KNX-Flash
ABB i-bus® KNX

Power and productivity
for a better world™

ABB

KNX-Flash

Contents

KNX and ABB i-bus® KNX
Intelligent Building Control

In many areas of our private and working lifes, the increasing level of automation is a trend that confronts us on a daily basis without actually being noticed.

Automation in buildings aims to combine individual room functions with one another and to simplify the implementation of individual customer preferences.

KNX is the logical development for implementing traditional and new requirements in electrical building installations and thus replacing

The conventional solution: Many separate cables, separate functionality, little flexibility
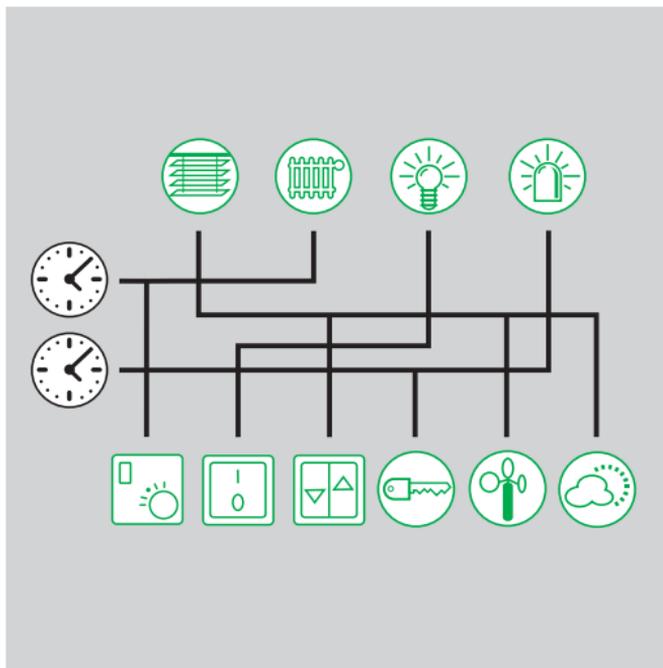
conventional installation techniques. The intelligent installation bus system efficiently performs the conventional functions and offers an additional broad range of expanded features, which could not be realized without a bus system.

ABB offers consultants, system integrators and electrical installers a comprehensive product range with ABB i-bus® KNX, in order to meet the challenges posed to electrical building installations both today and in the future.

The intelligent solution: KNX – a system, a standard, many interoperable functions for maximum flexibility

Actuators
(command recipients)

230 V

KNX
bus

Sensors
(issue commands)
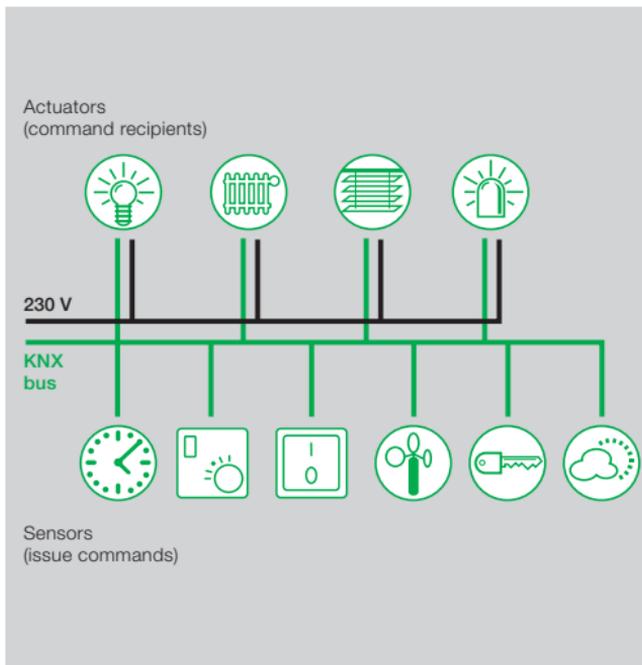
What does KNX stand for?
KNX – The standard

The KNX system is the leading intelligent control system for buildings world-wide.

KNX resulted from the merger of major bus systems, including the well-known EIB (European Installation Bus) that has been successfully on the market since 1992.

What does KNX stand for?

– KNX is the first globally standardized system for the automation of residential and non-residential buildings in accordance with the international standard (ISO/IEC 14543-3), the European standard (CENELEC EN 50090, CEN EN 13321-1 and 13321-2), the Chinese standard (GB/Z 20965) and the US standard (ANSI/ASHRAE 135).

– KNX has established a clearly defined system platform where the KNX products of different manufacturers can be operated with one another.

– Both the data protocol and the devices are certified compliant to the KNX standard.

– KNX thus guarantees the networkability, interoperability, is both upward and downward compatible and thus future-proof.

– Just one common software tool is required for planning, engineering and commissioning of all KNX installations.

– Both the manufacturers and the KNX Association support profes-sionals during planning, commissioning and maintenance world-wide.

– Comprehensive training opportunities are available for beginners and experienced users in certified training centres.

– More than 170 internationally certified manufacturers are members of the KNX association.

– More than 22,000 qualified KNX partners plan, install and integrate KNX systems worldwide.

– Thousands of buildings, ranging from private houses to airport complexes around the world, are equipped with more than 10 million KNX products.

Intelligent Building Control
for consultants, system integrators and electrical installers

Benefits for professionals

Efficient planning

Economic installation

Fast integration

Simple to commission

Flexible expansion

Benefits for customers

Comfortable to operate

Comprehensive functionality

Quick to change and expand

Energy saving

Future-proof investment

What does KNX do?
Application

The use of new materials and the application of renewable energies are considered as the most significant innovations in the building industry over the last few years. The growing desire for comfort and functionality simultaneously with the limited availability of resources and increasing energy costs provide the basis for intelligent building control in modern constructions.

KNX interconnects all the components in the electrical installation to form a networked system and thus guarantees the transparency and utilization of information across the installation. In this system, all users "communicate" via a single bus cable. Thus it is possible to integrate all the different fuctional subsystems within the building into a seamless solution.

KNX bus systems can be used both in residential and non-residential buildings.

Applications
– Lighting
– Climate control
– Sun protection
– Security
– Energy management
– Operation
– Automation
– Communication

Energy efficiency with ABB i-bus® KNX
Energy savings in the double-figure % range

Climate change and growing shortages of resources are the big challenges of our time. Efficient and sustainable energy usage is therefore an urgent necessity.

Scientific studies and measured values in practice show a high energy saving potential when bus technology is used in room and building automation.

The ABB i-bus® KNX intelligent building control system provides its customers with a broad range of options for optimum energy efficiency.

* BACS: Building automation and control system
** TBM: Technical building management

Building Automation and Control (BAC) efficiency classes to EN 15232

A High efficiency BACS* and TBM**

B Advanced BACS and TBM

C Standard BACS

D Non energy efficient BACS
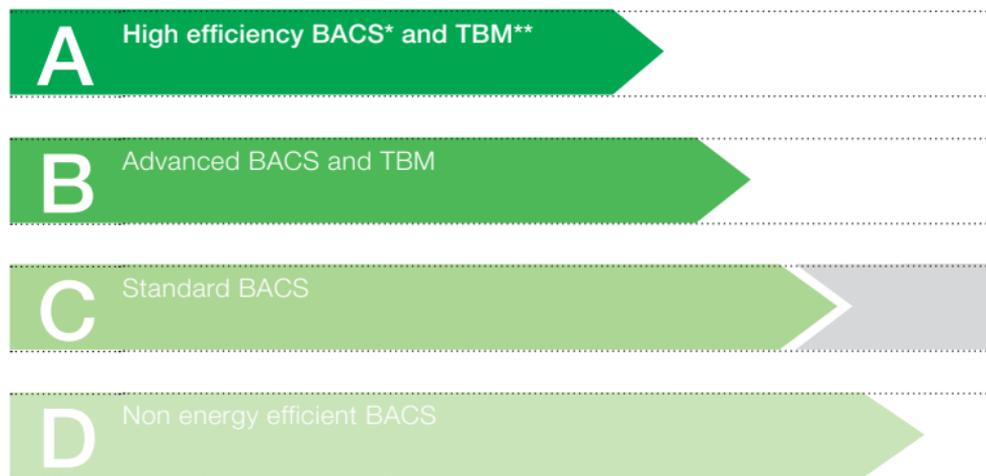
On the basis of the KNX standard, energy in the double-figure % range can be saved.

Around the world new legislation is promoting the use of energy efficient technologies. In Europe, for example, the criteria for energy efficiency in buildings is detailed in the European Standard EN 15232; the allocation into energy efficiency classes A to D serves as the basis for the evaluation.

The following diagram shows the differences in energy consumption for three building types in the energy efficiency classes A, B and D relative to the basis values in class C. For example, by using class A, 30% of the thermal energy can be saved in offices.

Efficiency factor for thermal energy			Efficiency factor for electric energy		
Office	School	Hotel	Office	School	Hotel
0.70	0.80	0.68	0.87	0.86	0.90
0.80	0.88	0.85	0.93	0.93	0.95
1	1	1	1	1	1
1.51	1.20	1.31	1.10	1.07	1.07

Energy efficiency with ABB i-bus® KNX
Energy savings in the double-figure % range

In principle, optimization of the energy consumption in buildings means

– Energy is only consumed when it is actually needed
  (for example through the usage of presence detectors)
– Only the amount of energy actually required is used
  (for example through the use of constant lighting control)
– The energy used is employed at the highest possible degree
  of efficiency (for example through the use of electronic ballasts)

Using the versitile functionality that intelligent building control offers real energy savings can be made. ABB i-bus® KNX is making a significant contribution to global climate protection and at the same time reducing operating costs in today's buildings.

Potential savings according to scientific studies

Room heating control	about 14 to 25 %
Heating automation	about 7 to 17 %
Shutter control	about 9 to 32 %
Lighting control	about 25 to 58 %
Air-conditioning control	about 20 to 45 %

In total, the average energy savings that result through optimization with KNX lie in the range of 11 to 31%.

How does ABB i-bus® KNX work?
Intelligent building control in detail

Within the KNX bus system, all sensors (e.g. buttons or motion detectors) are interconnected to the actuators (e.g. dimming actuators, roller shutter actuators) via a data cable as opposed to directly wired switches and consumers (conventional installation). The actuators control the power circuit to the consumer.

Communication for all devices is implemented using data telegrams on the same bus cable. The sensors send commands, actuators "listen in" and execute a defined function as soon as they are addressed.

A broad range of functions can be parameterized with ABB i-bus® KNX, such as group commands, logical sequences, control and regulation tasks.

System integration
What does system integration mean?

During system integration, all the requirements of the investor or building owner are implemented using KNX devices and the respective product software.

1. Planning
During planning, the preliminary requirements of the building owner are incorporated into the concept and are summarized in the functional description.

2. Engineering
The most suitable components and software applications are selected. The planning of the bus topology is realized during the engineering phase. The system devices required for implementing the KNX network are defined. The project engineering using the ETS on the basis of the functional description also takes place in this phase.

3. Commissioning
During the commissioning phase, the KNX devices are installed and programmed. The ETS project that has already been created is downloaded into the devices using the ETS software.

4. Handover
During the handover phase, the programmed functions are checked for compliance to the requirements in the functional description.
In this way, the correct function of the installation can be determined and documented.

5. Documentation
The customer receives the project documentation (schematics, function description and ETS project data) after the handover.

The elements of the "intelligent building control system"
Management, structure and topology

The communication medium – the KNX cable
In simple terms, the KNX bus consists of a pair of twisted-pair wires (cable type, e.g. YCYM 2 x 2 x 0.8 or J-H(ST) H 2 x 2 x 0.8 halogen-free) that connect the KNX devices. Over this cable, data telegrams are transmitted, and the electronics of the bus devices are supplied with energy. The KNX system can also be extended over IP-Networks and using RF solutions.

The KNX structure
The KNX structure created is very flexible in its design due to the possible connection of the devices: linear, tree and star wiring configurations are allowed.

The KNX topology
The KNX topology is arranged in lines that can be interconnected via couplers depending on the size of the network. The devices in the respective lines (sensors and actuators) are supplied with energy by a power supply (30 V) whereby the entire KNX bus system can be configured with more than 50.000 bus devices.

Schematic representation of the KNX bus

Power Supply/ Line Coupler

KNX bus

Tree wiring

Line wiring

Star wiring

OFFICE

COPY ROOM

CORRIDOR
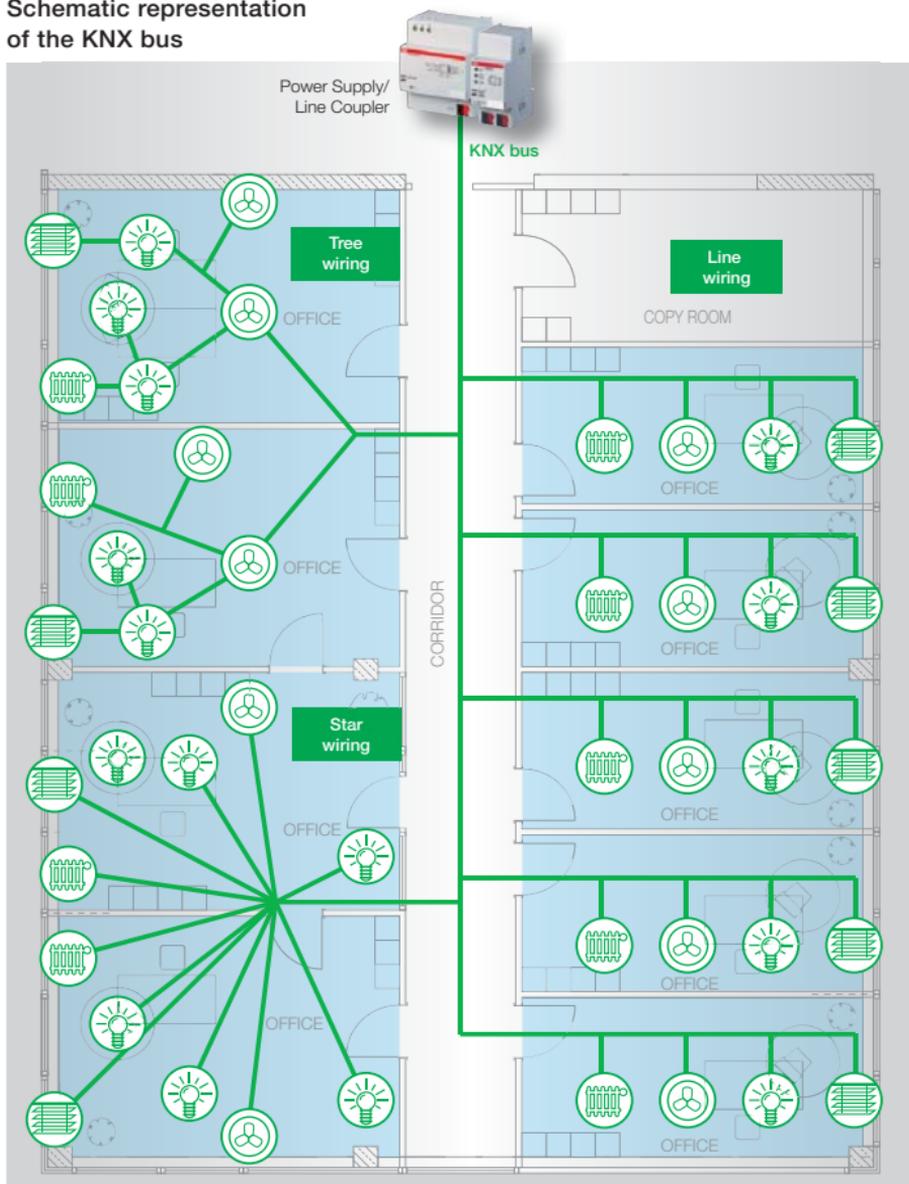
KNX
Telegram Structure
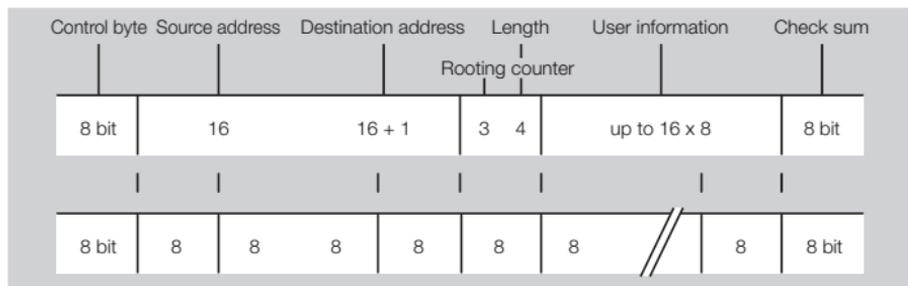
Telegram Structure

Devices communicate with one another using "telegrams" which are sent via the bus. A telegram consists of bus-specific information and the actual user information in which the event (e.g. pressing of a button) is communicated. The entire information is sent packaged as characters each 8 bit long.

Control byte	Source address	Destination address	Length		User information	Check sum
				Rooting counter		
8 bit	16	16 + 1	3	4	up to 16 x 8	8 bit
8 bit	8	8	8	8	8	8	8	8 bit

Telegram Acknowlegdement

After the telegram has been received by the devices, it will then send a receipt of acknowledgement.

D7	D6	D5	D4	D3	D2	D1	D0	Read direction of the data bit	
N	N	0	0	B	B	0	0	Acknowledge message	
1	1	0	0	0	0	0	0	BUSY	still busy
0	0	0	0	1	1	0	0	NAK	receipt not correct
1	1	0	0	1	1	0	0	ACK	receipt correct

B = 00 BUSY   N = 00 NAK

NAK
By acknowledging with NAK (receipt not correct) the telegram is repeated up to three times.

Busy
By acknowledging with BUSY the transmitting device will wait for a short time and then resend the telegram.

End
If the sending device does not receive an acknowledgement, the telegram is repeated up to three times before the sent request is terminated.

Flags
Setting of the Flags

Caution: The flags should only be modified in exceptional cases!

Flags are settings in the ETS. The behaviour of each communication object can be set on the bus by using flags.

Communication flags
- ✔ The communication object has a normal connection to the bus.
- – Telegrams are acknowledged, but the communication object is not changed.

Read flag
- ✔ The object value can be read out via the bus.
- – The object value cannot be read via the bus.

Write flag
- ✔ The object value can be modified via the bus.
- – The object value cannot be modified via the bus.

Transmit flag
- ✔ If (on the sensor) the object value is changed, a corresponding telegram is sent.
- – The communication object only sends a response telegram with a read request.

Update flag
- ✔ Value response telegrams are interpreted as write commands, the value of the communication object is updated. (always enabled in the BA – mask version 1.0 – 1.2).
- – Value response telegrams are interpreted as write commands, the value of the communication object is not changed.

(✔) = flag set / (–) = flag not set

Data Formats
Definition of the Data Formats / EIS Types

EIS is the designation for the "KNX Interworking Standard". This standard defined by the KNX association stipulates the manufacturer-independent characteristics for the user information of the telegram.

DPT-Type	EIS-Type	Name
DPT 1.0xx	EIS 01	Boolean
DPT 2.0xx	EIS 08	1-Bit Controlled
DPT 3.00x	EIS 02	3-Bit Controlled
DPT 4.00x	EIS 13	Character Set
DPT 5.00x	EIS 06	8-Bit Unsigned Value
DPT 6.010	EIS 14	8-Bit Signed Value
DPT 6.020		Status with Mode
DPT 7.0xx	EIS 10	2-Octet Unsigned Value
DPT 8.0xx	EIS 10 signed	2-Octet Signed Value
DPT 9.0xx	EIS 05	2-Octet Float Value
DPT 10.001	EIS 03	Time
DPT 11.001	EIS 04	Date
DPT 12.001	EIS 11	4-Octet Unsigned Value
DPT 13.0xx	EIS 11 signed	4-Octet Signed Value
DPT 14.0xx	EIS 09	4-Octet Float Value
DPT 15.000		Access
DPT 16.00x		String
DPT 29.012		8-Octet Signed Value

This guarantees that all KNX certified devices are compatible to one another. A clear benefit of KNX technology.

Bit/Byte	Data point types
1 bit	On/Off
2 bit	value 0,1: control inactive value 2: control active Off value 3: control active On
4 bit	0 = Stop, 1…7 darker, 8 = Stop, 9….15 brighter
8 bit	ASCII character
8 bit	percentual value: 0% = 0....255 = 100% unsigned Value: 0…255
8 bit	signed Value: -128…+127
8 bit	status with 3 modes
2 octets	value: 0…65'535
2 octets	valuet: -32'768…..+32'767
2 octets	temperature: -271…+ 670'760 °C temperature difference: +/- 670'760 K change of temperature: +/- 670'760 K/h illumination level : +/- 670'760 lux wind speed: +/- 670'760 m/s air pressure: +/- 670'760 Pa time difference: +/- 670'760 ms voltage: +/- 670'760 mV current: +/- 670'760 mA and others...
3 octets	day, hour, minute, second
3 octets	day, month, year
4 octets	value: 0…4'294'967'295
4 octets	value: -2'147'483'648….+2'147'483'647 (typical energy values like Wh, kWh, VAh..)
4 octets	value: 0…8'388'607 (typical values like V, Hz, A, W…)
4 octets	
14 octets	text with max. 14 characters
8 octets	value: -9 223 372 036 854 775 808….+9 223 372 036 854 775 807 (typical Wh, VAh, VARh)

Installation Instructions
KNX Installation
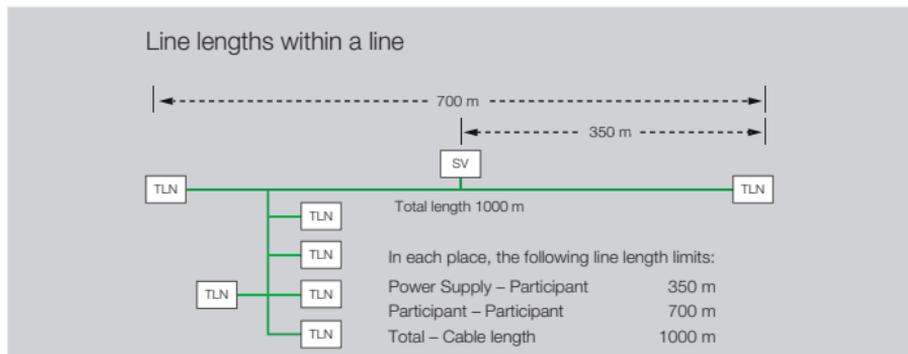
The 6 stages for correct KNX installation
1. Check for compliance of allowable line lengths.
2. Visual inspection for marking of bus cable ends.
3. Check for incorrect cable connections.
4. Measure the isolation resistance of the bus lines.
5. Polarity test of all bus nodes.
6. Measure the voltage on the bus cable ends (mind. 21 V).

Additions to the points above
1. The maximum permissible bus line lengths are defined by the voltage drops and the capacitances of the bus cables, and thus the telegram transmission times.
The measurement of the loop impedance of the bus line concerned can prove to be useful.

Line lengths within a line

- 700 m -
- 350 m -

SV

TLN   TLN

TLN

TLN   Total length 1000 m

TLN

TLN   In each place, the following line length limits:
Power Supply – Participant   350 m
Participant – Participant   700 m
TLN   Total – Cable length   1000 m

KNX Restrictions
– Permissible cable length in a line is **max. 1000 m**
– Distance between voltage supply – bus device is **max. 350 m**
– Distance between two voltage supplies incl. choke is **min. 200 m**
– Distance between two devices is **max. 700 m**

2. The ends of the bus cables should be labelled with "KNX" or "bus" clearly identifying them as the installation bus. Furthermore, details of the area and line will assist in the location of specific bus lines.

3. Different lines may only be connected using a (line) coupler. Inadmissible connections between the individual lines can be verified by switching off the power supply on the lines to be checked. If the power LED continues to light on the line coupler, an inadmissible connection has been made.

4. The insulation resistance of the bus cable should be measured with DC 250 V (DIN VDE 0100 part 610). The insulation resistance should be at least 250 kOhms. Measurement is performed from the conductor to PE, and not conductor to conductor.
   CAUTION: Overvoltage surge protection connectors should be removed before testing in order to avoid influencing the measurement or avoid damaging the surge protectors.

5. The polarity test should be performed on all bus devices. For this purpose switch to programming mode on the bus device with the programming button. The bus device is correctly connected if the LED lights up. By renewed pressing of the programming button the bus device is switched over to operating mode and the programming LED switches off.

6. The bus voltage should be checked with a voltmeter at the end of every bus cable after all bus devices have been installed. It must be at least 21 V.

Topology
IP Hierarchy

IP networks have now become standard in larger buildings.
These networks can also be used to transmit KNX telegrams. A flat hier-
archy can be established by the use of IP gateways and IP routers which
feature similar functionalities as line and area couplers. 255 KNX lines can
be compiled to an IP world. 255 IP worlds can also co-exist on a LAN or
WAN. Thus, even sections of the building which are further away can be
integrated into the system.
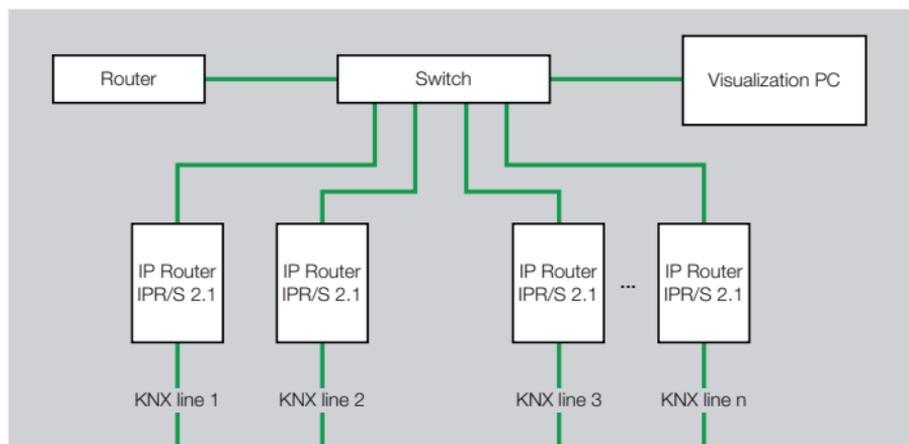
Replacement of line or area couplers by IP routers facilitates higher data
speeds between devices.
It combines interfacing of other systems (e.g. building control engineering or
visualization) to the KNX via the IP network using OPC. KNX devices can be
programmed via the IP network and remote access (remote programming
or remote control) is possible via the Internet.

Tips and Tricks
Commissioning

Before we commence with commissioning, the

– RS 232/USB interface must be programmed locally to suit the line. Failure to do so will mean the line couplers cannot be correctly programmed.
– Program the line couplers, possibly, setting the parameters then to route all telegrams unfiltered.
– ETS diagnostics ensures that no bus device is in programming mode. (programming button pressed, programming LED lights up.)

Commissioning of the bus devices

– Initially all of the bus devices will be physically addressed.
– If all devices are physically programmed, we can commence loading the applications. (In order to save time, the applications should be loaded during a break, e.g. lunch.
– The following points should be checked if communication problems occur:
  – The RS 232/USB interface is not physically programmed.
  – A device with an address corresponding to line x is located in another line.
  – Two different lines are interconnected with each other.
  – The line couplers are not programmed.

Caution: Line couplers must always be programmed at the start of commissioning. If they are not programmed, they interfere with the bus communication.

ETS4 enables simultaneous programming of devices in several lines in conjunction with the connection with IP routers. This helps you to save time during set-up.

Checklist
Functionality / Customer Requirements

Lighting
- ❍ Operation from one or more positions
- ❍ Operation from one or more positions
- ❍ Central/group operation
- ❍ Dimming from one or more positions
- ❍ Staircase lighting
- ❍ On and off delay
- ❍ Time control
- ❍ Presence-dependent control
- ❍ Logical combination
- ❍ Daylight dependent control
- ❍ Constant lighting control
- ❍ (Light) scenes
- ❍ Status report
- ❍ Panic alarm
- ❍ Connection to DALI

Shading / Windows / Skylights / Awning
- ❍ Operation from one/several positions
- ❍ Central/group operation
- ❍ Time control
- ❍ Movement to position
- ❍ Adjustment/movement of louvre positions
- ❍ Weather-dependent control (wind, rain, frost)
- ❍ Sun position dependent control (daylight reflection)

- ❍ Temperature dependent control
- ❍ Heating/cooling automatic
- ❍ Scene control
- ❍ State message
- ❍ Night cool down (window opening)
- ❍ Gutter heating control
- ❍ Control of heated areas

Heating / Ventilation / Air conditioning
- ❍ Individual room temperature control
- ❍ Time control
- ❍ Presence control
- ❍ Remote control (e.g. telephone)
- ❍ Boiler control/monitoring
- ❍ Window position monitoring
- ❍ Controlled ventilation
- ❍ Fault messages
- ❍ Parallel control of smoke and heat discharge systems

Safety functions
- ❍ Peripheral protection
- ❍ nternal surveillance
- ❍ External surveillance
- ❍ Smoke detection
- ❍ Water detection
- ❍ Gas detection
- ❍ Emergency call
- ❍ Internal alarm signal
- ❍ External alarm signal
- ❍ Presence simulation
- ❍ Triggering of in-house actions on alarm/arming

- ○ Panic alarm
- ○ Coupling of arming device with KNX
- ○ Access control
- ○ Connection to video monitoring

Operation / Display
- ○ Intelligent KNX push buttons
- ○ Design program
- ○ Several operational functions from one location
- ○ Status feedback via LED in push button
- ○ Labelling of the functions on the push button
- ○ Remote control via infrared
- ○ Conventional push buttons via interface
- ○ LCD display for visualisation and operation
- ○ Conventional control panel
- ○ Visualisation via PC
- ○ Display and operation via internet/ telephone/TV
- ○ Room control via Intranet
- ○ Voice control
- ○ Combination with intercom system

Different interdisciplinary functions
- ○ Detection/processing of (error) messages
- ○ Control of watering (Garden)
- ○ Control of water supply

- ○ Switching of hot water circulation pumps
- ○ Control of lavatory
- ○ Control of water taps
- ○ Voltage free of switching of installation
- ○ Switching of electrical outlets/ circuits
- ○ Monitoring of circuits
- ○ Detection of power consumption values
- ○ Load management
- ○ Room occupancy display
- ○ Interface to other systems (OPC server, IP gateway,...)
- ○ Control of audio/video systems
- ○ Connection of other systems via digital and analogue inputs and outputs
- ○ Connection of power line and radio system via interfaces
- ○ Solutions for special-needs and nursing homes
- ○ Acquisition of operating hours
- ○ Acquisition of weather data
- ○ Central KNX timer

KNX
Lamp and Consumer Loads

Quick overview Shutter actuators	SA/S 4.6.1 SA/S 8.6.1 SA/S 12.6.1	SA/S 2.10.1 SA/S 4.10.1 SA/S 8.10.1 SA/S 12.10.1	SA/S 2.16.1 SA/S 4.16.1 SA/S 8.16.1 SA/S 12.16.1	SA/S 2.16.5.1 SA/S 4.16.5.1 SA/S 8.16.5.1 SA/S 12.16.5.1	SA/S 2.16.6.1 SA/S 4.16.6.1 SA/S 8.16.6.1 SA/S 12.16.6.1
Installation type	MDRC	MDRC	MDRC	MDRC	MDRC
Number of outputs	4/8/12	2/4/8/12	2/4/8/12	2/4/8/12	2/4/8/12
Module width (space units)	2/4/6	2/4/8/12	2/4/8/12	2/4/8/12	2/4/8/12
Manual operation	–	■	■	■	■
Contact position display	–	■	■	■	■
I_n rated current (A)	6 A	10 AX	16 A	16/20 A C-load	16/20 A C-load
Current detection	–	–	–	–	■
Switch function					
– ON/OFF delay	■	■	■	■	■
– Staircase lighting	■	■	■	■	■
– Warning before end of staircase lighting	■	■	■	■	■
– Staircase lighting time set via object	■	■	■	■	■
– Flashing	■	■	■	■	■
– Switch response can be set (N.O./N.C.)	■	■	■	■	■
– Threshold values	■	■	■	■	■
Current detection	–	–	–	–	■
– Threshold value monitoring	–	–	–	–	■
– Measured value detection	–	–	–	–	■
Function Scene	■	■	■	■	■
Function Logic					
– Logical AND	■	■	■	■	■
– Logical OR	■	■	■	■	■
– Logical XOR	■	■	■	■	■
– Gate function	■	■	■	■	■
Priority object/ forced operation					
Heating/blower control					
– Switch ON/OFF (2 point control)	■	■	■	■	■
– Cyclic fault monitoring	■	■	■	■	■
– Automatic purge	■	■	■	■	■
Fan Coil control [4)]	■	■	■	■	■
Special functions					
– Default position on bus voltage failure	■	■	■	■	■
– Status messages	■	■	■	■	■
I_n rated current (A)	6 A	10 AX	16 A	16/20 A C-Last	16/20 A C-Last
U_n rated voltage (V)	250/440 V AC	250/440 V AC	250/440 V AC	250/440 V AC	250/440 V AC
AC1 operation (cos φ = 0.8) DIN EN 60947-4-1	6 A	10 A	16 A	20 A	20 A

Quick overview Shutter actuators	SA/S 4.6.1 SA/S 8.6.1 SA/S 12.6.1	SA/S 2.10.1 SA/S 4.10.1 SA/S 8.10.1 SA/S 12.10.1	SA/S 2.16.1 SA/S 4.16.1 SA/S 8.16.1 SA/S 12.16.1	SA/S 2.16.5.1 SA/S 4.16.5.1 SA/S 8.16.5.1 SA/S 12.16.5.1	SA/S 2.16.6.1 SA/S 4.16.6.1 SA/S 8.16.6.1 SA/S 12.16.6.1
AC3 operation (cos φ = 0.45) DIN EN 60947-4-1	6 A	8 A	– [5]	16 A	16 A
C-Load switching capacity	–	–	–	20 A	20 A
Fluorescent lighting load AX to EN 60669-1	6 A (35 μF) [3]	10 AX (140 μF) [3]	16 A (70 μF) [3]	20 AX (200 μF) [3]	20 AX (200 μF) [3]
Minimum switching capacity	10 mA/12 V	100 mA/12 V	100 mA/12 V	100 mA/12 V	100 mA/12 V
DC current switching capacity (resistive load)	7 A/24 V =	10 A/24 V =	16 A/24 V =	120 A/24 V =	20 A/24 V =
Mechanical contact endurance	> 10^7	> 3 x 10^6	> 3 x 10^6	> 10^6	> 10^6
Electronic endurance to IEC 60947-4-1: – Rated current AC1 (240V/0.8) – Rated current AC3 (240V/0.45) – Rated current AC5a (240V/0.45)	100,000 15,000 15,000	100,000 30,000 30,000	100,000 30,000 30,000	100,000 30,000 30,000	100,000 30,000 30,000
Incandescent lamp load at 230 V AC	1200 W	2500 W	2500 W	3680 W	3680 W
Fluorescent lamp T5/T8: – Uncorrected – Parallel compensated – DUO circuit	800 W 300 W 350 W	2500 W 1500 W 1500 W	2500 W 1500 W 1500 W	3680 W 2500 W 3680 W	3680 W 2500 W 3680 W
Low-voltage halogen lamps: – Inductive transformer – Electronic transformer	800 W 1000 W	1200 W 1500 W	1200 W 1500 W	2000 W 2500 W	2000 W 2500 W
Halogen lamps 230 V	1000 W	2500 W	2500 W	3680 W	3680 W
Dulux lamps: – Uncorrected – Parallel compensated	800 W 800 W	1100 W 1100 W	1100 W 1100 W	3680 W 3000 W	3680 W 3000 W
Mercury-vapour lamps: – Uncorrected – Parallel compensated	1000 W 800 W	2000 W 2000 W	2000 W 2000 W	3680 W 3000 W	3680 W 3000 W
Sodium vapour lamps: – Uncorrected – Parallel compensated	1000 W 800 W	2000 W 2000 W	2000 W 2000 W	3680 W 3000 W	3680 W 3000 W
Max. peak inrush-current: I_p (150 μs) I_p (250 μs) I_p (600 μs)	200 A 160 A 100 A	400 A 320 A 200 A	400 A 320 A 200 A	600 A 480 A 300 A	600 A 480 A 300 A
Number of electronic ballasts (T5/T8, single element): [1] 18 W (ABB EVG 1 x 18 SF) 24 W (ABB EVG 1 x 24 CY) 36 W (ABB EVG 1 x 36 CF) 58 W (ABB EVG 1 x 58 CF) 80 W (Helvar EL 1 x 80 SC)	10 ballasts 10 ballasts 7 ballasts 5 ballasts 3 ballasts	23 ballasts 23 ballasts 14 ballasts 11 ballasts 10 ballasts	23 ballasts 23 ballasts 14 ballasts 11 ballasts 10 ballasts	26 [2] ballasts 26 [2] ballasts 22 ballasts 12 [2] ballasts 12 [2] ballasts	26 [2] ballasts 26 [2] ballasts 22 ballasts 12 [2] ballasts 12 [2] ballasts

1) For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts.

2) The number of ballasts is limited by the protection with B16/B20 circuit-breakers.

3) The maximum inrush-current peak may not be exceeded.

4) See special ABB i-bus® KNX devices of the HVAC area, e.g. Fan/Fan Coil Actuator LFA/S or Fan Coil Actuator FCA/S.

5) Not intended for AC3 operation.

■ – possible function

Notes

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