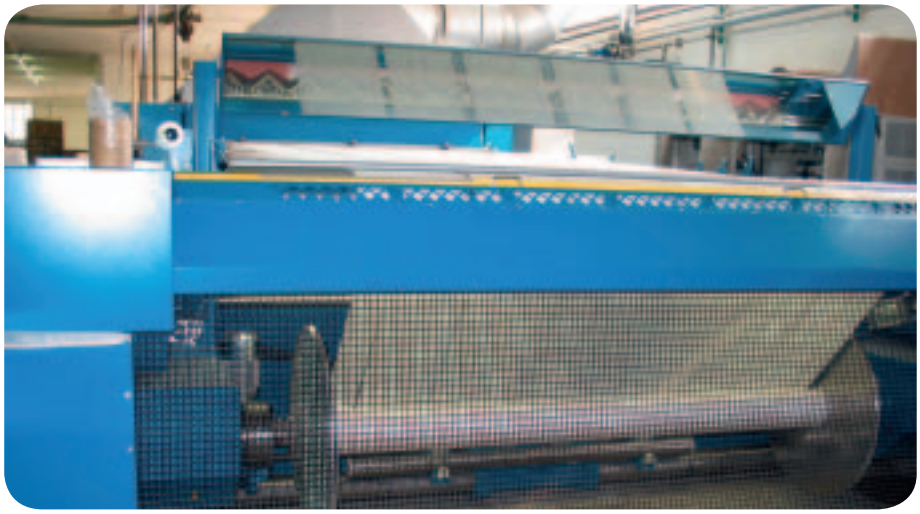


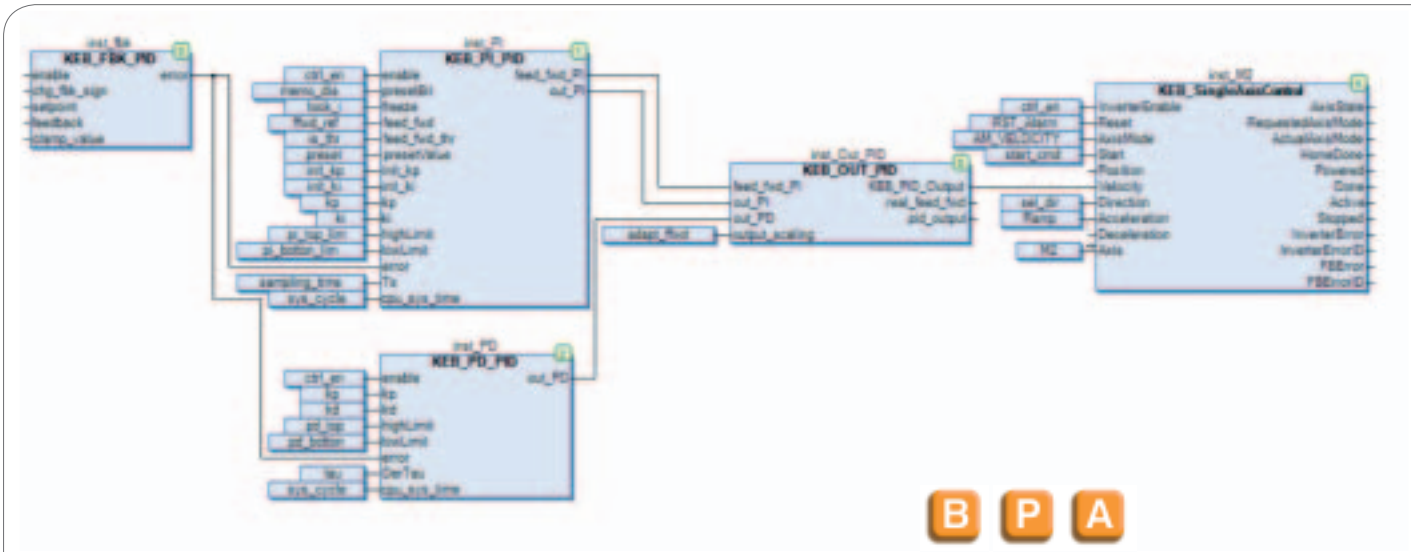
Power off library



Textile environments, where dust and humidity is the enemy of power electronics, are not a problem for the system integrator thanks to KEB special designs. Additionally **specialised function blocks to handle synchronised** system shut-down under power loss have been developed to avoid "breaking the thread". With a common DC bus, the kinematic energy is shared on all axes during deceleration all the way down to zero speed.

For machines where it is necessary to **keep synchronisation and material tension** via load cell or dancer feedback, KEB has developed a gearing **function block and special PID block** which can be used to wind / un-wind even tension-critical material.





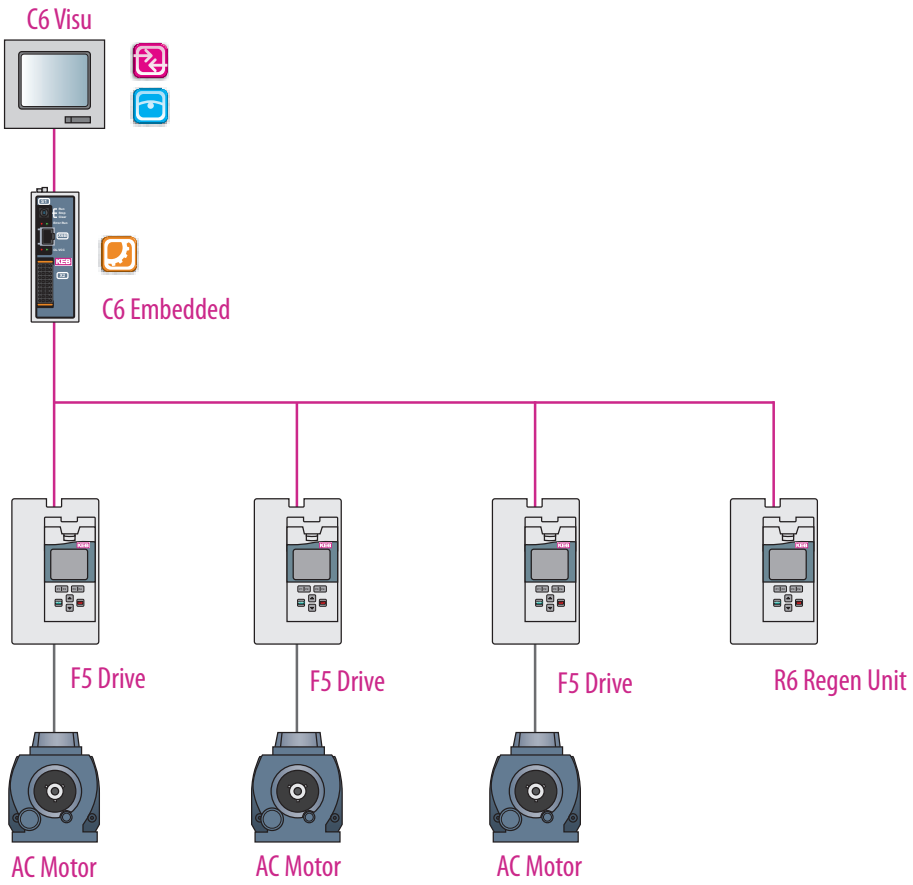
Feed Forward PID Diagram Block

Application Utilities

Intralogistics - Cranes - Elevator

When one thinks about **elevators**, the first thought is about **moving the load and safety**, in case something doesn't work properly.

The combination between hardware and software from KEB is the right choice. These **experiences comes from several year on developing such kind of application** and the result are in special library for torque management, weight evaluation and speed control in combination to all previous factors.



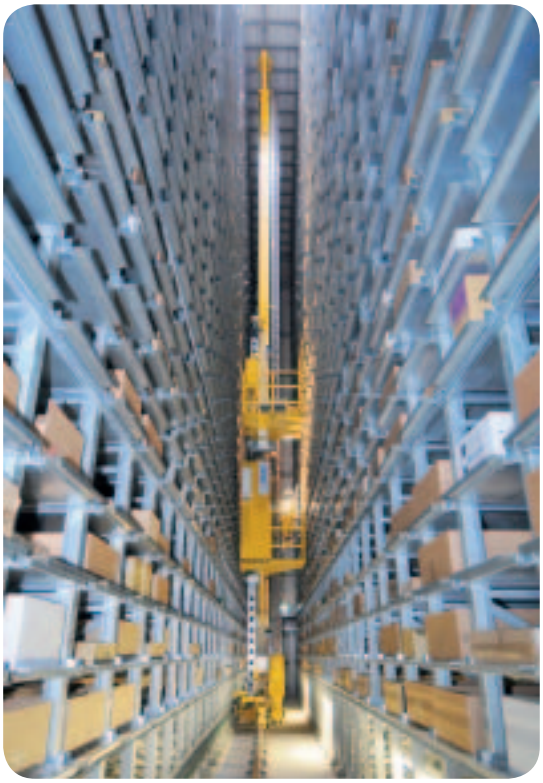
Intralogistic Diagram Block

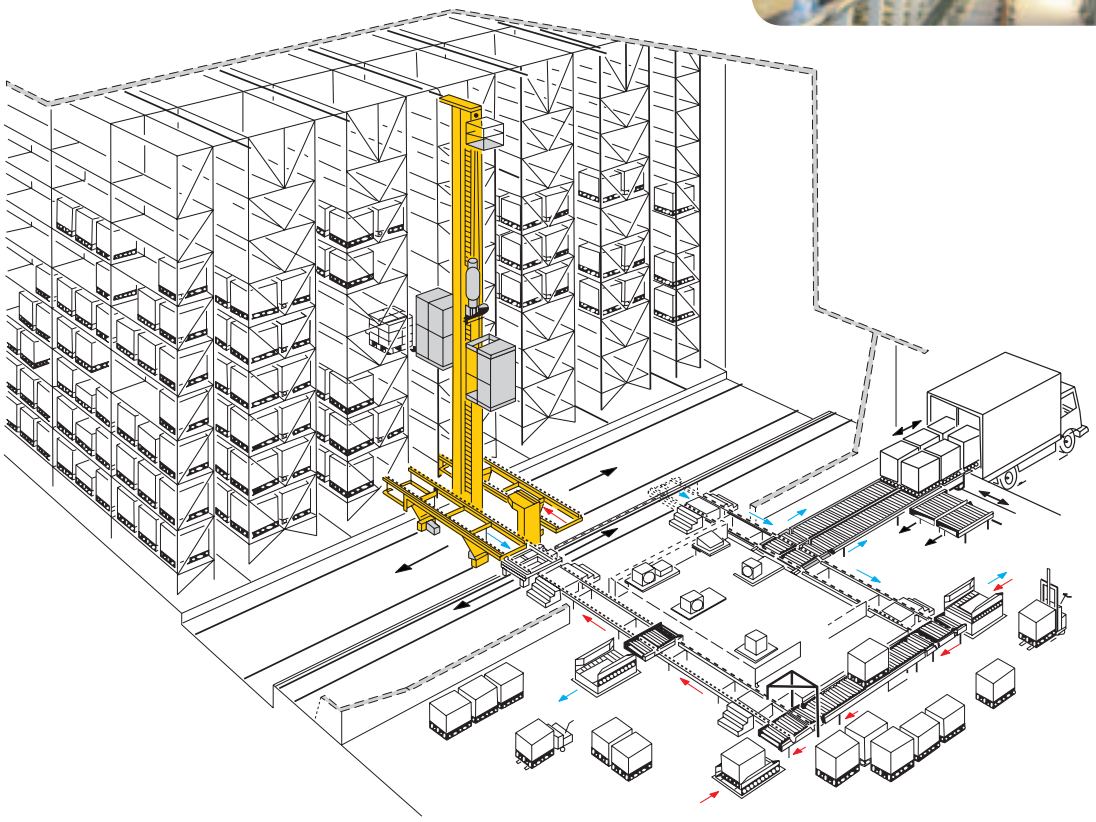
KEB is able to provide **special brakes for special environments such as marine**, where salt could affect a standard brake's torque.

Torque management and brake handling are just two considerations; another important topic is the **re-use** of all of the **potential energy stored** in the system through **regenerative drives**.

KEB offers a line of regenerative drives that can recover all of the system's stored energy **instead of burning it off as heat and lost energy as with braking resistors**.

Connected via fieldbus, the **KEB control can evaluate the energy used**, the energy returned and the complete system performance.



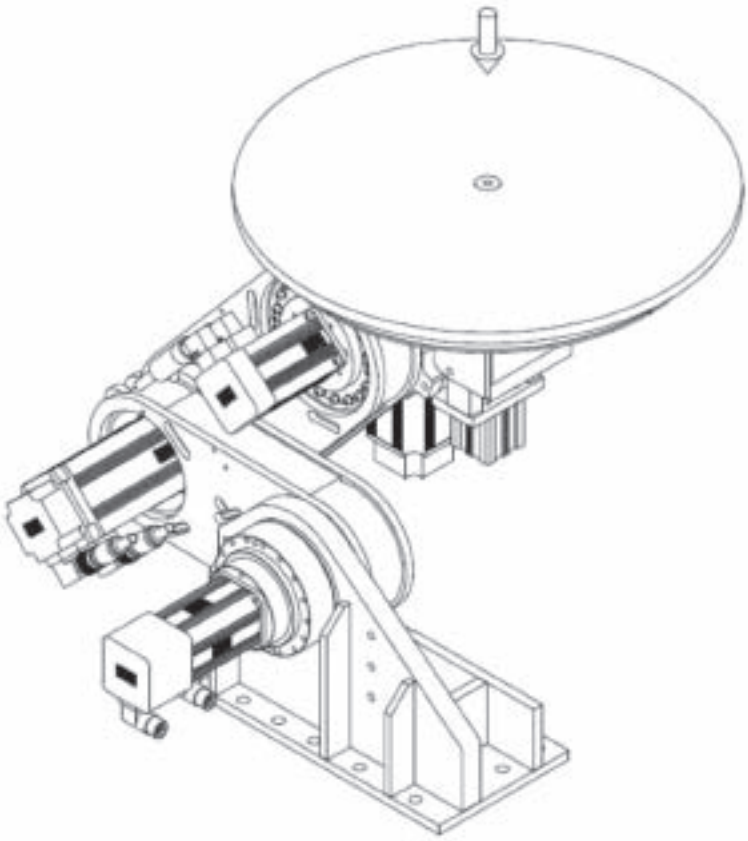


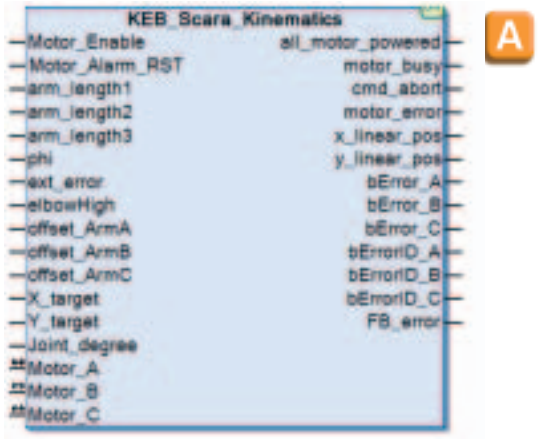
Application Utilities
Material handling

KEB's material handling competence is an extension of the cranes and elevators field. Hardware solutions are already well known and easily applied by the KEB applications group.

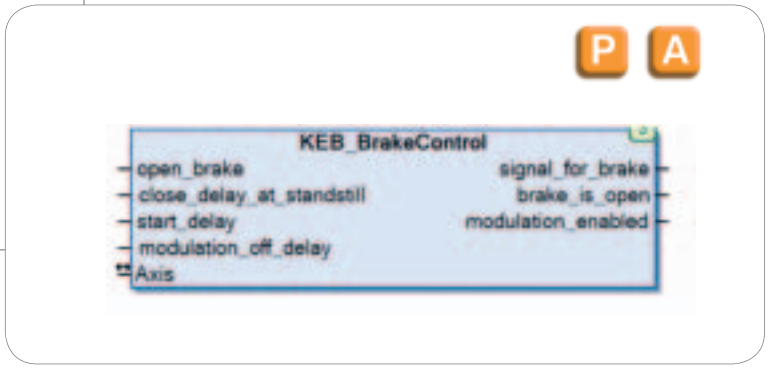
This is also true from the software point of view where special brake handling can make the difference even in small kinematic gantry systems.

For the machine builder, **selecting the best kinematics** for the application is easy when working with KEB solutions. **Nonlinear kinematics**, which normally can be complicated, **are easily handled using the KEB library** to transform Cartesian coordinates into polar coordinates. Robotic systems can easily shift the origin of axis during installation **to make commissioning a breeze**.





KEB SCARA kinematic library



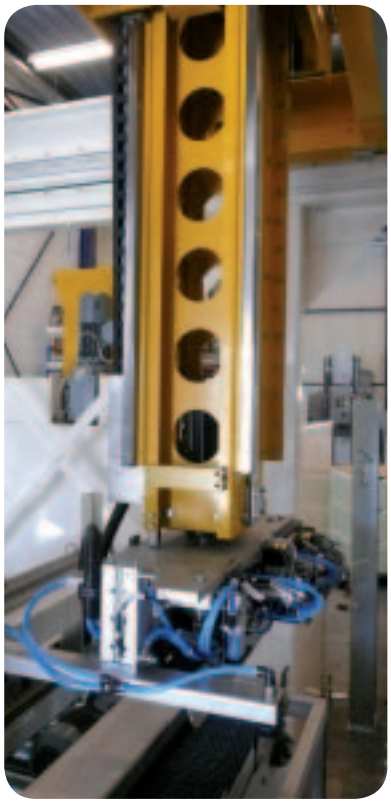
Brake Control Library

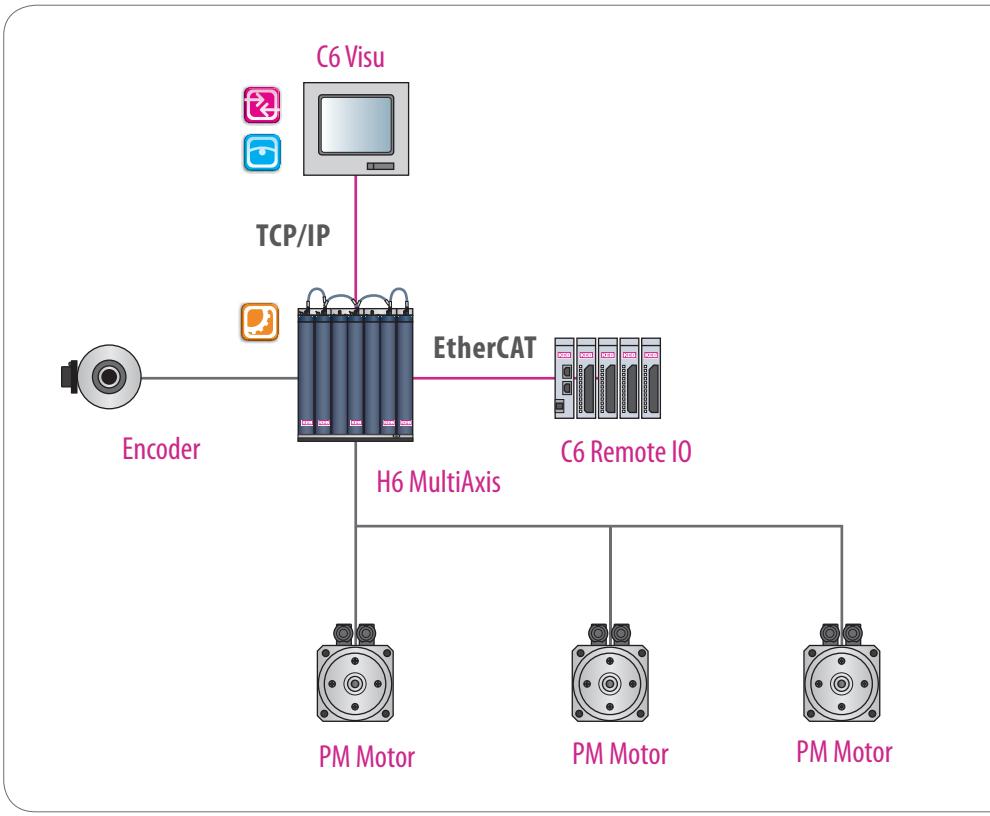
Thanks to **KEB's philosophy of hardware abstraction**, a user can choose a different type of hardware and only be required to change a communication driver. The core project does not need to be changed.

Examples of **different supported hardware**:

- **Portal system**
- **Bipod**
- **Tripod**
- **Scara robot**

Through its experiences KEB has developed a technique where **trajectories** for all axes are **interpolated and smoothed** by a spline interpolator to **reduce mechanical stresses**.





Application Utilities

Packaging technology

Driven by the highest standard, the **C6 provides repeatability**, fast bus cycle times and easy handling of function blocks. Simple adjustments of **electronic cams on-the-fly** allow countless synchronous movements. Fast input and outputs **allow print registration control** and cam-switch operation, matching the application's need. The **flexibility of the system** allows optimum design for your machine. The **open platform allows the integration of camera systems**, printers and barcode scanners.

For the visualisation and machine operation, **a variety of HMI solutions** with different IP protection classes are available, including such finishes as stainless steel. The visualisation offers a variety of options such as **recipe management, web servers and data recording.**

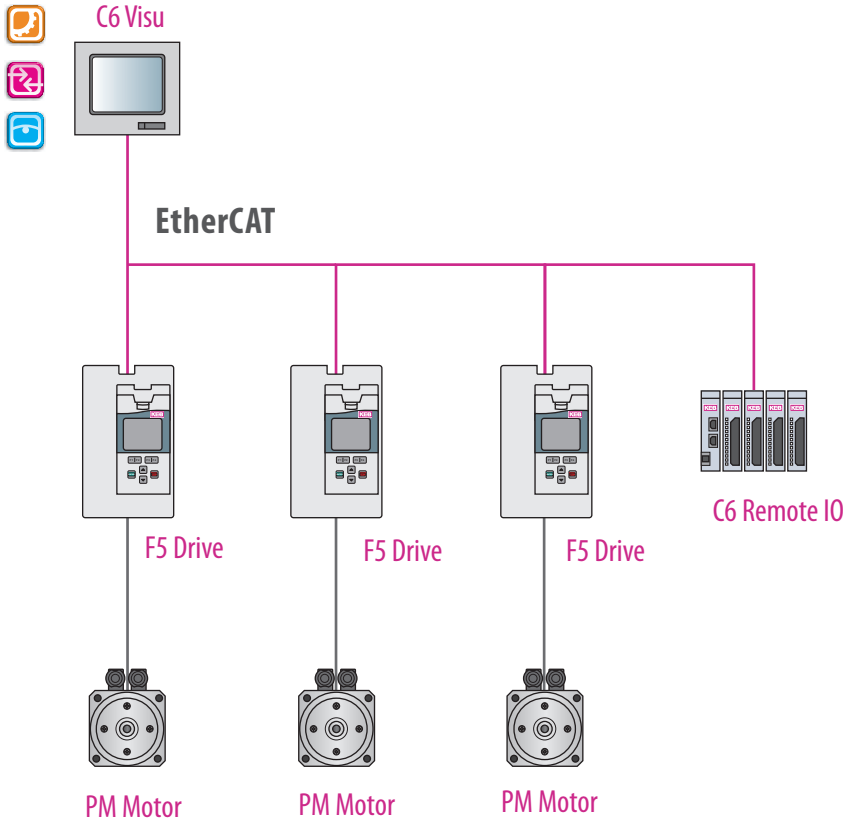
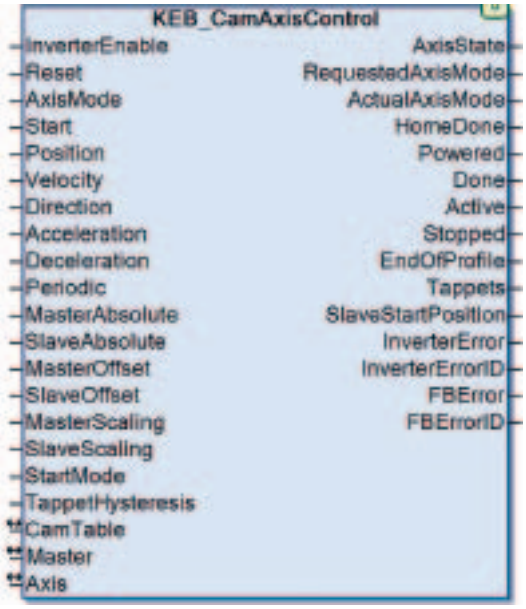


Diagram block Vertical pillow

- CAM Curve switch, adjust curve on the fly
- CAM Curve online and offline processing
- Various interpolation methods
- Winding tension control with inertia compensation
- Print mark detection / compensation
- Forming / Sealing temperature control related to product and speed
- Synchronised dynamic filling functionality
- Labelling of products
- Cutting
- Capping
- Printing
- Inserting
- Palletising
- Wrapping

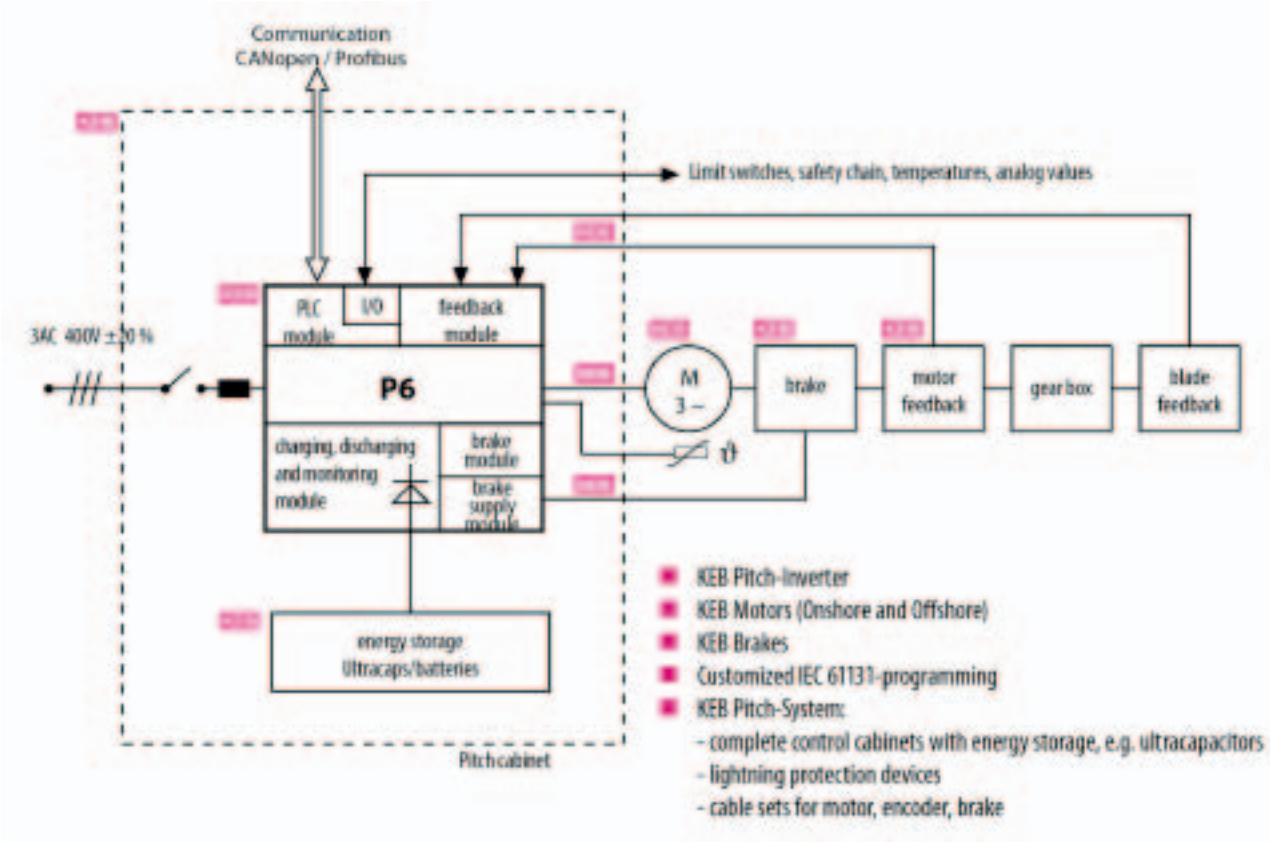


Vertical pillow

Application Utilities
Renewable Energy

KEB started working heavily with the **renewable energy sector** several years ago. The **experiences developed in permanent magnet motor** management, **specialised hardware design** for non-factory environments and the **financial capability to invest in equipment** and machinery necessary to verify extreme environmental conditions allows **KEB to provide dedicated solutions** to this fast-passed market.

An example of this capability is the **P6 pitch and yaw drives for wind turbines**: a drive for extreme temperatures and vibrations with an on-board IEC 61131 controller. This solution allows system designers to apply proprietary software functions right in the drive.



Pitch system Diagram Block

The KEB software solution for wind turbines is based on **strong experiences in regenerative management**, yaw control and robust functionality even under device failures. The system designer knows how important it is to be able to run the turbine and **find the optimum regeneration point, based on wind speed**.

In-the-field solutions such as **COMBIVIS Connect** and KEB's libraries provide the user the capability **to reach the turbine wherever it is installed** and make traces and data log files.

P6 Pitch Drive System

Regenerative Management library

Communication Utility

KEB products are born to be connected. In every controller there are a minimum of two Ethernet ports, giving the possibility to **exchange data in several ways**. As shown in the factory automation diagram, KEB can provide hardware and software for every communication layer.

Supervision / Command Level identifies the integration between company management systems and the machine level for production floor monitoring, scheduling, data logging, etc.

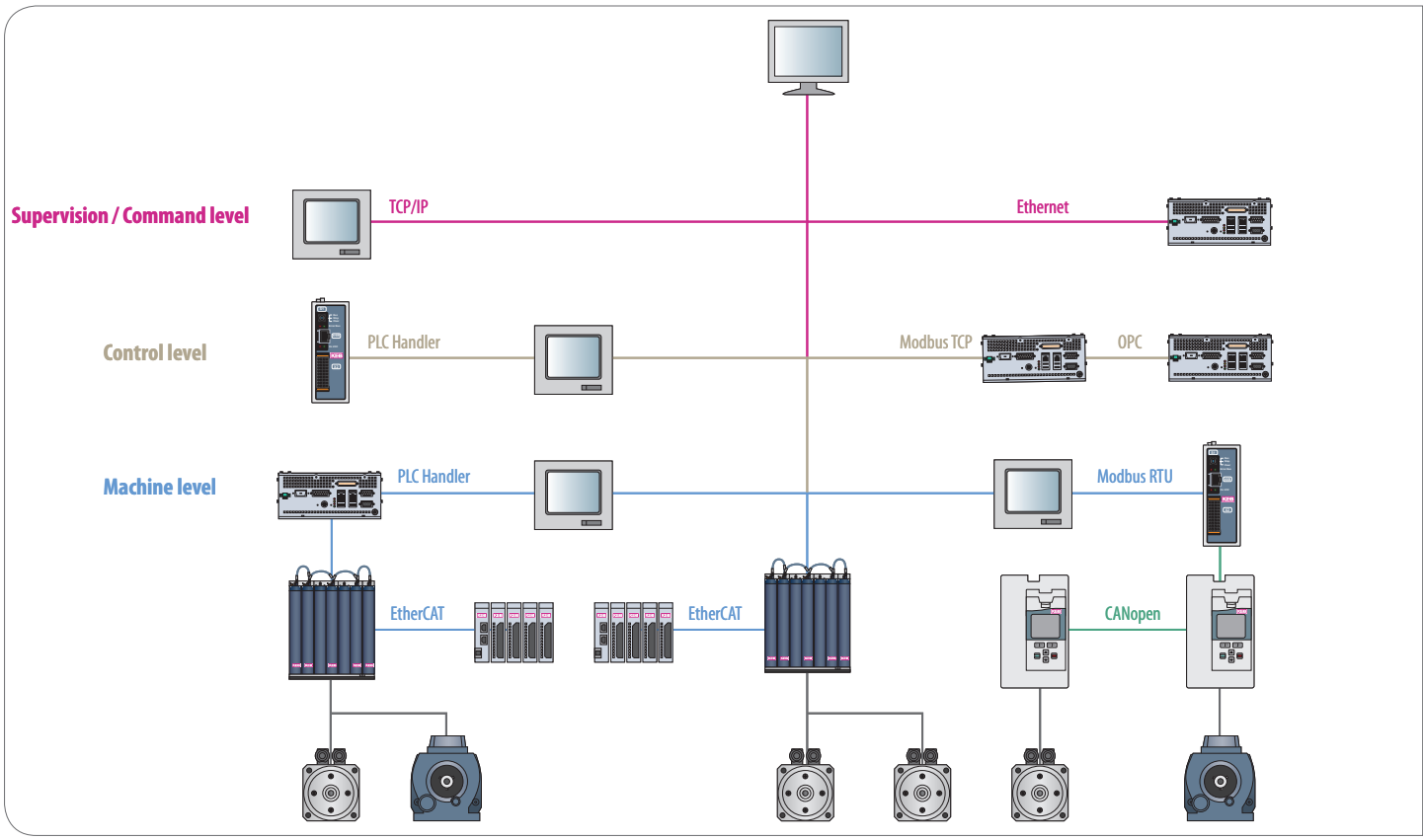
- E-mail
- Ftp
- SQL server
- Web server

Control Level identifies an intermediate layer between the command level and machine level which can collect a large volume of data from the machine for analysing performance, production rates, etc.

- OPC Client / Server
- Modbus TCP
- PLC Handler

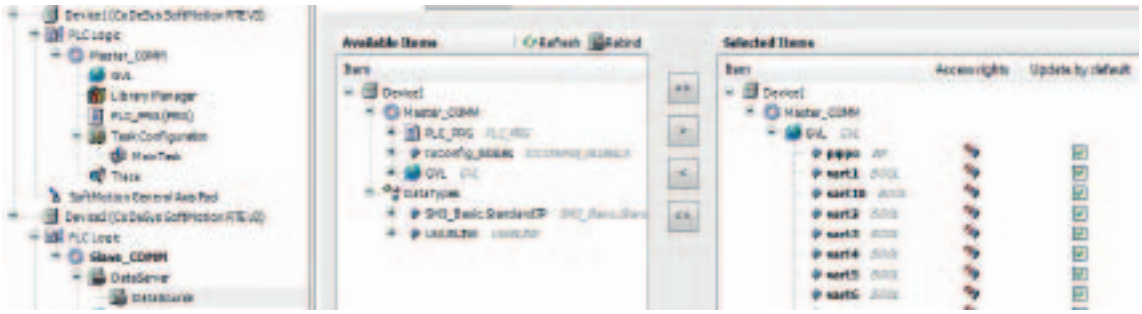
Machine Level identifies a number of possibilities to exchange data within a machine using KEB products. One group of communication protocols is for motion control, another group is for signal acquisition, HMI supervision, etc.

- EtherCAT
- CAN Open
- DIN 66019 II
- HSP5 (embedded system only)
- Profibus DP
- Interbus
- Modbus RTU



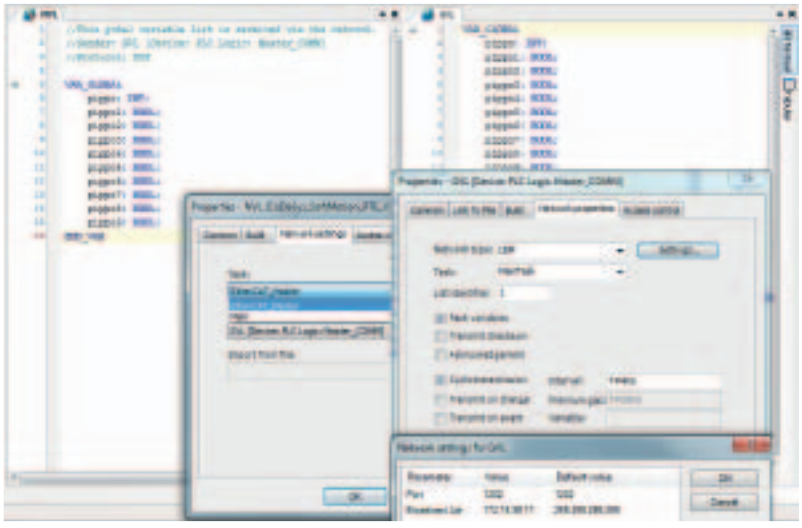
The **data server** functionality gives the user a chance to exchange data over a **point to point communication** TCP/IP (UDP) channel. Data is pre-selected using a configurator.

Global NetVar is a broadcasting method **to reach a network-connected device**. Configuration and setup is quick and easy. The programmer can select the communication method and the transmission modality.



Data Server Configurator

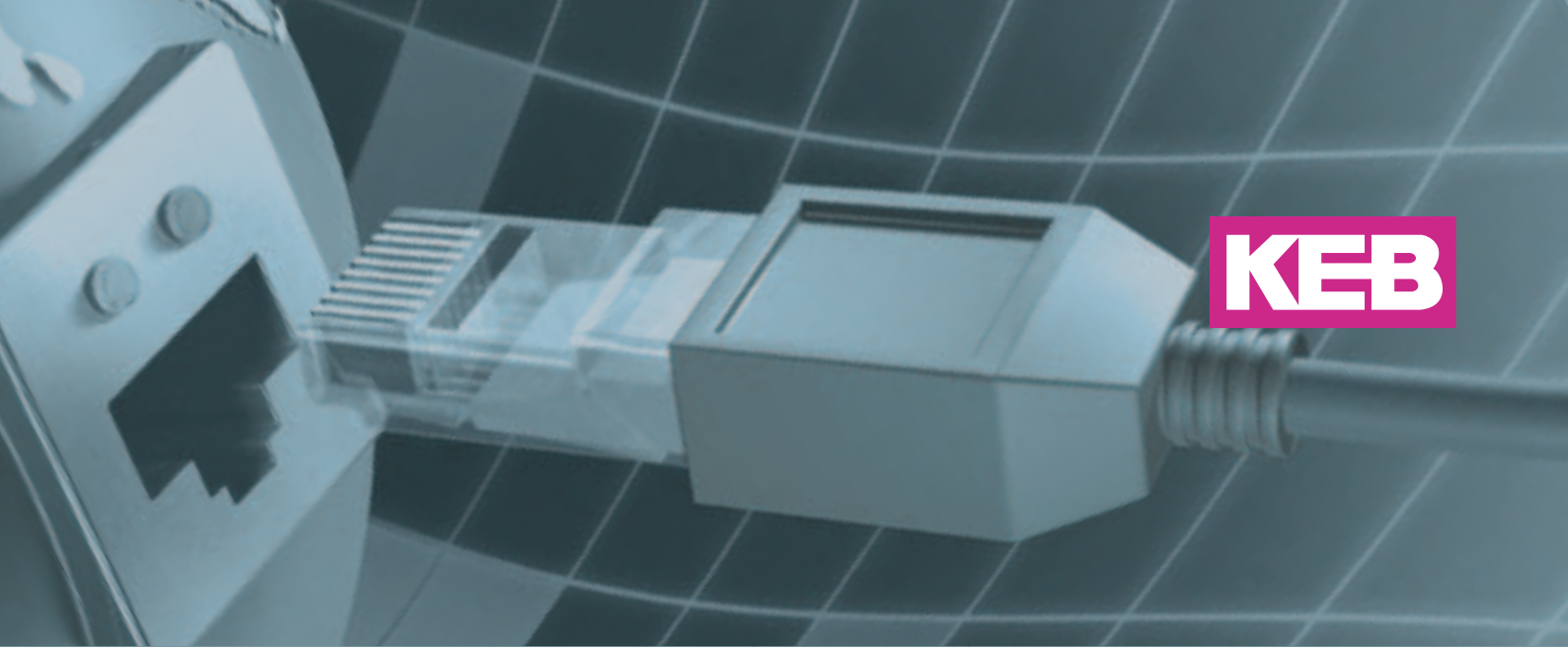
The **KEB skill in protocol communication** management gives to the user the chance to **encapsulate data from a protocol into another one**. This is handled automatically by the channel handler function block which is part of the **KEB Gateway library**. With this technic, for example, KEB can guarantee the **whole access to the drive parameter** simply including these function block into the project and using the **only one cable of the Motion Control bus** without affecting the real-time performance.



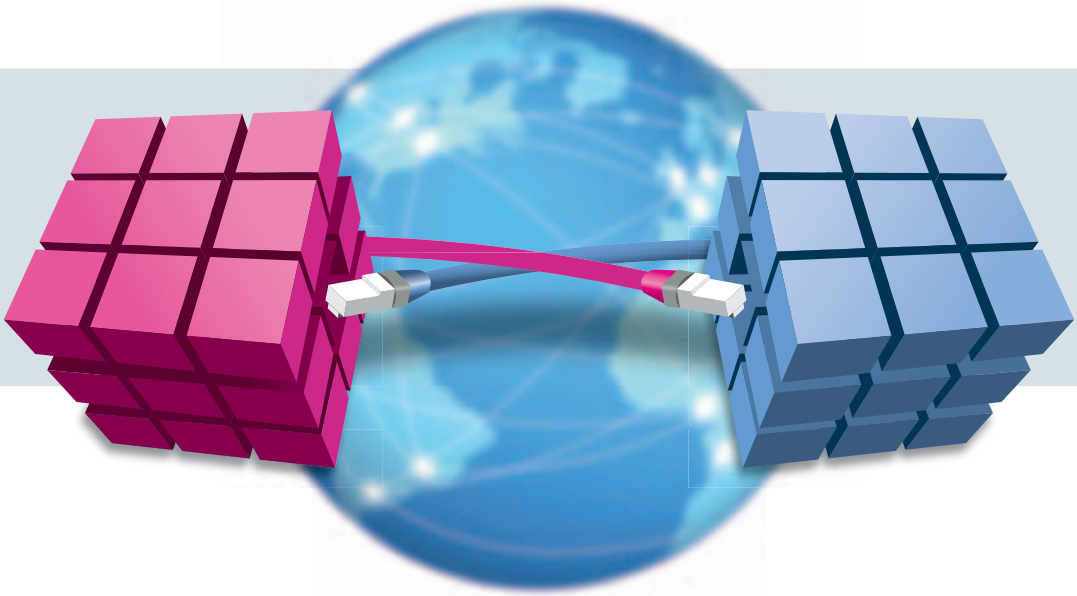
NET Var Configurator

Remote communication

COMBIVIS connect



CONTROL & AUTOMATION



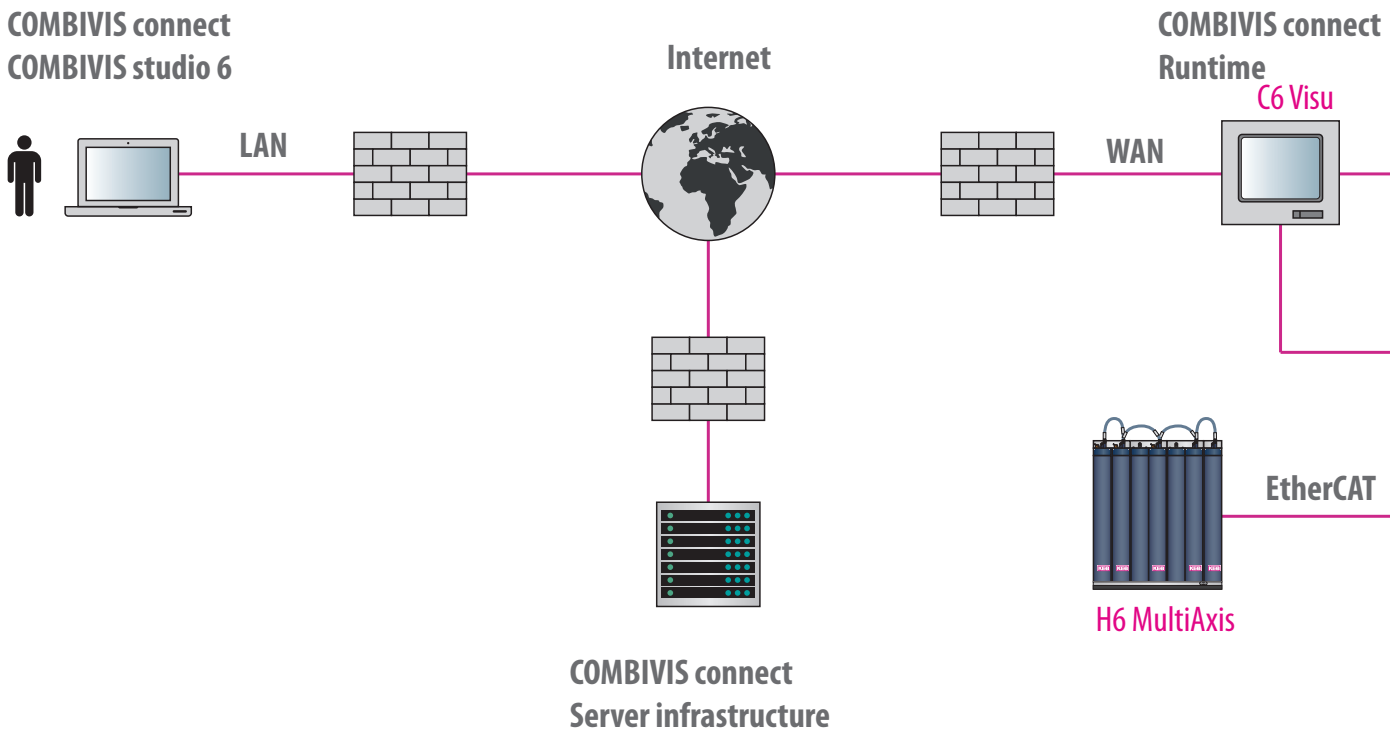
Remote Communication

COMBIVIS connect

COMBIVIS connect is a plug in to the COMBIVIS studio 6 IDE that **provides remote access**. Created in cooperation with KEB family partners, COMBIVIS Connect provides a wide range of powerful features to operate remote services on motion controllers and HMI systems **via Ethernet- or serial-connections** based on standard operating platform as Windows XP and CE.

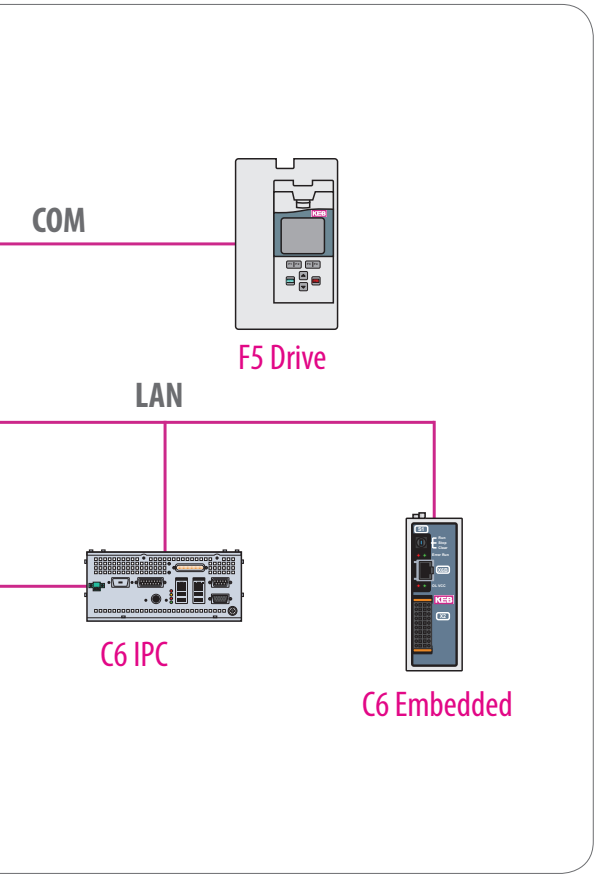
COMBIVIS connect is a plug in software which includes two components:

- **COMBIVIS Connect:** control center running on the service computer allowing system configuration, remote device registration, support session handling and configuration of groups and user security options.
- **COMBIVIS Connect Runtime:** software component installed on the KEB devices to be controlled remotely, available for HMI devices and for IPC systems.



COMBIVIS connect VPN works at data-link level. This mechanism has several advantages:

- The remote supervisor effectively joins the remote network and acquires an IP in the physical address range.
- The remote supervisor can use protocols based on UDP broadcast.
- No need to reconfigure the gateway of remote devices. They can still be accessed remotely because the remote supervisor has a compatible physical IP address.



COMBIVIS connect can create a virtual serial port on the Control Center PC. This serial port can be mapped to a physical port available on a remote device running **COMBIVIS connect Runtime**.

The COMBIVIS connect plugin is **hosted in the cloud** and gives the chance to use remote desktop, file exchange and chat, while complying with the **highest security standards** by using SSL/TLS protocols.

COMBIVIS connect lets you create different users, groups of users, groups of remote devices, each with different access rules and permissions. All operations performed remotely are saved on your own cloud domain space.

COMBIVIS connect clients automatically discover the local network topology and can always allow a remote connection as long as some kind of outgoing Internet connection is available.

Visualisation

COMBIVIS studio HMI

CONTROL & AUTOMATION

Visualisation

COMBIVIS studio HMI

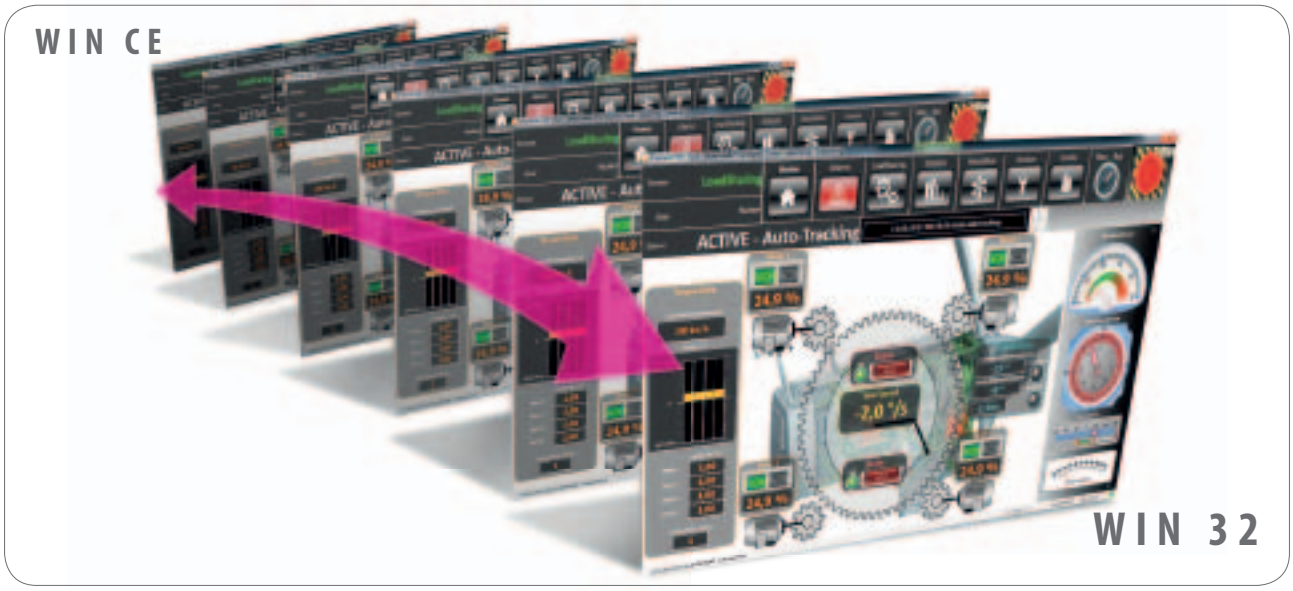
COMBIVIS studio HMI is a **powerful programming environment** for the creation and development of **graphical user interfaces**. It could be a plug in to the Integrated Development Environment such as COMBIVIS studio 6 that KEB propose as well as independent tool. When it is used as plug in, a **KEB communication driver** easily get all the variables from the controller, **otherwise a wide range of driver can be selected**. A project realised with BASIC or ADVANCED can be download for the Win CE and for Win 32 operating systems without any changes.

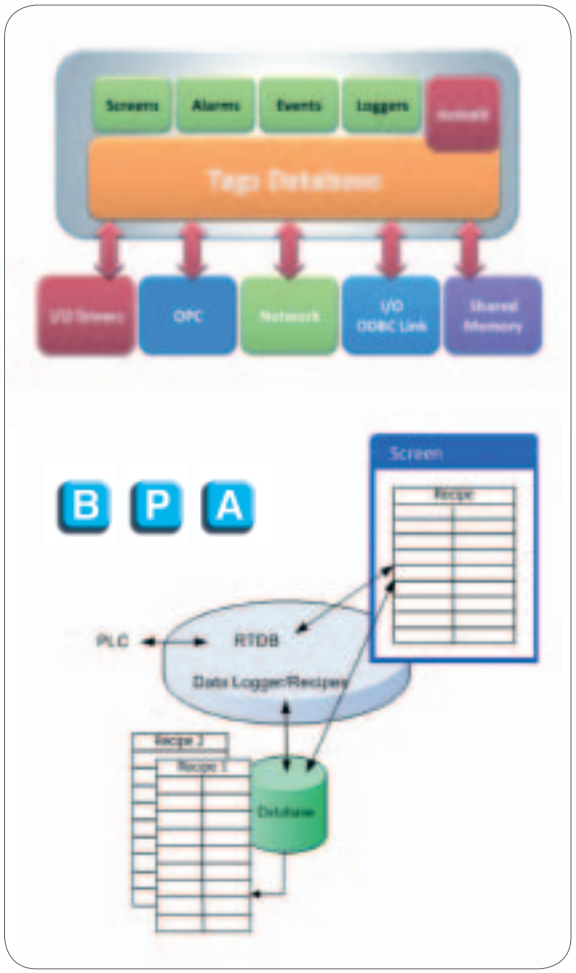
KEB offers three versions of the runtime which is installed on dedicated hardware like the C6 HMI or the motion controller RTE:

- The **BASIC version** includes all of the features necessary for the development of an HMI project with a limited number of variables.
- The **PRO version** is suitable for the development of more complex projects, where historical production trends and alarms on local or remote databases are required.
- The **ADVANCED version** adds a Web server function that makes the HMI project remotely accessible and can send SMS or emails in case of alarm.

COMBIVIS studio HMI offers very modern object libraries and functionality to animate graphics using simple, yet powerful commands. Graphic symbols are fully customisable. Support for WMF, EMF, BMP, GIF and JPG files. Graphics self-adjust to the devices screen resolution with rendering optimised.

Wherever the variables come from, the **COMBIVIS studio HMI database remains open**. The variables inside the project can be scaled with mathematics, traced, kept in retained memory, structured or protected by access level.



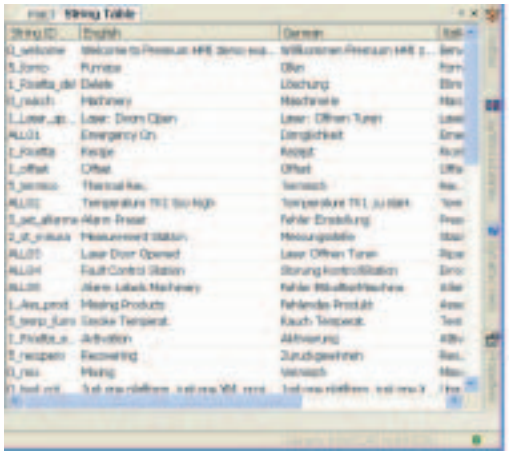


The architecture of the HMI runtime gives the developer a chance to **schedule the database** management according to the specific needs and realise historical trend with powerful sampling.
Historical logs based on the **data logger**, zoom, averages, logarithmic scales. **Sample-and-save logs in CSV** format can be created. All functionality that is necessary for visualisation and analysis can be found in KEB products.
KEB is a company that operates worldwide, so **Multilanguage functionality** is a corporate standard. The visualisation language can be changed at runtime via automatically generated global text tables. **String handling is Unicode** format compliant.

Automatic management of production increased by the possibility to change structure of the system so simple and clear. **This task is assigned to the recipes** which are based on XML architecture or text file. The creation is achieved by means of a few mouse clicks. Auto creation of editing pages with the possibility of customisation.

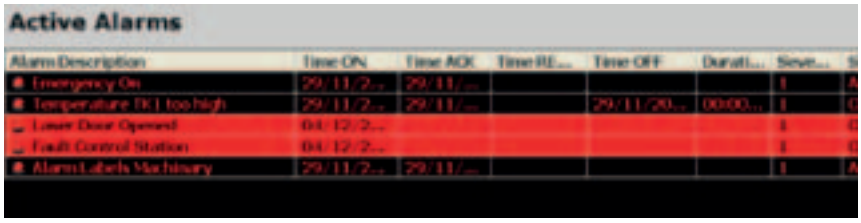
KEB's HMI solution offers complete **alarm management** in accordance with applicable **ISA standards**. Alarms can be customised with event recording via variable states and saved in **history logs using an XML database**. Additionally, application filtering and print spooler management are possible.

B P A

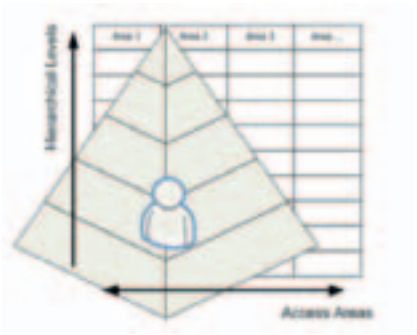


Visualisation

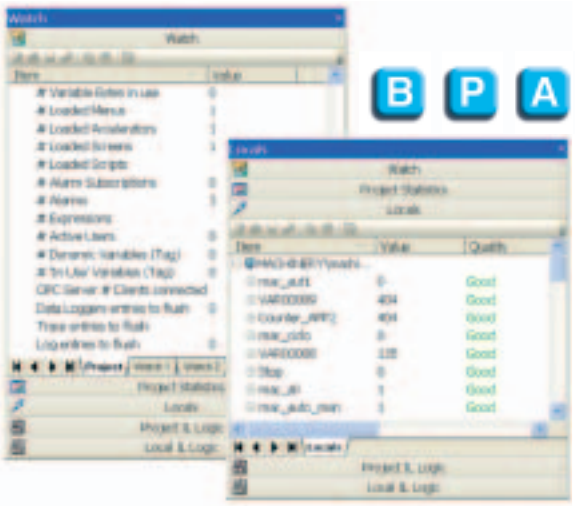
COMBIVIS studio HMI



The architecture that KEB offers is a multi-server solution based on a TCP/IP physical layer. **A high level of data security** can be set within the project. The **KEB HMI product complies with 21 CFR, part 11** prepared by the Food & Drug Administration for the electronic data stored certification in pharmaceutical and food production sites.



User passwords can be up to 1024 levels and 16 areas.



As with all good development tools, the **debug tools** are what make the difference. With the debug tools provided, the developer can make **analyses, watch variables, make statistics**, insert **break-points** and single-step the logic execution. The debugger not only works on a locally connected device, but **also with remote devices**.

Highlights

- Integrated WEB server
- Data logger over DB XML and SQL Server
- DCFR21 Part 11 project compliant
- High-level vector graphics
- Historical and dynamic trends
- Wide range of communication drivers for KEB devices, third parties PLC, inverters and temperature controllers
- XAML Graphic objects
- Powerful new graphics rendering engine
- Resolution graphics to 32 million colors
- Transparency effects
- New "gesture" pointer

	BASIC	ADVANCED
COMBIVIS studio 6 WinCE runtime		
RAM	512MB	512MB
I/O Bytes (Tags)	1024	4.096
Alarm	512	2.048
Data Loggers	max. 2	●
Multi-Drivers	max. 2	max. 4
SMS/E-mails		●
Web Server		2 user

	BASIC	PRO	ADVANCED
COMBIVIS studio 6 Win32 runtime			
RAM	1GB	1GB	1GB
I/O Bytes (Tags)	2.048	2.048	4.096
Alarm	2.048	2.048	2.048
Data Loggers	only 2 (not on Database)	-	-
Multi-Drivers	max. 2	max. 2	max. 4
SMS/E-mails			●
Web Server			max. 2 clients connected
VBA Multithreading		●	●
ActiveX- OCX		●	●
CFR21 part 11		●	●
Power Templates		●	●
Networking RAS		●	●
Mobile Application Support		●	●

Visualisation

COMBIVIS studio HMI

	BASIC Win CE	ADVANCED Win CE	BASIC Win 32	PRO Win 32	ADVANCED Win 32
RealTime DB					
RealTime DB	max. 512 byte	max. 4096 byte	max. 2048 byte	max. 2048 byte	max. 4096 byte
Scaling	●	●	●	●	●
ODBC Realtime	●	●	-	●	●
Trace DB	●	●	-	●	●
Data Structures	●	●	●	●	●
Event Object	●	●	-	●	●
Scaling Object	●	●	●	●	●
Graphic Interface					
Vectorial Graphic Editor	●	●	●	●	●
Support for BMP, GIF, JPG, WMF, EMF	●	●	●	●	●
Dynamic Animation	●	●	●	●	●
Symbols Library	●	●	●	●	●
Import/Export Symbols	●	●	●	●	●
Public Symbols	●	●	-	●	●
Power Template (VBA Simbols)	●	●	-	●	●
Grid	●	●	-	●	●
Scheduler	●	●	●	●	●
Editing Menu	●	●	●	●	●
Style Source Management in Symbols	●	●	-	●	●
Dundas Gauge	-	-	●	●	●
IP Camera Viewer	●	●	●	●	●
Alias management in Objects	●	●	-	●	●
Alarms Management	●	●	●	●	●
Historical Management (XML)	●	●	●	●	●
Historical Management (ODBC)	●	●	-	●	●
Alarms notification (SMS, Email, Voice)	-	●	-	-	●
Alarms area	●	●	●	●	●
Comments on alarm ACK	●	●	-	●	●
Schedulers objects	●	●	●	●	●
Recipes - Data Logger					
Recipes / Data Logger (XML)	●	●	max. 2	●	●
Recipes / Data Logger (ODBC)	max. 2	●	-	●	●
Textual Report	●	●	●	●	●
Trends					
Trend RealTime	●	●	●	●	●
Historical Trends on file .CVS	●	●	●	●	●
Historical Trends (linked to Data Logger XML)	●	●	●	●	●
Historical Trends Database (ODBC)	●	●	-	●	●
Data Analysis	●	●	-	●	●

	BASIC Win CE	ADVANCED Win CE	BASIC Win 32	PRO Win 32	ADVANCED Win 32
User & Password					
Use 1024 levels	●	●	●	●	●
Users Groups	●	●	●	●	●
CFR21	●	●	-	●	●
Runtime Users	●	●	●	●	●
Driver					
Max. Number of Driver	2	4	2	2	4
PLC Tag Importer	●	●	●	●	●
OPC Client DA	●	●	●	●	●
OPC Client XML DA	-	-	●	●	●
Logic					
IL Logic (Step5-Step7)	●	●	●	●	●
VBA Logic (WinWrap Basic)	●	●	Reduced (max. 2)	●	●
Sinapsis Logic	●	●	-	●	●
Tag in IntelliSense in Basic Scrip	●	●	-	●	●
Various					
Networking	●	●	●	●	●
Dynamic multilanguage	●	●	●	●	●
Unicode support	●	●	●	●	●
Child Projects	●	●	-	●	●
Screens navigation	●	●	-	●	●
Visual studio SourceSafe 2005 Integration	●	●	●	●	●
Web Client	-	●	-	-	●
Touch Screen support	●	●	●	●	●
Cross Reference	●	●	●	●	●
Debugger	●	●	●	●	●

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