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KNX EtherGate

A universal platform for KNX/IP interfaces

1 Introduction

While Konnex has grown into a major building automation standard, the Ethernet has evolved into a universal communications solution that can also be employed in automation systems. Because of their different system characteristics, Konnex and Ethernet complement each other well.

Photo of KNX EtherGate

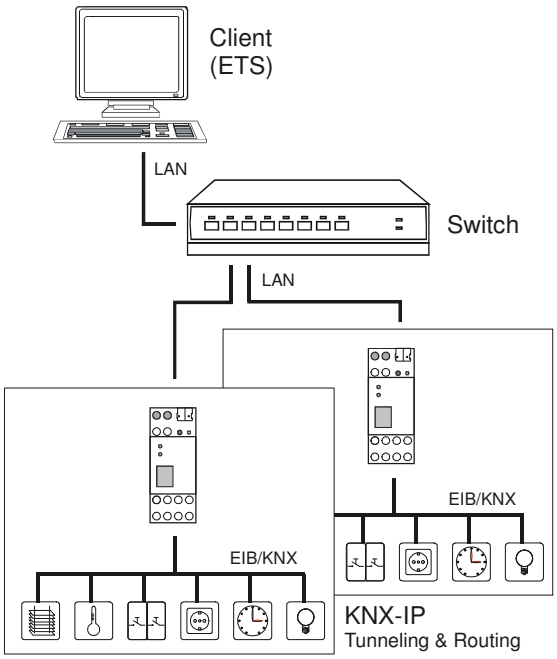
The advantages of the EIB/KNX bus as compared to the Ethernet lie in part in its simple and cost-effective topology, since the bus is merely connected through from one participant to the next. In addition, power consumption of the individual devices is very low, and the devices supplied by the KNX manufacturers are designed specifically for the installation system.

The decisive advantage of the Ethernet is its high bandwidth at relatively low cost and its very widespread use. Today, the Ethernet is not only used for networking computers in the office, but also for multimedia applications in the home and for industrial automation.

Despite, and indeed because of, the high transmission speeds, LAN networks cannot replace the KNX bus. Instead, the combination of Konnex TP1 and LAN provides an optimal solution for future building automation. Konnex TP1 is primarily suited for local control, while the LAN is used for inter-system communication. The transmission of control commands can take place in a LAN network together with Internet use, PC networking and multimedia. Overall, this results in a hierarchical architecture for building networking.

2 Routing in hierarchical architectures

One major motivation to extend the Konnex system with the Ethernet is to increase the transmission capacity of the overall system. Although the transmission speed of 9600 bit/s is fully adequate to form a bus line with up to 256 participants, a higher bandwidth may be needed in the backbone if a system has numerous lines that are connected by a line coupler. This is especially critical if the system contains devices used for purposes such as visualization to which all telegrams need to be transmitted. In this case, there can be no selective routing.



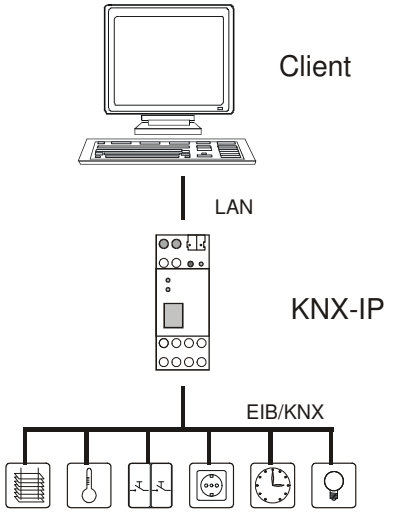
Application of the KNXnet/IP Routing standard

Here, the high bandwidth of a LAN network offers an optimal solution. While with Konnex TP1 a maximum of only 50 telegrams can be transmitted per second, transmission via LAN exceeds 10,000 telegrams at 10 MBit/s.

Since the Ethernet is of great significance to the installation system as the backbone, it was standardized in Konnex. The Routing subtopic of the KNXnet/IP specification (formerly EIBnet/IP) describes how KNX/IP gateways forward telegrams via IP. For forwarding via the Ethernet, the KNX telegrams are individually packed in UDP/IP telegrams and sent via the Ethernet as multicast telegrams. All KNX/IP routers in the network can receive these telegrams simultaneously and use their routing tables to determine whether to forward the telegram into the connected KNX line.

3 Tunnelling: PC access via a LAN connection

While routing is used for runtime communication, tunnelling refers to access, such as from a PC to a KNX network, during configuration and start-up. The connection of a client (PC) with a bus line or with an individual KNX device is of central importance. The tunnelling procedure is defined in the KNXnet/IP as well and also uses UDP. KNX/IP devices that support tunnelling can, for example, replace RS232 interfaces that in the past were used for bus access.



Application of the KNXnet/IP Tunnelling standard

4 Object server: From the telegram to the data point

For an increasing number of devices, such as in the areas of multimedia and security technology, the exchange of control information with the building automation is of significance. However, for certain devices it is preferable to not access the bus directly. Instead, a connection can be established to the KNX via the Ethernet. Communication via the Ethernet is particularly interesting for devices that are already equipped with a network port. If the protocol stack for TCP/UDP/IP already exists in the operating system, applications can communicate with other devices via the Ethernet with little additional effort. This applies to many Linux-based devices.

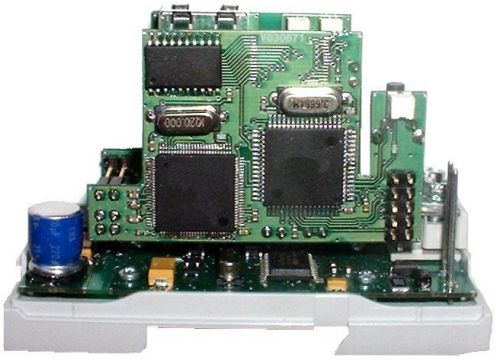
If you were to use tunnelling or routing as a solution, the devices would be able to access the KNX network but would still have to generate and interpret KNX telegrams.

It is far simpler for the KNX/IP interface to take over this task. In this case, the KNX/IP gateway assumes the roll of a KNX terminal. This means that the KNX communication software also contains the data points, making it possible for the device to interpret received telegrams.

A client can access the data points via TCP/IP without having to know the syntax of the KNX telegrams. The data points are configured using the ETS software (Engineering Tool Software). The group addresses are downloaded to the KNX/IP gateway. To the KNX bus and the ETS, the combination of the terminal and the KNX/IP device thus has the appearance of a standard bus participant.

5 Hardware

The hardware is an ideal platform for various gateways between KNX and IP. At its core is a microcontroller that is connected to the LAN via a network chip and that can communicate with the KNX via a TP-UART. It has sufficient computing power and memory capacity to implement various applications in parallel.

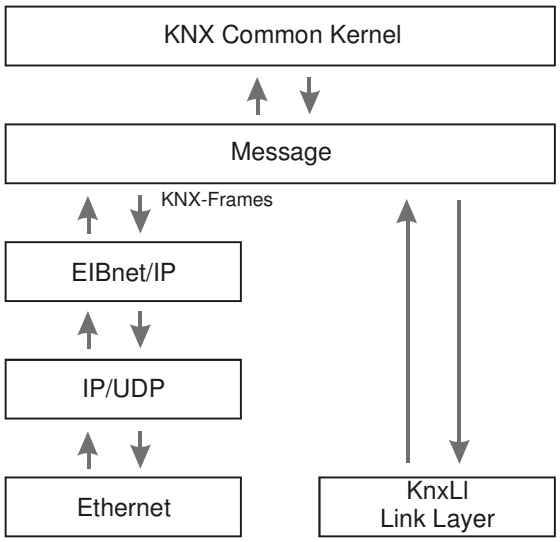


The KNX/IP gateway hardware

Power can be drawn from an external power source of 12-24 V. In addition, the gateway supports the Power over Ethernet Standard (PoE). If the device is operated with a switch that also supports PoE, an external supply is not necessary. The device is connected to the switch merely by means of a patch cable (RJ45) and connected to the bus via a bus terminal. Its power consumption is approx. 800 mW. The Ethernet and KNX connections are electrically isolated.

6 Software

The core of the software is a lean operating system that was optimised for the KNX/IP gateway hardware. It contains a KNX stack and the stack for the TCP/UDP/IP. Applications can use the various protocols listed below.



The software architecture

The following protocols are available:

- IP with ARP, DHCP
- UDP for KNXnet/IP
- TCP for Objekt Server or Web Server
- KNXnet/IP Core Services
- KNXnet/IP Tunnelling
- KNXnet/IP Routing
- KNX Object Server
- HTTP (Web Server)
- KNX Stack (Common Kernel)

Literature

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[5] Weinzierl, Thomas: Integriertes Managementkonzept für die Gebäudesystemtechnik; Pflaum Verlag München 2001; ISBN 3-7905-0851-9

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[7] More information available at www.weinzierl.de