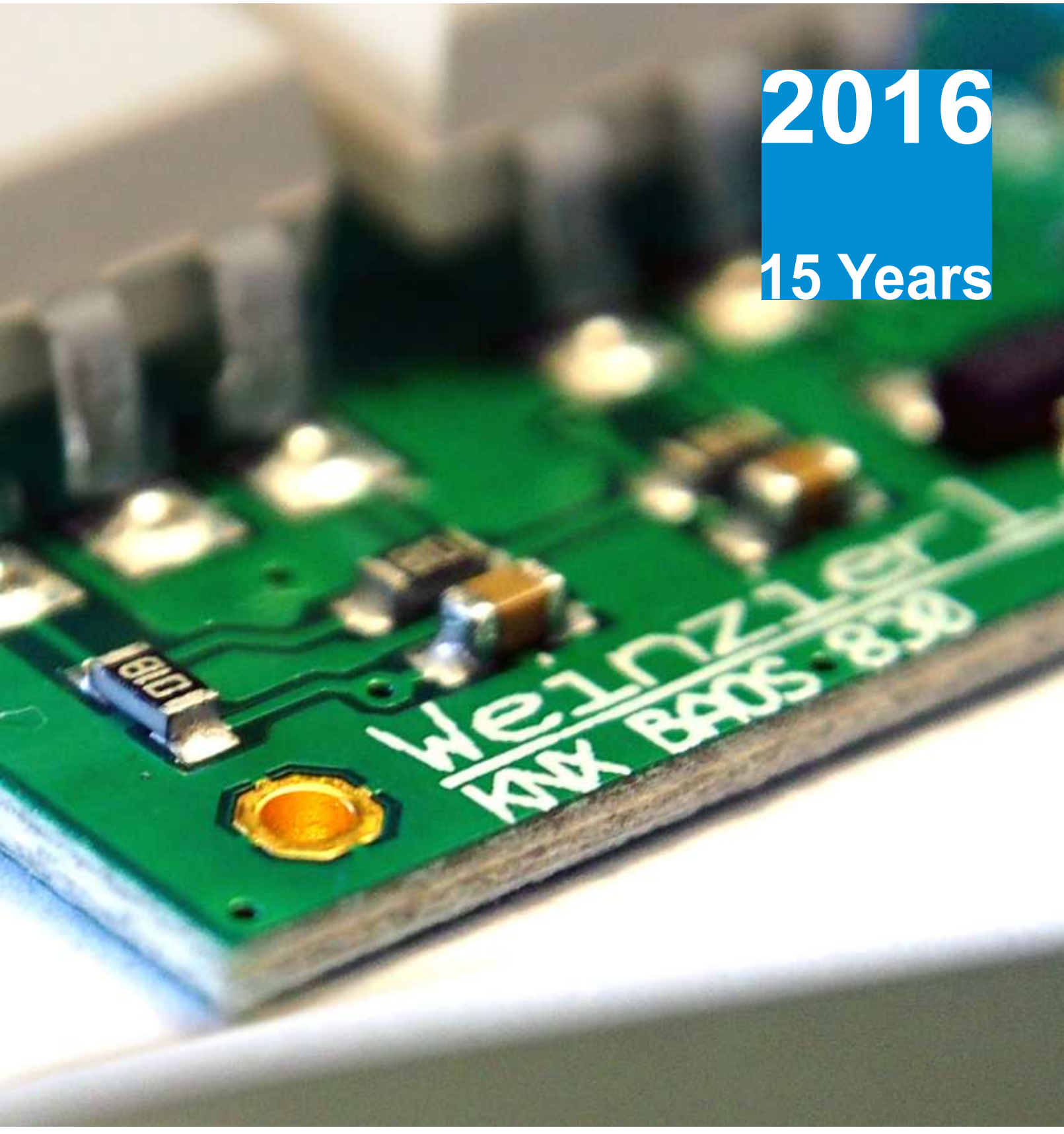
WEINZIERL



KNX Development Solutions 2016

About Us

We are Weinzierl

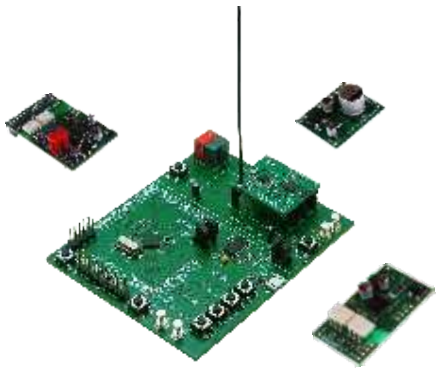
Weinzierl Engineering GmbH develops software and hardware components for building electronic systems. Our focus is on building networks based on the KNX standard. With our team of experienced developers and dedicated staff, we comprehensively cover the KNX system with our products and development solutions.

Worldwide unique and open

KNX is the world's only open standard for home and building control. The KNX technology with its different media, is used worldwide for a large number of installations. KNX is the only system for building control which complies with international standards like ISO/IEC and ANSI.

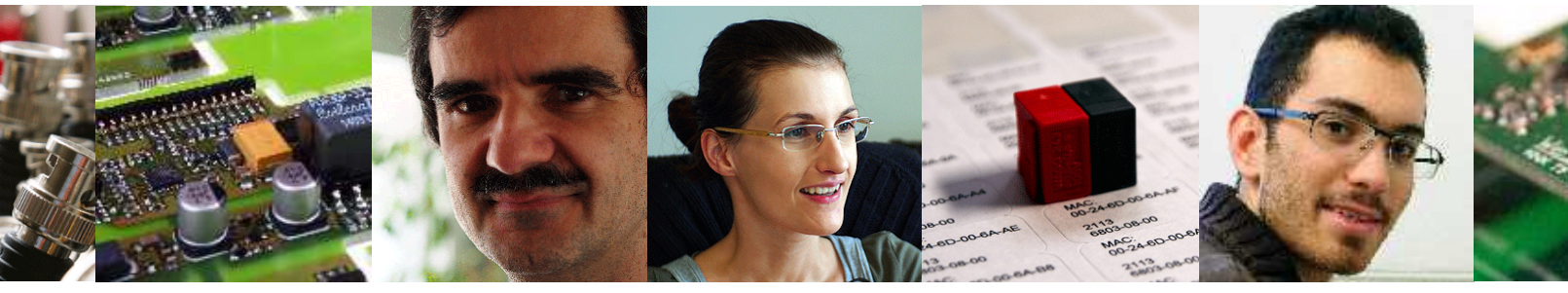
Quality for your Success

The quality of our products and services is a main basis for the success of our customers. For more than 10 years our company is certified according to ISO 9001. To ensure the quality of KNX solutions we have established an inhouse test lab accredited by the KNX Association.

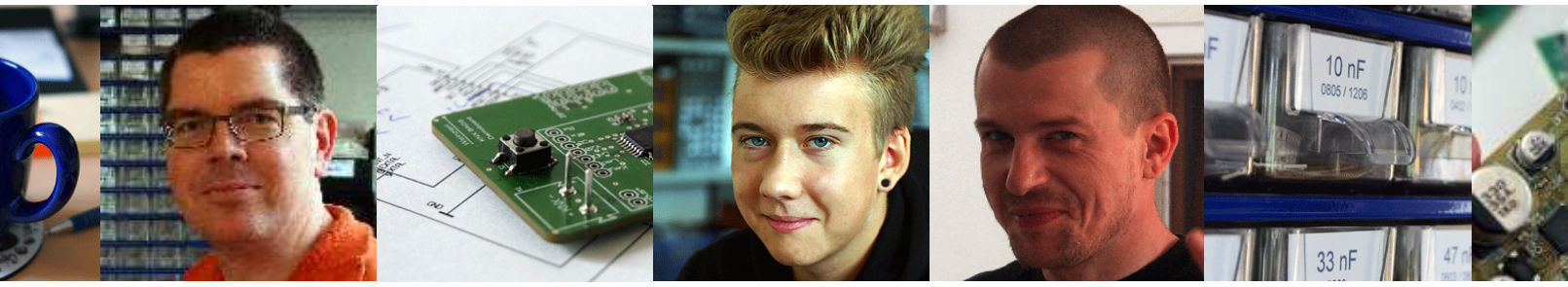


We shape the Future

The KNX standard is continually evolving. To actively support this process we are a member of the KNX System Group (KSG) and take part in special working groups, like the KNX IP Task Force. Thus, we always offer you the latest information and trends.

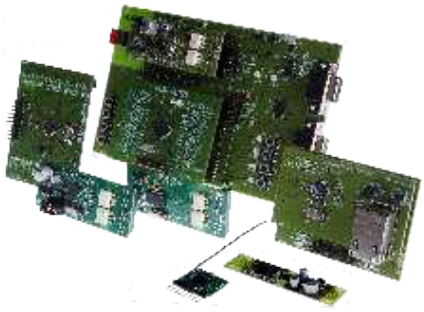


About KNX



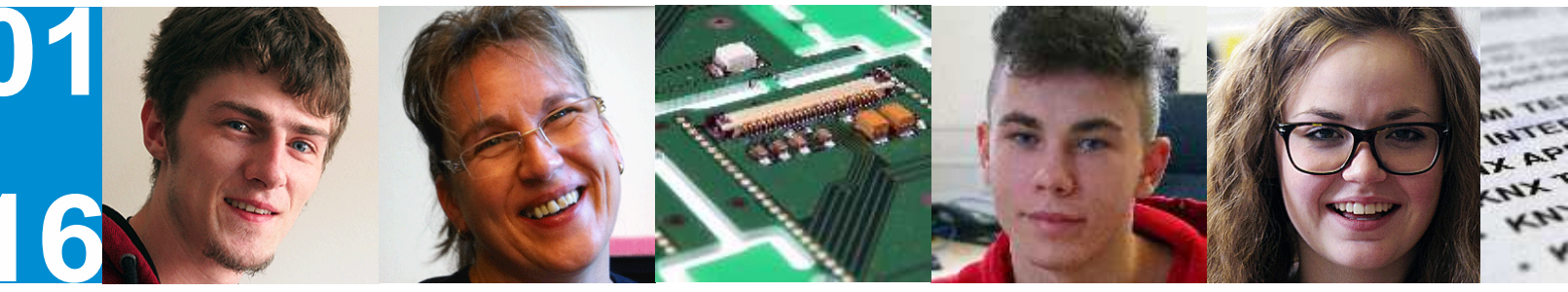
Solutions for your Development

Our core development products are components for the integration of KNX connectivity into embedded devices. This includes a wide range of KNX Modules and Stacks, offering cost effective yet scalable solutions for KNX devices. With our broad product range we deliver optimal solutions for all your development needs.



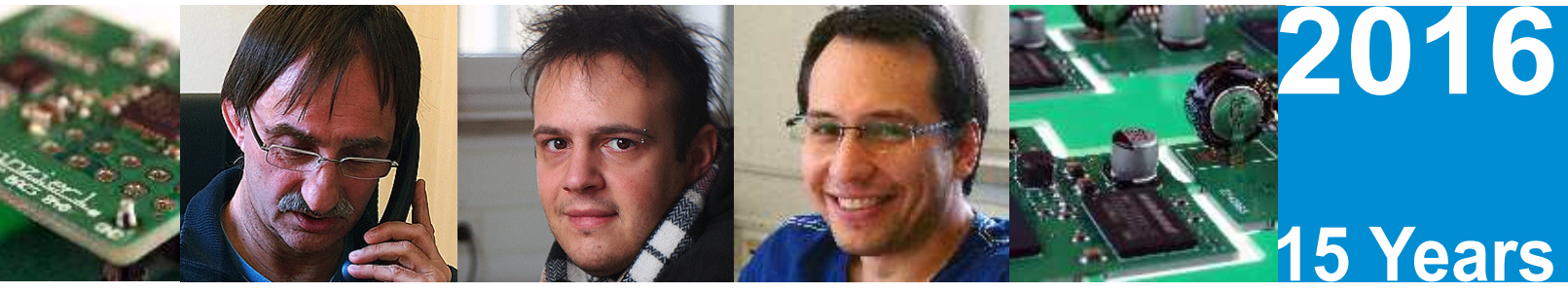
Our technological Heart

At the heart of our development solutions are our stack implementations for all standardized device models and media for KNX. We offer KNX certified system software for Twisted Pair (TP), Radio Frequency (RF) and Ethernet (IP). Our system software is available as a standalone product – also in source code if needed.



Your Partner for KNX

The comprehensive specifications of the KNX standard are a great opportunity for manufacturers to create new solutions for home and building automation. Offering proffessional development services and a KNX accredited test lab, Weinzierl is your partner for cost effective solutions to develop and implement your KNX devices.



Developing: How to start

DEVELOPMENT

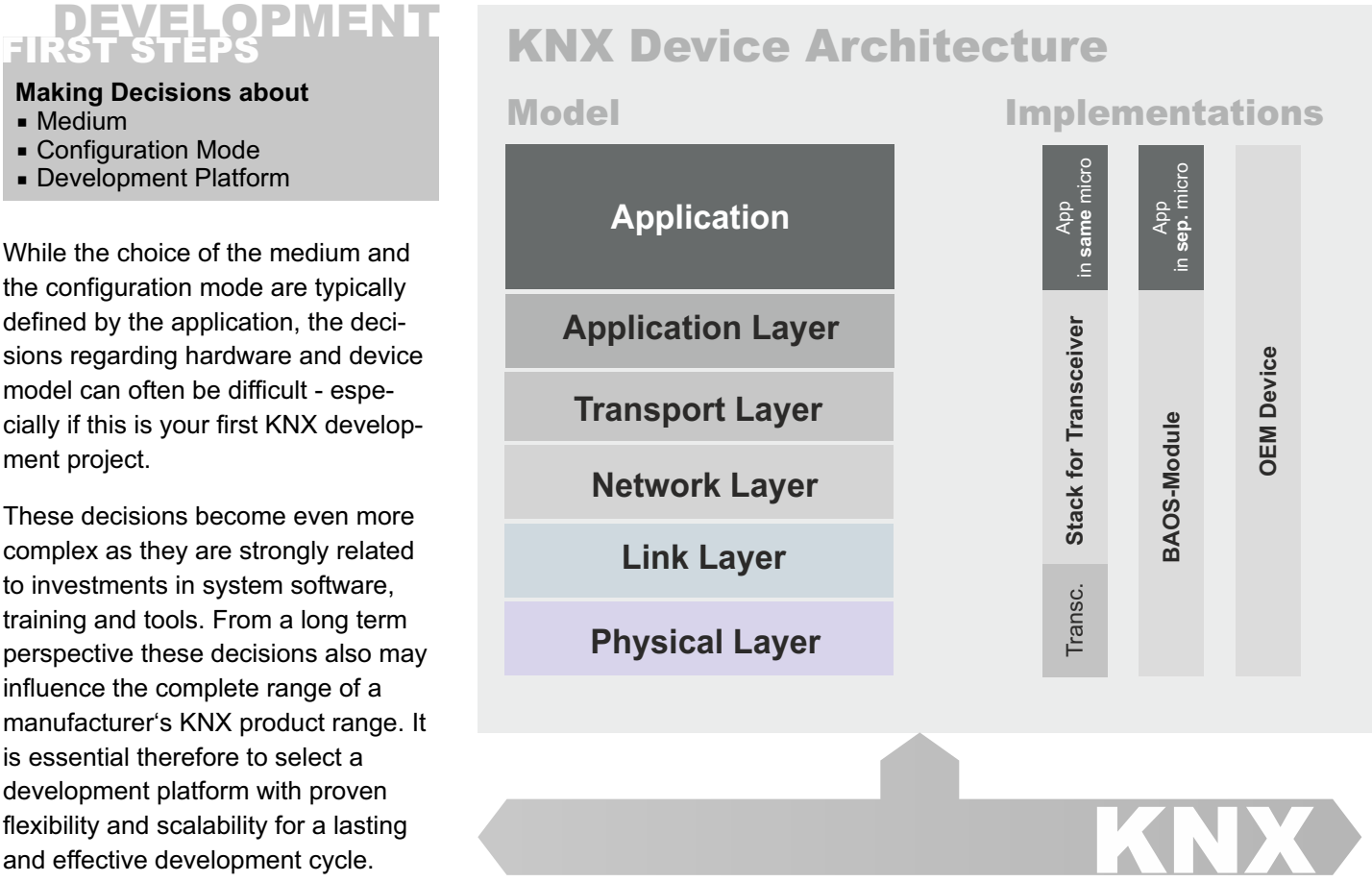
FIRST STEPS

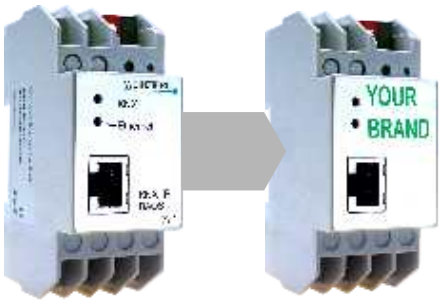
Making Decisions about

- Medium
- Configuration Mode
- Development Platform

While the choice of the medium and the configuration mode are typically defined by the application, the decisions regarding hardware and device model can often be difficult - especially if this is your first KNX development project.

These decisions become even more complex as they are strongly related to investments in system software, training and tools. From a long term perspective these decisions also may influence the complete range of a manufacturer‘s KNX product range. It is essential therefore to select a development platform with proven flexibility and scalability for a lasting and effective development cycle.





Jump Start: OEM Devices

With OEM versions of our devices you can quickly offer your own branded KNX solutions. Choose between our comprehensive range of USB Interfaces, Gateways, IP Interfaces, IP Routers, our innovative IP BAOS devices and our new KNX IO series. We manage the complete production process including full customization of the devices and thus you can easily complete your product range.

Platforms for individual OEM

If you need more individual features for your KNX devices we develop your KNX devices with feature sets tailored to your needs. Based on our platform concept we can create devices with unique selling points for your offering.

BAOS Modules

Weinzierl BAOS Modules

A quick and efficient solution to connect your devices with KNX are KNX BAOS modules. The "Bus Access and Object Server" modules include both a KNX transceiver and a microcontroller with a certified KNX stack. Communication with the module is executed via the reliable Serial Protocol FT1.2.

It enables sending and receiving of KNX telegrams according to the EMI (External Message Interface) format, however the main use case is the communication on the datapoint level. The basic functionality of the BAOS TP modules is also available as a complete rail mounted device, the KNX Serial BAOS 870.

BAOS Development Kit

To start your development project, a BAOS Development Kit is available which contains:

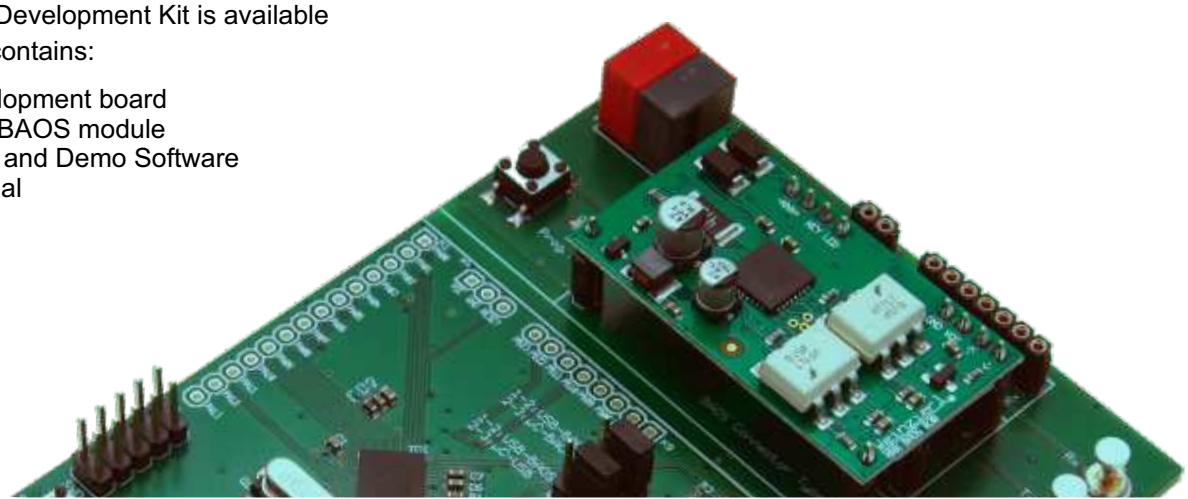
- Development board
- KNX BAOS module
- Tools and Demo Software
- Manual

KNX BAOS 830 TP

The latest generation of KNX BAOS Modules: the KNX BAOS 830 offers a generic data base with 1000 group objects/data points, galvanic isolation and is powered via the bus.

KNX BAOS 838 TP kBerry

The KNX BAOS Module 838 kBerry is an adaptation of our KNX BAOS modules specifically made for the Raspberry Pi. It can be attached directly to the pins of the Raspberry Pi and communicates via a serial port. A free SDK is available for download.



KNX BAOS 832 TP

Same feature set as the model 830, the KNX BAOS Module 832 provides power for the application without galvanic isolation.

KNX BAOS 840 RF

The wireless member within the modules family is the KNX BAOS Module 840 RF: it is the wireless variant (KNX RF) of the KNX BAOS 830 module and implements KNX RF with full ETS5 support.

KNX Stack Overview

KNX Communication

Each device which communicates via a KNX network needs an implementation of the KNX protocol. The KNX protocol is specified according to the OSI reference model (Open Systems Interconnection) as a set of layers.

The KNX system is a decentralized network. The runtime communication is mainly based on group telegrams in multicast. To participate in the KNX runtime communication each device must be configured, e.g. group addresses must be assigned.

Typically this is done via the official ETS® program available from the KNX Association. The configuration can be loaded into the distributed devices via the KNX network during the device download. The management procedures are quite complex and are also part of the KNX Standard.

In contrast to the runtime communication the network management is asymmetric. A KNX device which can be loaded via the network is called a KNX management server. It offers services like memory write to the programming tool which is called a KNX management client.

KNX Stacks for End Devices

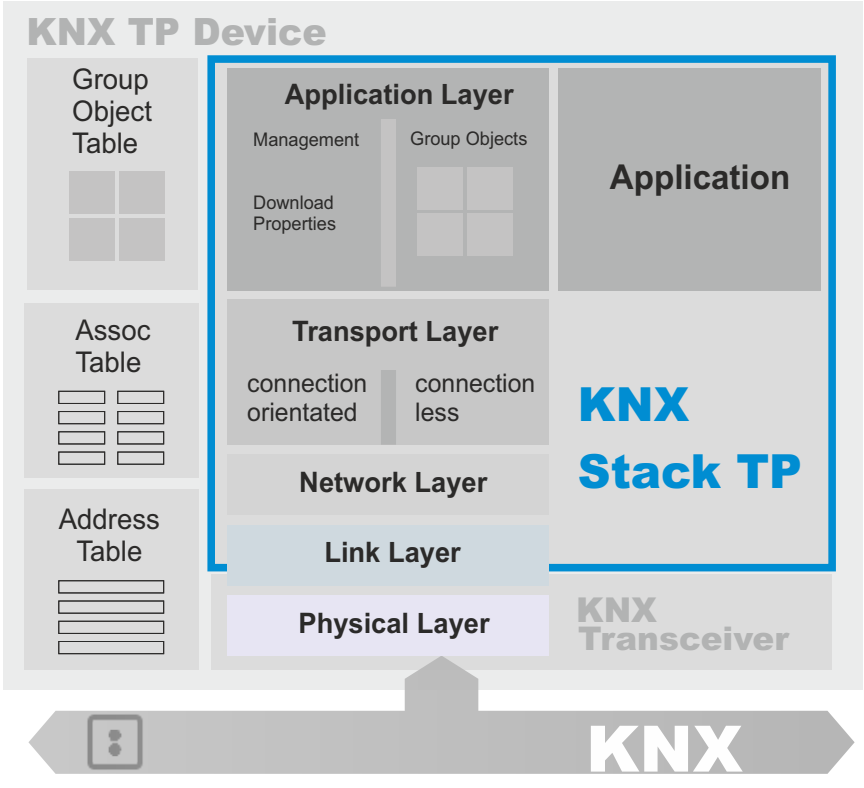
Typically, the term “KNX Stack” is used for the system software of a KNX device. A KNX Stack is the firmware which can be used to develop KNX devices like sensors or actuators. Today, our KNX Stacks are globally used by many well-known manufacturers for a great variety of KNX devices which are produced in high quantities.

A KNX device is always based on a device model. A device model specifies both the management procedure (how the device is configured via the bus) and identifies the resources available in the device (e.g. the maximum size of the connection table).

KNX Stacks for Tool Programming

A program running on a PC typically is not managed by the ETS Software. Therefore, no KNX Device Stack is required.

For PC based solutions we provide access to KNX telegrams as well as to KNX services within the framework of our Software Development Kit kDrive explained later in this brochure.



Classic: System 7

As a classic solution, System 7 is still used for many devices in the market. System 7 supports up to 255 communication objects and a loadable area of up to 30 kB.

The simple structure and flat organization of the project files allow a fast start into KNX development and is a good choice with small footprint for all platforms including 8 and 16 bit microcontrollers for cost sensitive applications.

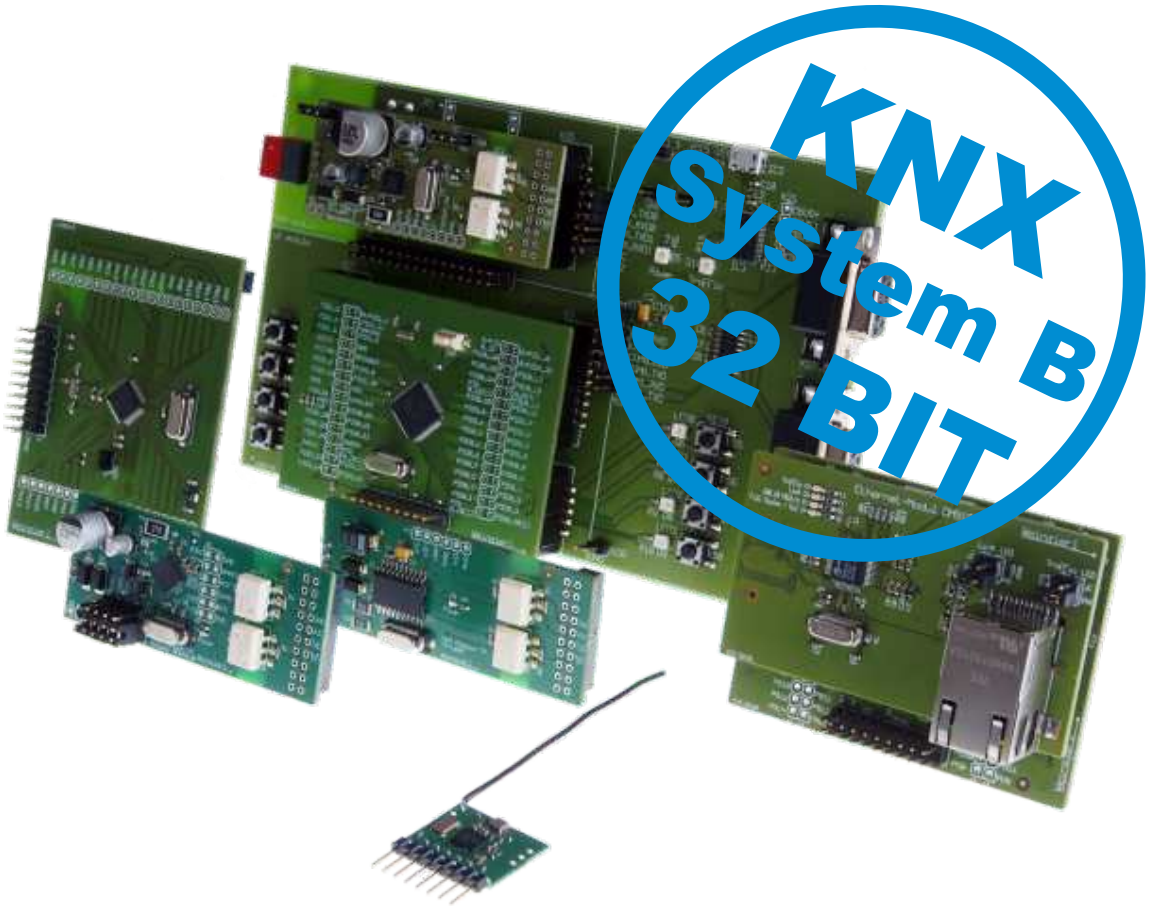
Our KNX Stack Classic for Twisted Pair (TP) is a System 7 implementation and – with regards to its installed base – may be the most used KNX stack implementation. The firmware includes more than just the communication stack: it provides a complete implementation of the standardized device model System 7 and fully emulates the memory areas and memory types for this profile. The result is full compatibility with the ETS software. The source code is well structured, fully documented and can be included in the scope of delivery.

Power: System B

Without a doubt: System B is the most powerful device model in the KNX standard and a truly scalable solution. System B is very flexible and can be used on different media. In 2013 the device model System B has been adapted to the KNX IP medium as well as to KNX RF in the KNX Standard – System B supports the following media:

- KNX TP (Twisted Pair)
- KNX RF (Radio Frequency)
- KNX IP (KNXnet/IP, Ethernet)

System B is the logical choice for our KNX Stack NGS for both the COMPACT and PLUS editions.



KNX Stack NGS

COMPACT and PLUS

As the most flexible device model for KNX System B is suitable both for simple devices as well as for complex devices that impose significant demands in terms of KNX resources. For this reason our KNX Stack NGS is available in the following editions:

- KNX Stack NGS **COMPACT**
- KNX Stack NGS **PLUS**.

Both editions – COMPACT and PLUS – share the same code basis. This simplifies the change between both versions. Virtual address spaces are used that are resolved at the driver level and mapped to the corresponding physical storage areas. So applications can easily be ported to different platforms.

The firmware includes more than just the communication stack: it provides a complete implementation of the standardized device model System B. The result is unrestricted compatibility with the ETS software. The source code is of modular structure, fully documented and can be included in the KNX Stack NGS package (depending on the license model).

Included in our KNX Stack NGS solution is a developer workshop to help you getting started. We will advise you on system architecture and give you full support for your development work.

COMPACT FEATURES

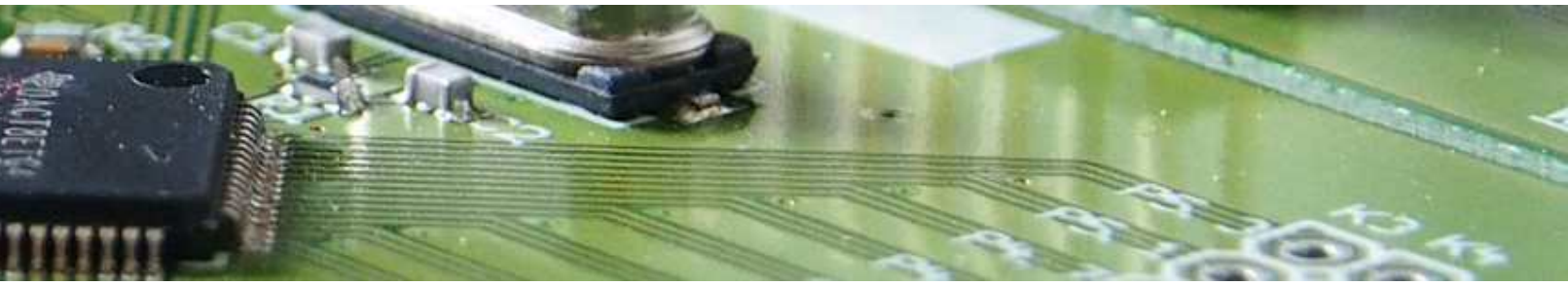
- System software for KNX devices
- Medium: TP, RF, IP
- Configuration modes: System mode (ETS), Easy Mode
- Device model: System B
- Up to 255 group objects
- Up to 64 kB loadable memory
- Available for different microcontrollers
- Bus access: KNX UART Transceiver
- Source code in ‘C‘ programming language
- Modular development boards
- Software tools
- ETS support
- KNX certified

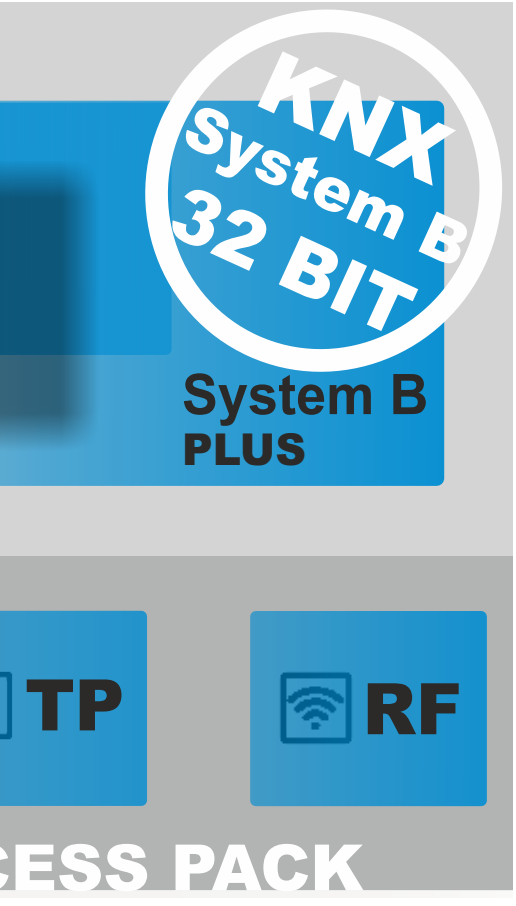
COMPACT ADVANTAGES

The COMPACT edition of the KNX Stack NGS comes with a small footprint but enables a complexity which is suitable for the majority of today's KNX devices. The new Weinzierl System B implementation is very scalable and allows a migration to the even more powerful PLUS edition – making the COMPACT edition future proof.

Supported Microcontroller

As our new KNX Stack NGS implementations are not dependent on special controller architectures the KNX Stack NGS can run on any existing micro controller family as long as a minimum of features is available. To be able to provide a “ready to develop” solution, we offer our software already optimized and certified for different controller families - please contact us.





Development Hardware

Another advantage of Weinzierl's new KNX Stack implementation is in the uniform concept and design of the provided evaluation hardware. The evaluation boards for KNX RF, for KNX TP and KNX IP system software are very similar regarding their schematics and therefore can be used without significant changes by the same application.

FEATURES PLUS

- System software for KNX devices
- Medium: TP, RF, IP
- Configuration modes: System mode (ETS), Easy Mode
- Device model: System B
- Up to thousands of group objects
- Up to 1 MB loadable memory
- Available for different microcontrollers
- Bus access: KNX UART Transceiver
- Source code in 'C' programming language
- Modular development boards
- Software tools
- ETS support
- KNX certified
- Advanced table handling
- Download of op-code
- Long frames support allows faster download

ADVANTAGES PLUS

The most obvious advantage of the PLUS edition is the number of available group objects. While the COMPACT version supports up to 255 objects, the PLUS version allows thousands of group objects. To achieve this the formats of the communication tables (group address, association and group object tables) use the extended format for System B. The PLUS version also offers a significantly increased address space. The configuration data like parameters and tables can be loaded into a range of up to 1 MB via the bus. The extended address range can also be used to load application code via the bus – possible within an ETS download.

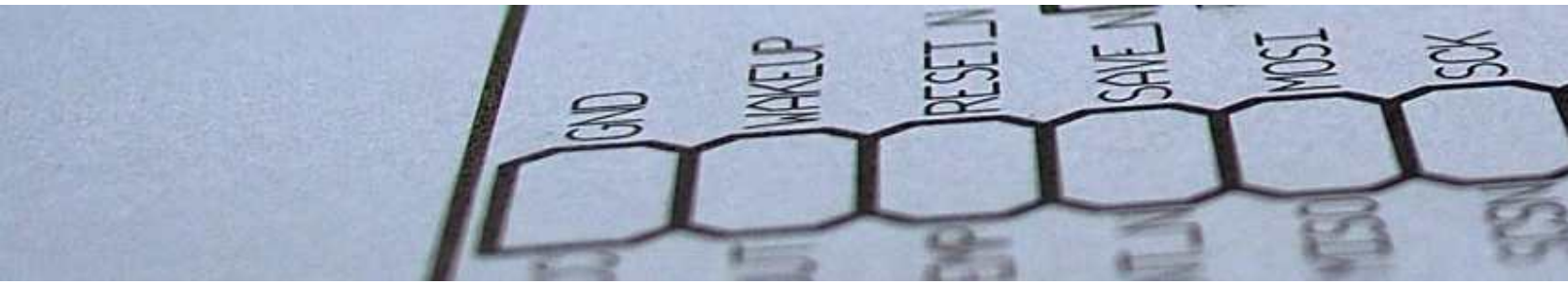
Complex Performance

The PLUS edition of the KNX Stack NGS specifically targets complex devices with a 32-bit architecture. It is optimized to ensure high performance for all application sizes. For complex devices it is not only required to support bigger tables. Regardless of the number of group objects, in any case they have to be processed “in-time”. While the COMPACT edition is based on code-saving search algorithms, the PLUS editions uses additional lookup tables that allow quick access via indices. The processing of the communication objects has also been accelerated and a linear search through all objects is avoided with the use of additional buffers. This increases the demand on memory - however, a huge reduction of CPU clock speed is possible. Furthermore, long frames enable faster downloads.

Loadable Code

For most devices it is favorable to program the application program ex factory. So in the field the ETS only writes the group addresses and the parameters. The benefit is a faster download. For special reasons (e.g. bug fixing or project business) it might be necessary to load a complete application program via the ETS – our PLUS edition supports the loading of op-code.

Medium Access Packs for KNX Stack NGS



Medium Access Packages

The Weinzierl KNX Stack NGS is not only scalable but also modular. Both the COMPACT as well as the PLUS edition of the Core Pack can be used for each KNX medium. Medium Access packages are available for

- KNX TP (Twisted Pair)
- KNX RF (Radio Frequency)
- KNX IP (KNXnet/IP, Ethernet)

A Medium Access Package (MAP) contains all medium related firmware parts for the KNX Stack NGS.

KNX TP

Twisted Pair is still the most used medium in KNX. Devices connected to the TP can be powered over the bus. Our Medium Access Package for KNX TP contains all TP related firmware and drivers for KNX UART transceivers and dev boards.

KNX TP

FEATURES

- High reliability
- Adequate bandwidth
- Power supply for devices
- Low cost

For new designs we recommend the latest generation transceivers such as:

- E981.03 (Elmos)
- NCN5120 (ON Semiconductor)
- TP-UART II (Siemens)

They combine a power supply with quite high output current and a small footprint on the PCB.

KNX RF

Radio Frequency RF is the wireless alternative in the KNX standard. In locations that are not suited for cabling KNX RF is used for wireless data transmission. KNX RF was, until recently, only supported by Easy Mode. Starting with the ETS5 however, KNX wireless devices will be configured in the same professional way as standard TP products.

KNX RF

FEATURES

- Medium access over standard ISM Transceiver
- Evaluation board
- Reference Designs
- RF Modules
- Support of System Mode (ETS)

The Medium Access Package for KNX RF contains all RF related firmware parts for the KNX Stack NGS. For KNX RF no dedicated KNX hardware is required. There are different microcontrollers and RF transceivers available which are suitable to implement the KNX RF protocol. The KNX RF standard differentiates between (true) bidirectional and semidirectional devices which are bidirectional for configuration and unidirectional in runtime to save energy.

As RF devices are typically less complex than most TP devices the COMPACT edition of the System B Stack is perfectly suited to implement KNX RF devices for System Mode. For more demanding applications, the PLUS version also supports KNX RF.

KNX IP

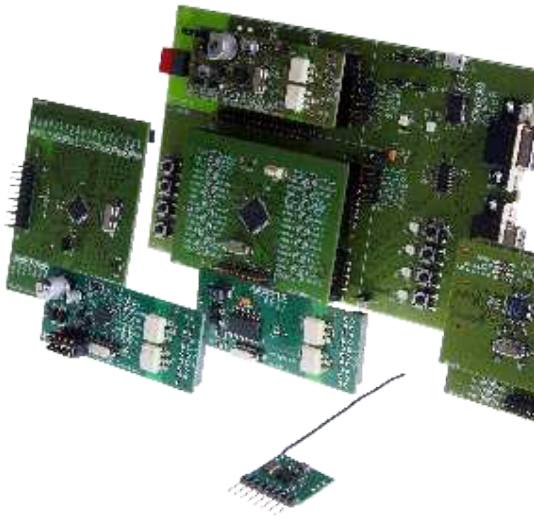
The Internet Protocol (IP) is integrated in KNX as a stand-alone medium and is on the same level as TP or RF. KNX IP devices enable the use of powerful KNX features – like configuration modes and interworking – also on IP.

KNX IP

FEATURES

- High bandwidth
- Usage of existing infrastructure
- Evaluation board

KNX IP opens the door to top level communication within a building (e.g. telecommunication, multimedia, etc.) and allows an entirely new class of KNX devices. Transmission of KNX messages via Ethernet is defined as part of the KNXnet/IP protocol based on UDP. The Medium Access Package for KNX IP contains the stack extensions required for IP communication including a UDP/IP stack. Additional hardware with an Ethernet connection is part of the solution package.



kScript for KNX Stack NGS

ETS Product Entry made quick

One major task in application development is the representation of the device in the ETS. Each application is represented in ETS as a set of group objects, parameters and dependencies. The outline of the application can be created with the KNX Manufacturer Tool (KNX MT). This task is quite complex and time consuming. In parallel the application code which runs in the device must be fully in line with the application defined in the ETS. Even a single mistake ends in an unpredictable behavior of a device.

Just write it down

kScript solves these problems by using a script based development system. The basic idea is to define the outline of the device only once and create the application framework for the device in parallel to the application for the ETS. As both tasks use the same input the output is always in-line - both the static and the dynamic parts inculding all dependencies and translations. For a programmer the most effective and universal way to describe relations is text. Human readable text is still the basis of all modern programming languages. To avoid the invention of a new syntax for KNX application a well-tried scripting language has been chosen: Python. It is a popular script language in the fields of automation and testing.

Faster and more efficient

The usage of a programming language enables all option of programming. So scripts can use loops which are a typical requirement for multi-channel devices. Also sub functions can be used and text can be created automatically, like 'Channel 1' and 'Channel 2'. The application script is handled as an integrated file of the application. It can be edited in the IDE (Integrated Development Environment) of the project. The execution of the script is just a pre-build command. As output the script library creates the xml-File as input to MT. In addition it creates the binary data as input for the KNX Stack. This is on the one hand a set of c-files which hold any data as arrays of bytes and on the other hand a set of header files which allow an easy access to configuration data. The configuration data can be used directly by the Weinzierl KNX Stack NGS. Also the application code can use the output data to access group objects and parameter settings.

Instant Changes

One essential advantage of the integrated solution becomes visible if a change of the application is requested. Any modification can easily be done in the script. After a run a new ETS entry is generated and new application data for the stack that is automatically in-line.

BENEFITS kScript

- Script as unique base for application description
- Fast editing in standard text editor
- Usage of loops, conditions etc.
- Usage of functions
- Automated generation of ETS entry
- Automated generation of application data
- Fully compatible with ETS and KNX MT

kScript

Main elements

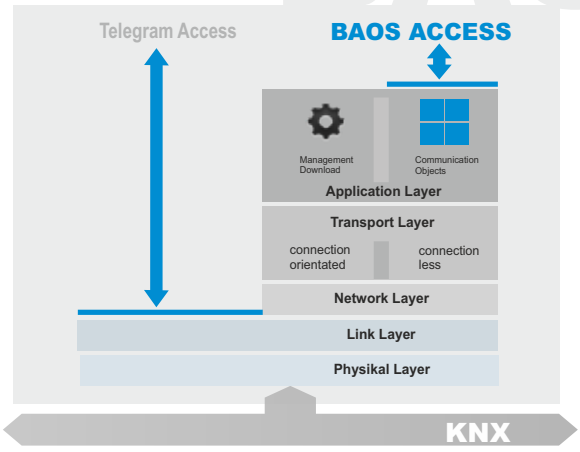
The main elements of the script are:

```
# Create the ETS XML application framework
application_program()

# Add a parameter
type_restriction('TP_ENABLE', 8, [('YES', 1), ('NO', 0)])
parameter('CHANNEL_1_VALUE_1', 'TP_ENABLE', 'SUB_MCB_4')

# Add a channel and a parameter block
channel('DYNAMIC', 'CHANNEL_0', number=0)
par_block('CHANNEL_0', 'CHANNEL_0_BLOCK')

# Add a group object
go_type('GT_INFO', '1.001')
go('CHANNEL_0_BLOCK', 'GO_CH_0_1', number=1, go_type_key='GT_INFO')

# Defining dependencies
# Add go when value of CHANNEL_1_VALUE_1 is "YES"
go('CHANNEL_0_BLOCK.CHANNEL_1_VALUE_1.(YES)', 'GO_CH_0_2', number=2)
Build the output
```

BAOS SDK

The fast Lane to KNX

BAOS – short for "Bus Access and Object Server" – is not only the name of our KNX modules and devices. It is a universal architecture to enable KNX connectivity for a great variety of applications and products. Simply speaking, BAOS is based on a powerful protocol language which communicates between KNX and - in case of the BAOS devices - IP. Thus you can easily connect devices with an Ethernet port to KNX via one of our KNX IP BAOS devices. BAOS does the communication and „translates“ the commands between KNX and your device.



The application itself is released from the complexity of the KNX protocol, including the network configuration using ETS® software. The KNX IP BAOS devices builds a micro server on IP which provides access directly to KNX data points. This decouples the client access from bus traffic. A certified KNX stack ensures high performance runtime communication as well as complete compatibility with ETS and other KNX devices.

BAOS for mobile Applications

KNX IP BAOS devices not only allow access to the KNX network. Via the BAOS architecture these devices can also provide semantic information about the installation, including rooms, installed functions and data points. The source of all this information is the configuration done in ETS. An ETS product entry with building structure allows the configuration of a complete visualization without the need of an additional editor.

This guarantees the consistency of all KNX addresses used in the system. While the KNX integration completely is done by the installer using ETS, the look and feel of the visualization is a task of the mobile app. Individual ETS entries for OEM projects are possible as well.

Responsive Apps

The Object Server stores the most recent values of the installation, even if no client is connected. This means that when a client reconnects all states are available with short latency and without value reads via the KNX bus. For mobile devices, which are not typically permanently connected to KNX, this feature is essential for responsive operation and control.

KNX IP BAOS 771

Up to 250 datapoints
Power supply: External or PoE
Power consumption: < 0.8 W
Case: For DIN rail (2 modules)

KNX IP BAOS 777

OLED Display with micro UI
Integrated web server for visualization
Up to 2000 datapoints
External power supply or PoE
Power consumption < 2 W
compact DIN rail case (2 modules)

kDrive SDK

Gateway for non-KNX Devices

Connectivity to KNX is a demand for many building automation applications. While full integration of a KNX interface via a hardware module or a software stack is the first choice for native KNX products external solutions are an option for many applications that simply need access to the KNX network.

Especially for devices where KNX connectivity is not the devices' core focus an external interface device such as the KNX IP BAOS is the optimal solution. The external interface contains the KNX Stack and provides direct access to the data of the KNX network without KNX addressing and telegram formatting.

KNX IP BAOS 772

Up to 1000 datapoints
Power supply: External or PoE
Power consumption: < 0.8 W
Case: For DIN rail (2 modules)

Many complex devices like boilers or audio systems already have a connection to LAN/IP. So an IP based solution just results in a software extension. For the development process we provide generic ETS entries. For final products an individual ETS product entry is recommended. The result is a certified integration of non-KNX devices in the KNX network and to ETS enviroment.

BAOS Protocols

The KNX IP BAOS devices support two separate BAOS protocols: a binary protocol and a RESTful web services protocol. While the BAOS Binary protocol is recommended for controller applications, the BAOS web services are intended for web applications. For both styles of the BAOS protocol a free SDK is available. The free variant of the Net'n Node bus monitor and analyzer supports the BAOS binary protocol as a client tool for development and test.

SDK for BAOS Binary Services

The Software Development Kit SDK for BAOS Binary Services is a C++ implementation of the KNX BAOS Binary Protocol. It can be used for a rapid development of native applications for KNX control which are using the KNX BAOS IP Interfaces. The main use case for this SDK is the integration of the BAOS protocol into controller software.

SDK for BAOS Web Services

The SDK for BAOS Web Services is a Java Script implementation of the KNX BAOS Web Services Protocol. It can be used for a rapid development of web applications for KNX control which are using the KNX IP BAOS Interfaces. The main use case for this SDK is the development of visualization apps running in a web browser.

Both BAOS SDKs support the KNX IP BAOS 771, the KNX IP BAOS 772 and the KNX IP BAOS 777.

SDK kDrive

kDrive by Weinzierl Engineering is a powerful software development kit (SDK) for KNX communication via KNX standard interfaces on the telegram level. It is implemented as a cross-platform software component library with a high grade of flexibility. kDrive defines a complete ecosystem for the rapid development of KNX applications on platforms with POSIX (like) operating systems, such as Linux and Windows. Application programming interfaces (APIs) are available in C++, C and .NET.

kDrive

Application area

The purpose of kDrive is to enable the development of KNX software on different operating systems. It can be the basis for visualization tools as well as for individual management clients. A common use case is the implementation of test tools for production. The kDrive library can be used for all media in KNX via standard serial, USB and IP interfaces. kDriveExpress is the binary distribution of the kDrive Library. It is available as free and as commercial license.The following components are currently available in the framework of kDriveExpress:

- Telegram access
- Services

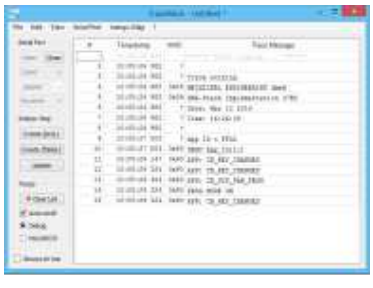
Development Tools

Development Tools

Quality of development depends highly on the tools being used during development. It is a great benefit for the customer to work with powerful tools from one source. Due to the common look and the uniform user interface of the tools the developer saves time and resources.

TraceMon: Debug Support

One big advantage of our unified software model is the overall debugging concept. In parallel to any available hardware debugger via JTAG interface the KNX system software offers additional debug support. The developer has access to a software debugging system that traces debug information via, for instance, an on-chip UART of the microcontroller. TraceMon is very resource saving as the main operation is done on the PC and not on the KNX device itself.



The level of the debug information (e.g. errors, warnings) can be set separately for every software module or can be turned off completely. Customer finds the same debugging procedures and settings in all of our KNX stacks. For the view of the debug output on PC the software tool TraceMon is part of our solution package.

Net'n Node: Bus Monitor

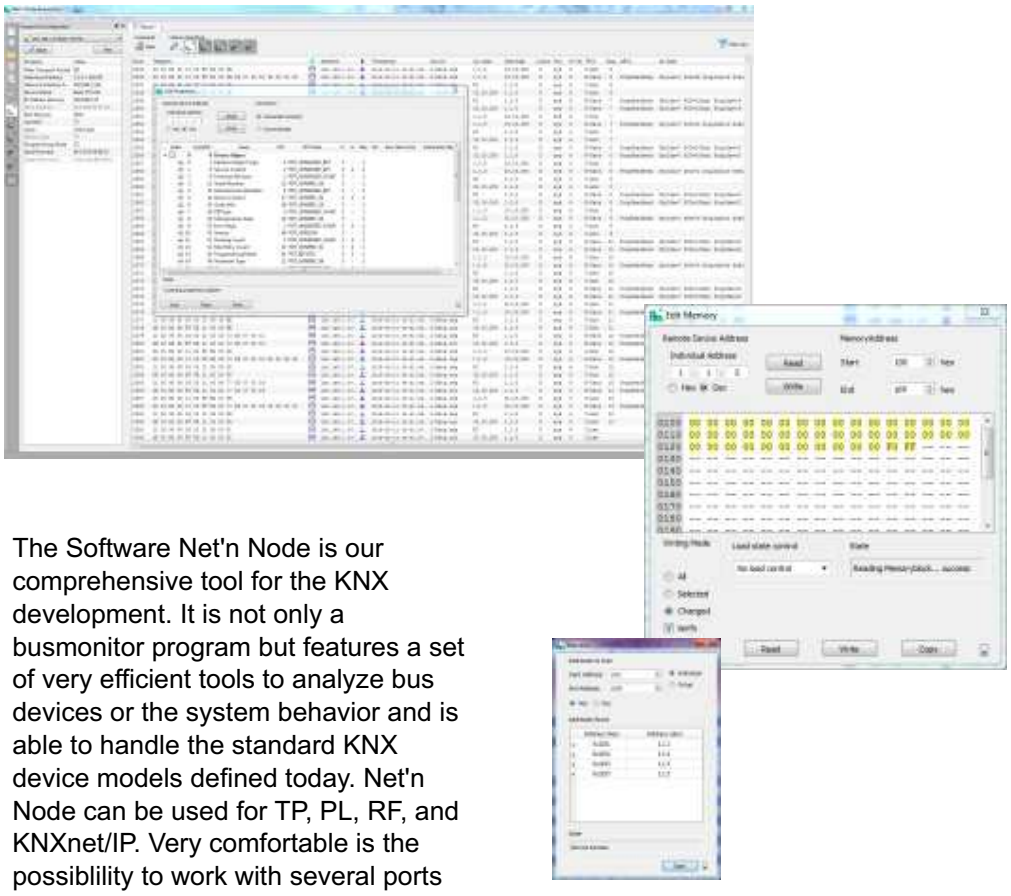
During the development of components for a bus system it is important to have a detailed view in what is going on in the devices and in the complete system. To analyze the behavior of a bus device or the interworking of the system a busmonitor is required.

Net'n Node

FEATURES

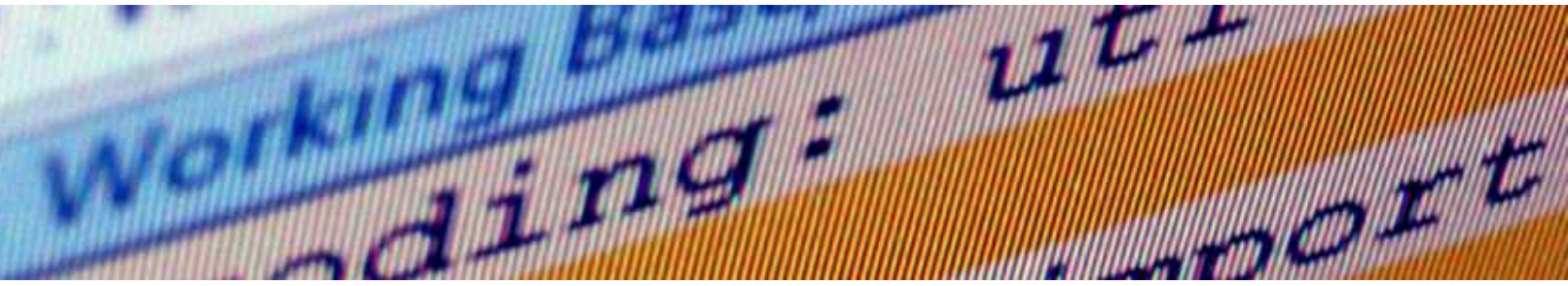
- Sending and receiving Telegrams over KNX
- Analysis of a KNX Installation
- Analysis and Control of single Devices
- Reading out Group Objects
- Programming of Bus Devices
- Support of BAOS Protocol
- Access to KNX over serial, USB and IP Interfaces and Routers

net'n'node



The Software Net'n Node is our comprehensive tool for the KNX development. It is not only a busmonitor program but features a set of very efficient tools to analyze bus devices or the system behavior and is able to handle the standard KNX device models defined today. Net'n Node can be used for TP, PL, RF, and KNXnet/IP. Very comfortable is the possiblility to work with several ports in parallel.

Services and Support



Accredited Test Lab

Cross-manufacturer compatibility of various applications and products is one of the main columns of the KNX system. This is achieved by the advanced certification system of the KNX Association. All devices with a KNX logo must be tested by a test laboratory accredited by the KNX Association for compatibility.

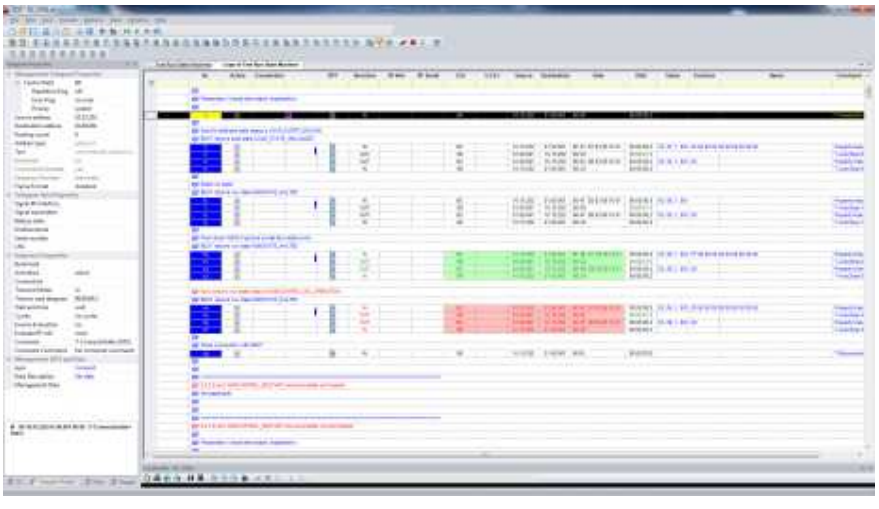
Weinzierl has founded its own accredited Test Lab for both system software (KNX Stack test) as well as for applications (KNX interworking and functional test). The Test Lab completes our range of system solutions for KNX.

TEST LAB KNX®

Test Lab

SERVICES

- Advice before and during development (e.g. behaviour and description of KNX Data Points)
- Support for product registration
- Creation of test concept (ETS configurations)
- Creation of test setup
- Preparation of test sequences with the official test tool (EITT)
- Compliance tests according to the KNX specifications
- Creation of detailled test report



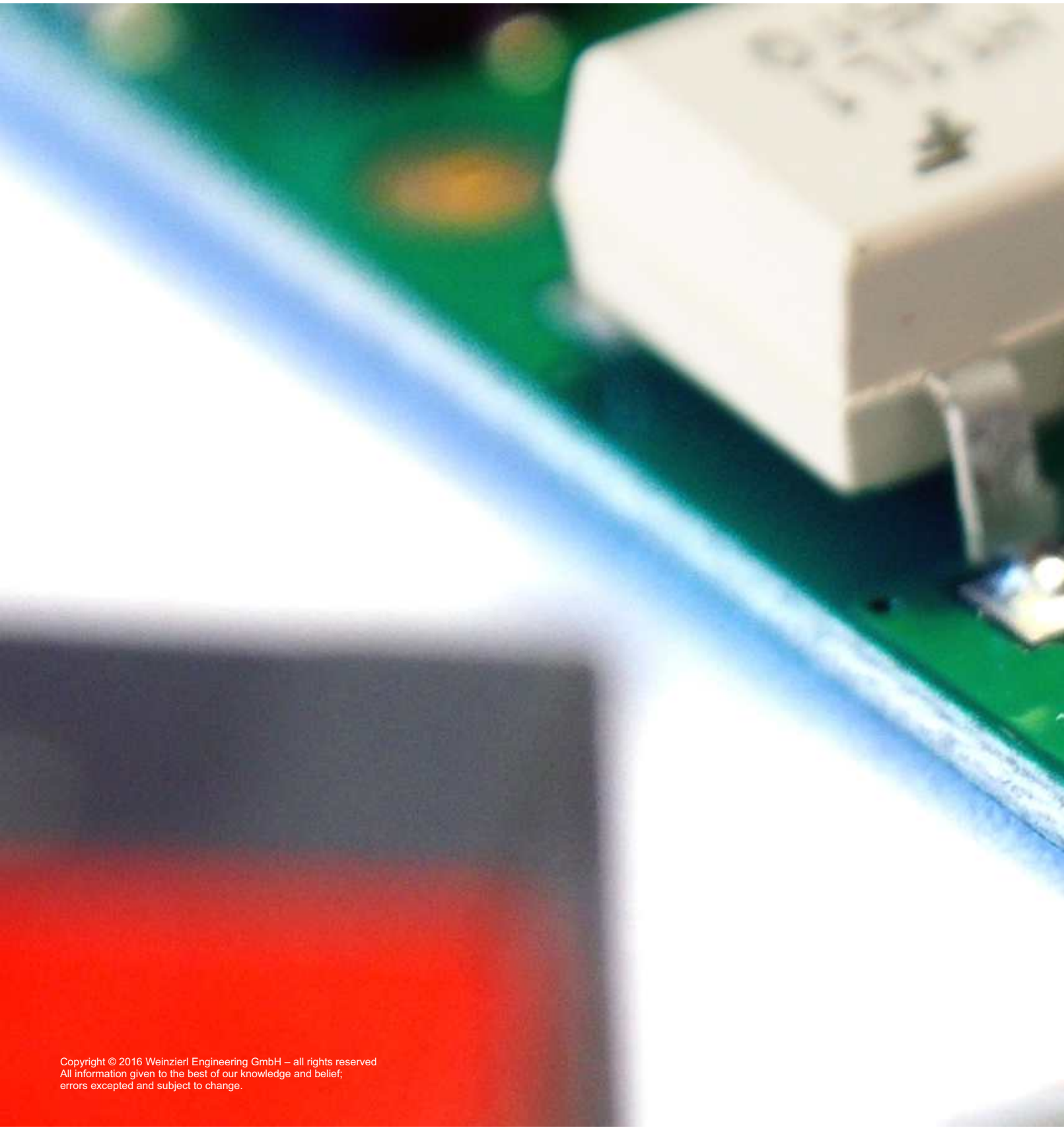
Development Services

Apart from a great product idea system design is THE basis for successful development. Our system analysis includes both the integration of your product in the current KNX environment as well as architectural design of new KNX devices.

If you are interested in individual solutions or complete device development, we offer application development services including hardware design, programming and system integration. With broad experience in the development of bus components and systems, we are looking forward to finding solutions tailored specifically to your requirements. Of course, KNX product certification is also included in our service portfolio.

Support

For development projects we offer support for our customers. In addition, we offer our consulting and training services also independently of product development.



Weinzierl Engineering GmbH
Achatz 3-4
DE-84508 Burgkirchen / Alz
GERMANY

Phone +49 (0)86 77 / 916 36 - 0
Fax +49 (0)86 77 / 916 36 - 19

Email info@weinzierl.de
Web www.weinzierl.de