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Ingenuity for life
Projects
The worldwide standard for home and building control
KNX
Application examples
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Optimum control requires accurate measurements

This manual was written by practitioners for practitioners and has become a popular and indispensable reference book over the last few years.

Legal regulations increasingly appeal for the economic use of energy. At the same time, the indoor climate must meet stringent requirements. Both requirements can be fully met only if all necessary measured data are available and the sensors remain absolutely reliable year after year. Sensors thus form a key basis for optimizing energy efficiency in rooms.

Professional and high-quality products are needed to meet this goal – along with a few practical basic rules.

A control operation is only as good as the measuring accuracy of the sensors which detect the control variable (such as temperature, humidity and pressure) and transmit it to the controller as an actual value. While this process hasn't changed, the measuring technology and methods for mounting sensors are more cutting-edge than ever before.

Future-proof building control

Everything you need for a good working climate

Working concentrated while saving energy – products from Siemens improve the atmosphere in rooms and facilitate more economical operations.

The result: perfectly temperature-controlled and air-conditioned rooms with good lighting and reduced energy consumption.

Highlights

- Saves up to 30 percent energy with individual room control and energy saving functions
- Protects investments on the basis of reliable products and the ability to add KNX devices
- Easy commissioning and adaptation to changes in use due to tested applications
- Extremely environmentally friendly due to energy-independent variants with EnOcean technology

Contact and support

GAMMA instabus:
siemens.com/gamma

Technical documentation:
siemens.com/gamma-td

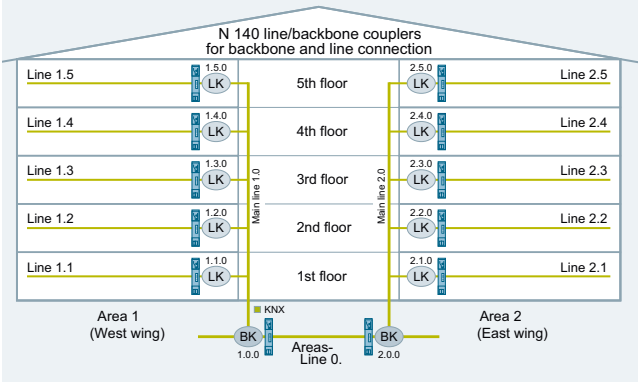
HVAC Integrated Tool (HIT):
siemens.com/hit

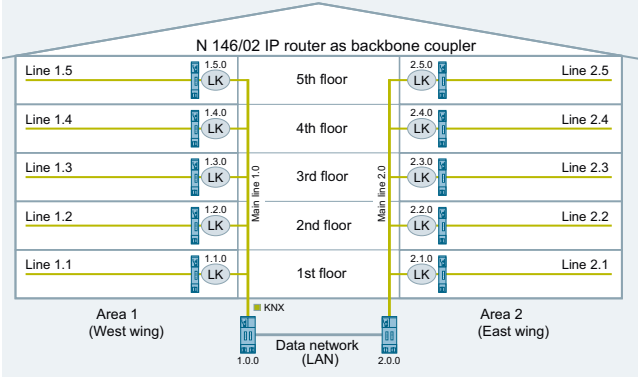
Support e-mail address:
support.automation@siemens.com

Support online platform:
siemens.com/automation/support-request

Application examples

Backbone and line couplers





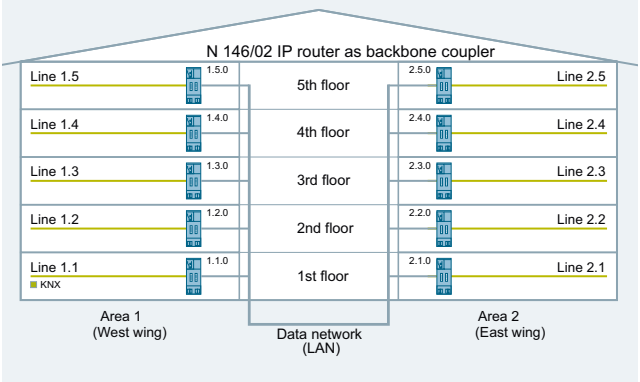
Conventional topology

In conventional topologies, all line and backbone couplers have usually been designed as KNX couplers. This topology is proven and widely used. For the most part, the bus line lengths are limited to one building.

Modern topology

In this modern topology, the backbone couplers are replaced with N 146/02 IP routers. Thanks to the use of standard network components, the connection for example of two building sections is no longer limited to bus line lengths. Use of other media such as fiber-optic cabling or WLAN is also possible for the purpose of coupling distant buildings and exchanging group address telegrams.

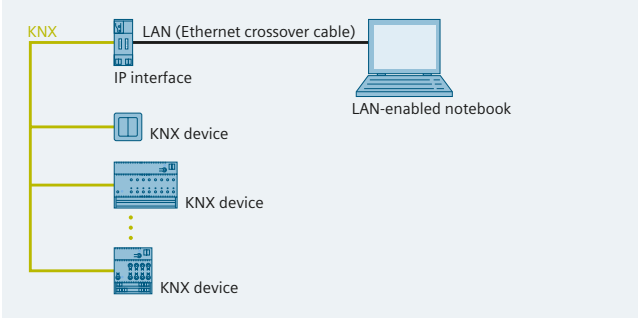
Backbone and line couplers



Innovative topology

In this innovative topology, all line couplers are replaced with N 146/02 IP routers. Backbone couplers are no longer needed. This configuration allows to connect every building floor by Ethernet (LAN) and utilize existing LAN networks. Moreover, correct configuration of the N 146/02 IP router enables major projects to be commissioned as smaller, individual subprojects in a simpler, clearer manner. It's possible to exchange group address telegrams despite the separation into individual projects.

Commissioning a KNX system via Ethernet (LAN)



In every GAMMA instabus project, the devices are commissioned after their installation. Once the physical addresses have been assigned, application programs, parameters and addresses are loaded to the devices. This can take some time in large-scope projects with many devices.

The LAN connection from Siemens makes it all go much faster, saving you time and money. Simply connect your notebook to the GAMMA instabus via an IP interface and start the download. With a LAN connection, the download takes only half as long as it does with USB.

Benefits

- Plan, configure, commission and diagnose with ETS, the KNX commissioning software
- Simply connect your notebook and start the download
- Downloading takes only half as long, thereby halving commissioning times and significantly reducing time at the project site

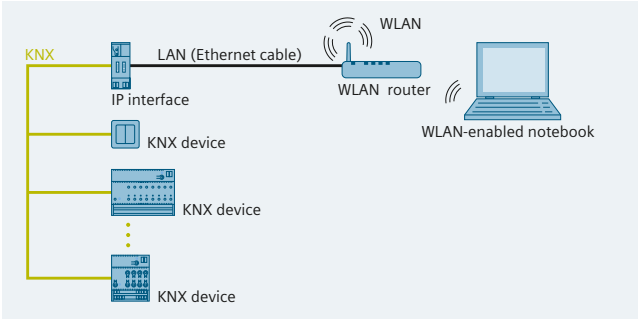
Follow these steps

- Connect the IP interface to the KNX bus line
- Connect the notebook to the IP interface using the Ethernet crossover cable – and start the download

You will need

- An IP interface N 148/22, for example
- 24-V power supply for IP interface N 148/22, e.g. Power over Ethernet, unchoked bus voltage
- Crossover cable
- LAN-enabled notebook
- ETS; see knx.org for the latest version

Commissioning a KNX system via Ethernet (WLAN)



In every GAMMA instabus project, the devices are commissioned after their installation. First, the physical addresses must be assigned. To do this, select the device in ETS on the notebook and press the programming key on the device. If you have various devices at different places such as flush-mounted bus coupling units, this can result in intensive walkways. That's the reason why two people usually perform the commissioning. You can save yourself this considerable extra work by connecting your notebook wirelessly to the KNX via WLAN. This lets you move about freely during commissioning – just take your notebook with you to each room. Any errors such as mixup of devices due to misunderstandings are ruled out.

Benefits

- Wireless GAMMA instabus commissioning via WLAN
- Possible to move freely throughout the building
- Only one person needed for commissioning

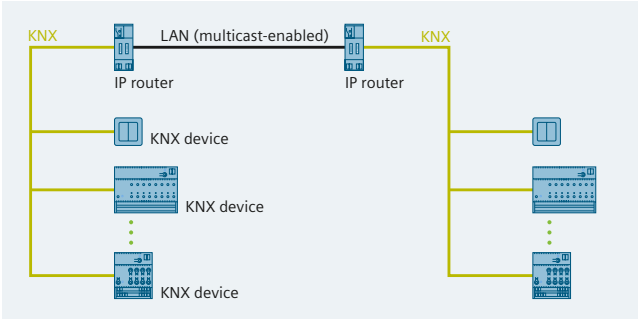
Follow these steps

- Connect the IP interface with the KNX, and connect the WLAN router to the IP interface using the Ethernet cable – and you can go to each individual room with your notebook and the ETS
- The related safety and security requirements governing the LAN and WLAN have to be observed

You will need

- An IP interface N 148/22, for example
- 24-V power supply for IP interface N 148/22, e.g. Power over Ethernet, unchoked bus voltage
- Ethernet
- WLAN router
- WLAN-enabled notebook
- ETS; see knx.org for the latest version

Coupling KNX lines via Ethernet (LAN)



The new KNXnet/IP standard enables KNX telegrams to be transmitted via Ethernet (LAN), which leads to new applications and solutions.

Existing network infrastructure and technologies are used to transmit KNX data over longer distances.

Connections between buildings or floors can be clearly and easily implemented with KNXnet/IP.

Benefits

- LAN as the main and backbone line
- Data can be transmitted over longer distances
- Existing data network and components (LAN) can be used

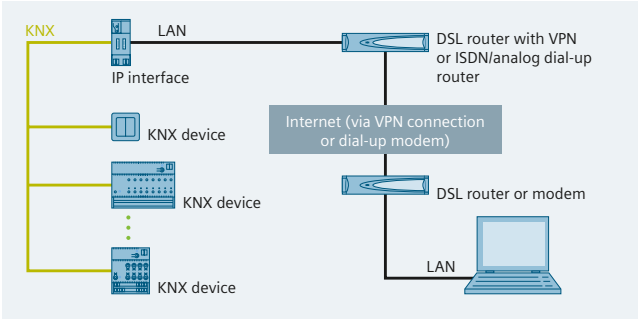
Follow these steps

- Connect an IP router N 146/02 to every KNX line (instead of a line coupler N 140/03)
- Connect the IP router N 146/02 via a multicast-enabled LAN
- Commission each IP router N 146/02 just like a “conventional” line/backbone coupler using ETS
- Observe the related safety and security requirements governing the LAN

You will need

- One IP router N 146/02 per line
- 24-V power supply for IP router N 146/02, e.g. Power over Ethernet, unchoked bus voltage
- Ethernet patch cable or LAN, depending on the size
- ETS; see knx.org for the latest version

Remote access to a KNX system via the Internet



In almost every project, changes are often requested during building completion or after the building goes into operation, for example if the set lighting times are too long. Up to now this meant making an appointment with the customer, driving to the property, changing the parameter settings, driving back again. Now you can cut time and costs by making these changes remotely from your office via Internet, LAN or a wired broadband connection (fiber optics or DSL). Most buildings already have an Internet and LAN connection – thus providing global connectivity. This is why data security must be ensured using a VPN DSL router or dial-up router respectively.

Benefits

- Parameters can be quickly changed by remote access
- Remote access saves driving time and costs
- Data security is ensured

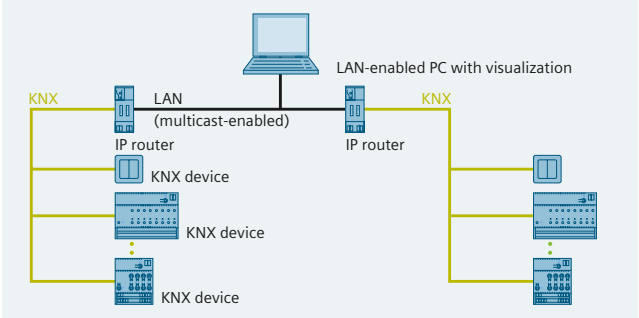
Follow these steps

- Connect IP interface N 148/22 to the KNX and LAN
- Configure the VPN DSL router or dial-up router

You will need

- An IP interface N 148/22, for example
- 24-V power supply for IP interface N 148/22, e.g. Power over Ethernet, unchoked bus voltage
- VPN DSL router or ISDN/analog dial-up router
- ETS; see knx.org for the latest version

KNX visualization via Ethernet (LAN)



When retrieving large numbers of data points cyclically for visualization in large projects, waiting periods can sometimes occur while data is being updated.

Use your LAN as the main and backbone line and connect your PC for visualization to the LAN. This makes visualization up to 200 times faster: you can monitor larger numbers of data points and the data volume is no longer important.

Benefits

- LAN as the main and backbone line
- Visualization up to 200 times faster than previously
- High data volume possible
- No data concentrators needed

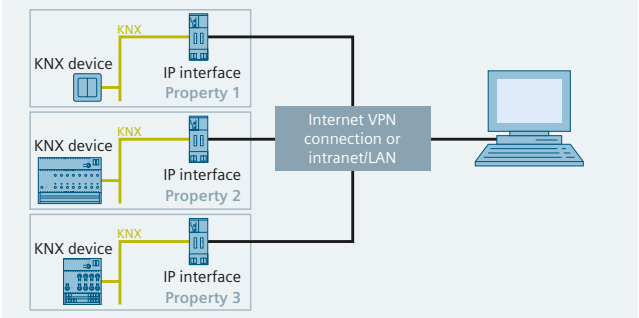
Follow these steps

- Commission the KNX devices, including the IP router N 146/02
- Install the visualization software
- Find and connect the IP router N 146/02 as the visualization interface
- Configure the visualization
- Observe the related safety and security requirements governing the LAN

You will need

- One IP router N 146/02 per line
- IP Control Center N 152
- 24-V power supply for IP interface N 146/02, e.g. Power over Ethernet, unchoked bus voltage
- Ethernet network (LAN)
- ETS; see knx.org for the latest version

Monitoring properties with KNX via Ethernet (LAN)



Some distributed properties need to be checked regularly for certain conditions and maintained accordingly, for example the fill levels of oil tanks in distributed apartment buildings or the operating hours of consumers.

These states can now be reported centrally to any location. This can eliminate the need for cyclical inspection walk-throughs and appropriate maintenance can be carried out when needed, such as refilling the oil tanks in distributed properties. You can even select the best time to do this, such as when oil prices are lowest.

Benefits

- Central status messages for distributed properties
- Less maintenance required
- Optimization of maintenance costs

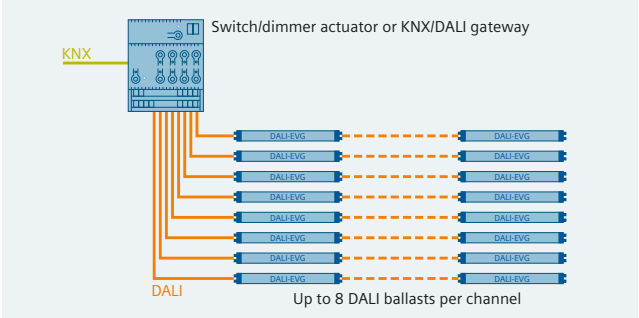
Follow these steps

- Connect one IP interface N 148/22 to the KNX for each property
- Connect the IP interface N 148/22 to the LAN
- Configure the IP interface N 148/22 via the Internet or intranet for accessibility
- Define the IP interface N 148/22 in the visualization software or ETS respectively
- Observe the related safety and security requirements governing the LAN

You will need

- One IP interface N 148/22 for each property, for example
- 24-V power supply for IP interface N 148/22, e.g. Power over Ethernet, unchoked bus voltage
- Visualization software
- ETS; see knx.org for the latest version

Using DALI luminaires with easy KNX commissioning



Ballasts with a DALI interface are used in lighting controls, e.g., to report lamp failure. The N 525E switch/dimmer actuator now makes it possible to completely replace DALI devices with GAMMA instabus without any knowledge of DALI or DALI commissioning procedures.

The N 525E switch/dimmer actuator switches and dims eight independent groups of fluorescent lamps with dimmable ballasts and DALI interfaces. Up to eight DALI ballasts can be connected to each of the eight channels.

Benefits

- True 0 to 100% light value control
- High operating safety due to targeted shutdown in the event of an error
- Error messages for luminaire groups
- For individual room lighting control

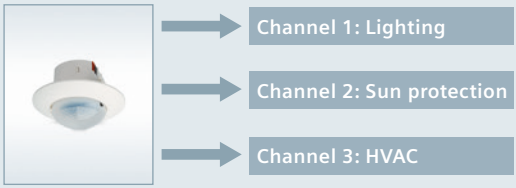
Follow these steps

- Connect the switch/dimmer actuator N 525E to the KNX
- Connect each group of DALI ballasts to be controlled jointly to one output of the switch/dimmer actuator N 525E
- Configure each channel in ETS just as you would a conventional actuator and program the device

You will need

- Switch/dimmer actuator N 525E
- Dimmable ballasts with DALI interfaces
- ETS; see knx.org for the latest version

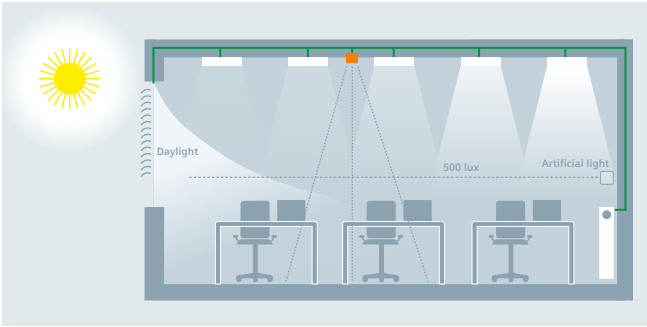
Presence- and daylight-dependent control



The presence detector with integrated brightness control regulates up to three independent output channels for various functions in the room, such as lighting, sun protection and HVAC systems. The automation serves to optimally adjust the room temperature and brightness to the room's actual use on a presence-dependent basis. That means optimum comfort and always a pleasant room climate, yet with low energy consumption.

At the start and end of every movement, each output channel individually actuates the respective functions. The follow-up times and brightness thresholds can be set independently of each other.

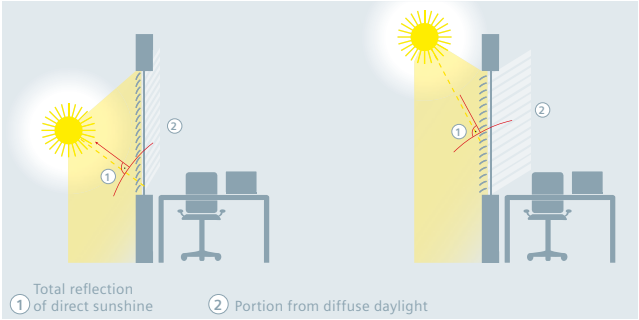
Constant light level control



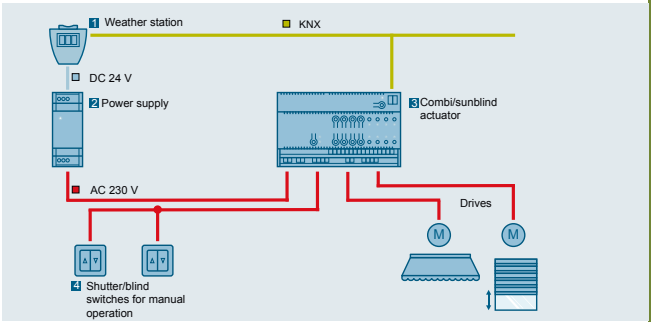
Benefits

- Integrated constant light level controller with main lighting group and up to four lighting subgroups with one brightness sensor
- Automatic assignment of the artificial light distribution in the room to enable constant light level control of the up to five lighting groups via control characteristics
- Entry of five brightness values, measured under the lights during pure daylight, as parameters in ETS
- Automatic measurement of artificial lighting in the room when it is dark (without daylight) through targeted on/off switching of the lighting groups and simultaneous measurement at the brightness sensor of the detector

Sunlight tracking control



With sunlight tracking control, the position of the sun is tracked so that the blind slats are not completely closed, but rather automatically adjusted to prevent the sun from shining directly into the room. The spacing between the blind slats still allows diffuse daylight to enter the room and contribute to ensuring glare-free room lighting while lowering electricity costs.



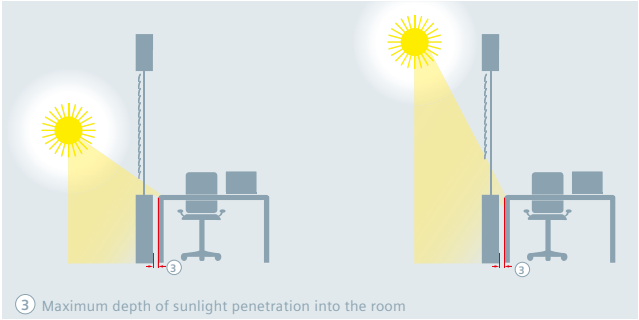
Benefits

- Reduced energy consumption and costs for room lighting
- Optimum room climate
- Glare-free workplaces

You will need

- Weather station AP 257
- Electronic power supply unit
- Sunblind actuator N 523/11
- Pushbutton, double UP 222/3
- Drives
- Bus coupling unit UP 117/12 (for pushbuttons)

Shadow tracking control

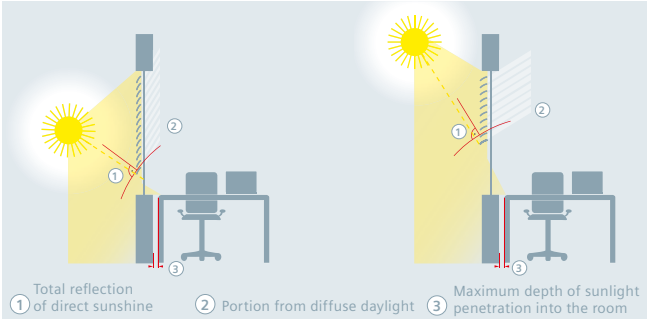


3 Maximum depth of sunlight penetration into the room

With shadow tracking control, sun protection is not lowered completely but only so far that the sun can still shine into the room for a certain distance (e.g. 50 cm), which can be set by adjustable parameters.

Benefits: This enables room occupants to look outside through the lower part of the window, and plants arranged on the windowsill can still be exposed to direct sunlight, while the room occupants are protected. This creates an optimum room climate, ensures glare-free workplaces and lowers energy demand and costs for room lighting.

Sunlight tracking control with shadow tracking control

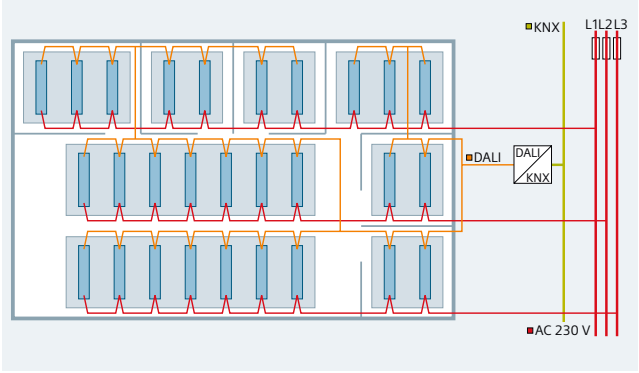


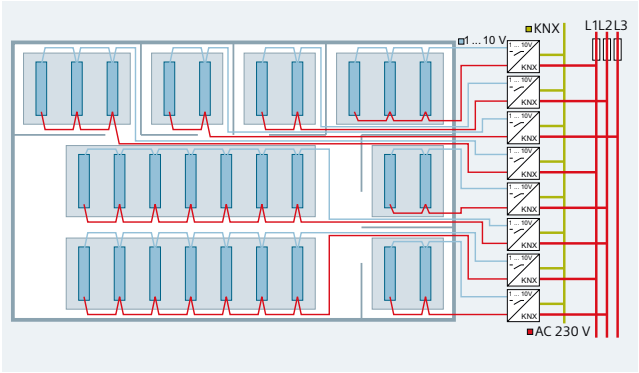
The functions of sunlight tracking control and shadow tracking control can be performed with the same devices individually or in combination.

You will need

- Weather station AP 257
- Electronic power supply unit
- Sunblind actuator N 523/11
- Pushbutton, double UP 222/3
- Drive
- Bus coupling unit UP 117/12 (for pushbuttons)

Wiring of lighting groups with DALI



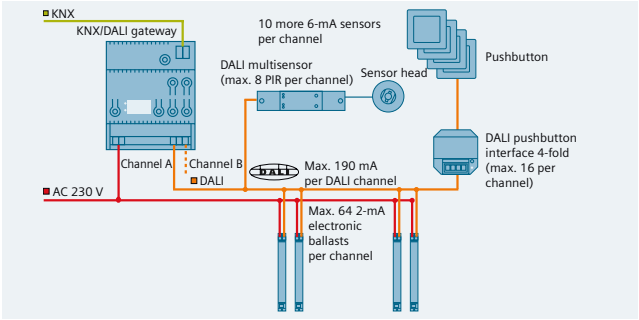


Modern lighting systems can be controlled efficiently and conveniently with DALI. Their efficiency can be increased even more when combined with the advantages of KNX. That's why KNX/DALI gateways from Siemens offer both standards directly: for DALI digital lighting (IEC 62386) and for KNX building control (ISO/IEC 14543-3 or DIN EN 50090). It's possible to integrate DALI lighting into KNX installations quickly and easily.

Benefits

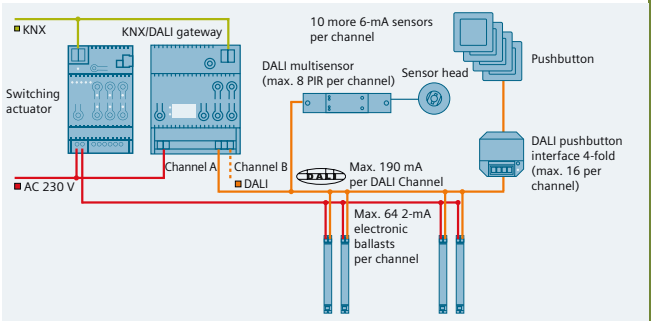
- Lighting groups are not hardwire-connected
- Possible to plan control lines and power supply separately
- Even, uniform load distribution throughout the power supply network
- Lower fire load thanks to fewer cables
- Planning is simpler and faster
- Integration of emergency lighting into the general lighting
- Support for selected sensors with DALI interface
- Switching off standby when lighting is turned off
- Replacement of defective single-channel ballasts without software

DALI topology with sensors



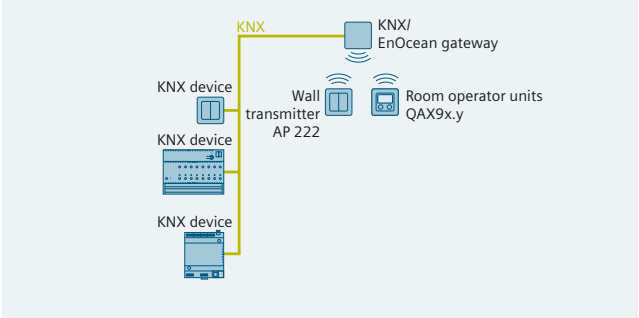
The KNX/DALI gateway can control up to 64 ballasts per channel. In addition, selected DALI sensors that meet specifications from Siemens can be commissioned together with the KNX/DALI gateway. The maximum number of DALI devices is limited to the guaranteed rated current of 190 mA per channel or to the maximum number of the DALI sensor type.

Switching off standby with DALI



Luminaires with electronic ballasts usually need a closed-circuit current, even when the lighting system is turned off or is in standby mode. This energy consumption adds up, but can be conserved using the KNX/DALI gateway Twin plus: by automatically cutting off power to the electronic ballasts. After the lighting is turned off and as soon as all electronic ballasts in the defined area are no longer needed for lighting, the ballasts can be disconnected from the power supply via a command from a switch actuator controlled for this purpose. If one or more luminaires are in operation, the switch actuator first restores power to the electronic ballast, and the gateway dims the luminaire to the required brightness level.

Wireless remote control (KNX/EnOcean)



In many indoor applications, cables are either not wanted, laying cables is too labor-intensive or simply not possible at all.

Maintenance-free switches and room devices based on the open EnOcean communication standard are the ideal solution for these applications.

Benefits

- Battery-free and thus environmentally friendly and maintenance-free
- Communication via open standard
- Mounting on any surface: glue or screw them in place, done
- Can be upgraded without new cables
- Can be connected to GAMMA instabus: KNX via KNX/EnOcean gateway

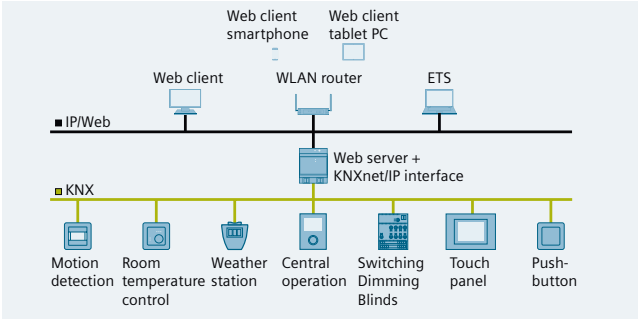
Follow these steps

- Connect the KNX/EnOcean gateway RXZ97.1 with the KNX
- Configure and program the KNX/EnOcean gateway RXZ97.1 in ETS
- Program the EnOcean devices

You will need

- KNX/EnOcean gateway RXZ97.1
- Further EnOcean devices, depending on the application
- For lighting/sun protection applications: EnOcean wall transmitter AP 22x
- HVAC applications: room operator units QAX9x.y
- ETS; see knx.org for the latest version

Web-based visualization



The Control Center N 152 is a compact visualization controller. It enables the entire room and building automation to be conveniently operated and visualized via Web-enabled PCs, tablets and smartphones – also in a wireless configuration via WLAN. Up to 1,250 KNX objects and group addresses are available for this purpose. In the event of a fault, an alarm message is sent via e-mail. The integrated KNX interface allows commissioning of the KNX installation. With an additional router, the KNX installation can be serviced via remote maintenance.

Benefits

- IP Control Center N 152
- An integrated Web editor
- For all Web-enabled operating devices such as PCs, notebooks, tablets and smartphones
- Create customized visualization of operating and display interfaces

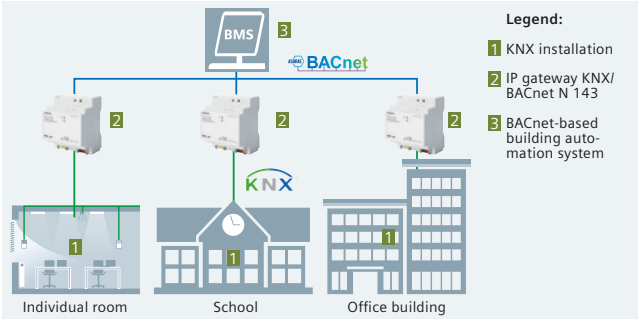
Follow these steps

- Connect the IP Control Center N 152 to the KNX, and configure and program it in ETS
- Create the visualization of the operating and display interfaces via the Web editor
- The related safety and security requirements governing the WLAN shall be observed

You will need

- IP Control Center N 152
- ETS; see knx.org for the latest version

Integrating KNX into BACnet



The IP gateway KNX/BACnet enables KNX installations to be integrated into BACnet-based networks and building automation systems quickly, simply and efficiently. No separate commissioning interface is needed owing to the KNXnet/IP interface integrated into the gateway. This facilitates for example the integration of new KNX installations into already existing building management systems that use BACnet as their system protocol. It enables building automation systems to be expanded simply and cost-efficiently. Thanks to its KNXnet/IP interface, the KNX installation technician can commission the gateway using the ETS. The system integrator that recognizes the IP gateway KNX/BACnet as controller (B-ASC) is responsible for the integration into the BACnet system.

Benefits

- Commissioning of the IP gateway KNX/BACnet N 143 by the KNX installation technician only using the ETS
- Integration of a KNX installation into a BACnet system without KNX knowledge by the BACnet system integrator
- Clear separation of responsibility for KNX installation and BACnet system integration/building management
- Simple, flexible integration of a KNX installation
- Integrated Web server for documentation of the configuration and export of an EDE file
- Configuration of a KNX installation via IP gateway KNX/BACnet N 143

Follow these steps

- Connect the IP gateway KNX/BACnet N 143 to the KNX, and configure and program it in ETS
- 250 BACnet objects can be created, for which up to 455 BACnet entries for automatic forwarding of BACnet object values can be stored

You will need

- IP gateway KNX/BACnet N 143
- ETS; see knx.org for the latest version

Glossary

Definitions and explanations of certain technical terms used in the previous chapters

AC	Alternating current
ASCII	ASCII (American Standard Code for Information Interchange) is a 7-bit character encoding standard that enables data exchange.
ASHRAE	ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) is a globally active American association for engineers focusing on technical building services.
BTL	The BTL brand was developed by the American BACnet International for BACnet Testing Laboratories (BTL).
CEN	The CEN (Comité Européen de Normalisation) is the European Committee for Standardization.
CENELEC	The CENELEC (Comité Européen de Normalisation Électrotechnique) is the European Committee for Electrotechnical Standardization.
Certification	A process for verifying that products comply with certain specific standards

Conformity	Designates the good agreement of something with the codes and standards governing that particular context
DALI	DALI (Digital Addressable Lighting Interface) is a digital interface that is integrated into the ballasts of luminaires and permits flexible wiring and commissioning. In addition to switching and dimming functions, it also detects and transmits lamp failures.
DC	Direct current
DIN	DIN stands for Deutsches Institut für Normung e.V., the German Institute for Standardization.
ECG	Electronic control gear (ballast)
EIB	EIB (European Installation Bus) is a standard according to EN 50090. Today, EIB is continued as KNX.
EMC	Electromagnetic compatibility
EN	European Norm

EnOcean	The EnOcean Alliance was formed by leading companies in the building automation industry with the goal of implementing innovative wireless solutions for sustainable building automation projects.
ETS	The ETS (Engineering Tool Software) is a vendor-independent commissioning software for all KNX devices.
Group address (KNX)	Communication between KNX devices is performed via group addresses. They contain a clear function or piece of information.
IEC	International Electrotechnical Commission
IEEE	The IEEE (Institute of Electrical and Electronics Engineers) is a global professional association of engineers.
Interoperability	The ability of independent, heterogeneous systems to work seamlessly together in order to efficiently exchange useable information or make it available to the user without the systems having to negotiate the transfer separately
IP	Internet Protocol

ISO	The ISO (International Organization for Standardization) is the international association of standardization organizations.
KNX Association	The KNX Association is an amalgamation of over 400 companies in 35 countries who have agreed on a standard technology known as KNX for exchanging telegrams between sensors and actuators within building automation systems. The Engineering Tool Software (ETS) is a vendor-independent commissioning software for KNX devices.
KNXnet/IP	KNX bus communication via the Internet Protocol
KNX PL-Link	KNX PL-Link (PeripheraL-Link) corresponds entirely to the KNX standard. It is a Desigo-specific bus system optimized to enable communication between decentrally installed field devices and the modular PXC3 room automation stations.
KNX RF	KNX bus communication via radio frequency
KNX TP	KNX bus communication via two-wire connection (twisted pair)

LAN	LAN is the abbreviation for Local Area Network. Data transfer on LANs is organized by IP (Internet Protocol) – the standard network protocol on the Internet.
LON/ LonWorks	A LON (Local Operating Network) is a decentralized network. LonWorks Network Services also provides services for installation, administration, analysis and license controlling of LON networks.
Object	Term denoting an example of a particular data type. Every object is characterized by state, behavior and identity. The state of an object consists of its attributes and connections to other objects.
Physical address (KNX)	The physical address assigns a unique address to a device depending on the given topology.
PICS	PICS stands for Protocol Implementation Conformance Statement. The PICS document belonging to a device lists all supported BIBBs, object types, character sets and communication options.
PIR	PIR (Passive Infrared) is a frequently used measuring principle for motion detection.

PL	PL (Power Line) is a connection via the AC 230 V power supply grid.
Plug and play	The possibility of connecting new devices without having to undertake any additional settings or adjustments
PoE	PoE (Power-over-Ethernet) refers to a method for supplying power to network-able devices over the 8-wire Ethernet cable.
Protocol	A system of rules that specify the format, content, meaning and order of messages transmitted between various entities of the same communications system
RTU	Remote terminal unit
SELV	Safety extra-low voltage
TCP	The TCP (Transmission Control Protocol) is part of the TCP/IP protocol family. As a connection-oriented protocol, TCP assumes within TCP/IP the task of data security and data flow control, and initiates countermeasures in the event of data loss.

UDP Besides TCP, the UDP (User Datagram Protocol) is the most important transport protocol of the Internet protocol family. As a minimal, connectionless network protocol, it is also used in the BACnet/IP standard, and forms there the basis for efficient processing of the actual data traffic.

VDE VDE is the Verband der Elektrotechnik Elektronik Informationstechnik e.V., the German Association for Electrical, Electronic & Information Technologies.

VPN VPNs (Virtual Private Networks) are used to set up a secure subnetwork over an open, unprotected network such as the Internet or radio network, in which the communication is protected against monitoring and access by external users. This is done by "tunneling" the data traffic over a VPN server, where the connections must be authenticated during setup, and by simultaneously encrypting the data.

Web browser Software applications for presenting Web sites or, generally, documents and data, e.g. Internet Explorer.

Web service	An interface based on Web technologies for exchanging data between computers on the Internet (machine-to-machine communication)
WLAN	Wireless Local Area Network, i.e. a local radio network

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