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KNX PROJECT PREPARATION



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KNX PROJECT DESIGN GUIDELINES

Structured Realisation of KNX Projects

General

The “KNX Project Design Guidelines” intend to assist KNX Partners to realise KNX projects in a proper and structured manner. They are meant to complement the “KNX Project Checklists”, which concentrate on the project handling starting from the identification of the customer requirements up to the handover. KNX has elaborated these “KNX Project Guidelines” in order to make the realisation of KNX projects easier for all companies involved.

More Success with a simple Structure

Properly structuring a KNX Project is an important element in its eventual successful realisation. Configuring the topology and the address scheme according to a suitable structure is essential to be able to finally hand over a properly functioning installation to the customer. These “KNX Project Guidelines” contain important basic information and ideas for successful project design.

Users of these Guidelines

The „KNX Project Guidelines“ are meant to complement the “KNX Project Checklists”. Amongst others they lend a helping hand to the below listed companies in their daily work with KNX:

- Consulting engineers as a basis for the call for tenders and as guidelines for the realisation of projects
 - Beginners as a basis for company-internal structuring of KNX Projects
 - Experienced integrators as an improvement and a complement to their own project guidelines
 - Training centres for the integration into their training documents
 - KNX Certified training centers as supplementary information to the official training documents
- KNX wishes all partners involved in KNX Projects lots of success and happy project designing!

Notes

The content of this document is mainly the result of many years of experience of KNX system integrators realising KNX projects with the aim to install for their customers an optimised, error free and energy efficient system. This document has been worked out by a KNX project team consisting of training centres and system integrators. The information and specification published in this document has been compiled to the best of knowledge. Errors and technical alterations are reserved. KNX does not take responsibility for the practical application of these guidelines. Alterations and suggestions are welcome via info@knx.org.

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Physical Topology

In the same way as major construction projects are subdivided in areas, buildings, floors and rooms, the physical structure of a bus system needs to be organised accordingly. The more similar these structures can be made, the easier and clearer will be the project design and the programming.

It is recommended – in case of doubt – to foresee an additional line, if this improves the clear arrangement of the project structure.

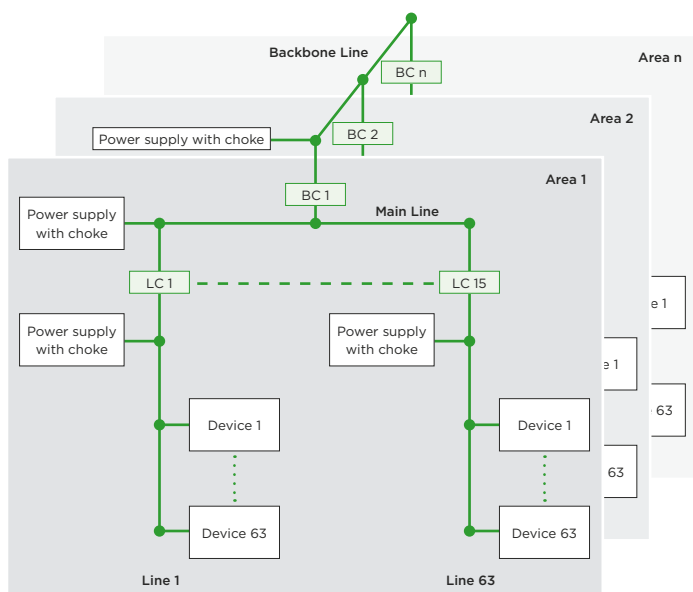
Segmentation in Areas and Lines

Number of possible areas and lines

As it is well known, a KNX project can contain up to 15 areas. Per area again up to 16 lines (15 lines and one main line) can be defined. Areas, respectively lines are electrically isolated from each other by a coupler. Therefore, each line, respectively each segment of a line needs its own power supply. Hence, the correct number of power supplies in a project is: number of line couplers + 1.

According to the KNX standard, the topology is structured in:

- lines (always 1-15)
- main line (connects the corresponding line couplers)
- area line (connects the corresponding area couplers), in practice this line is often referred to as the “backbone”.



KNX Topology
LC: Line coupler | BC: Backbone coupler

Topology in Practice

In major projects where 16 lines (15 lines and 1 main line) are insufficient or when required by the building structure, lines are extended by areas. In a single family house (SFH) one line might be sufficient either per floor or even for the entire building. In commercial buildings one area should be foreseen per floor and one line per energy zone, even if not all areas contain the maximum number of 15 lines.

Examples of Topologies

Area 1: Building		
Main Line	Staircase	(Devices 1.0.xxx)
Line 1	Basement	(Devices 1.1.xxx)
Line 2	Ground floor	(Devices 1.2.xxx)
Line 3	First floor	(Devices 1.3.xxx)

Example: Topology SFH with only a few devices

Area Line	(Devices 0.0.xxx)
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Area 1: (North Building) Basement		
Main Line		(Devices 1.0.xxx)
Line 1	Energy zone 1	(Devices 1.1.xxx)
Line 2	Energy zone 2	(Devices 1.2.xxx)
Line 3	Energy zone 3	(Devices 1.3.xxx)
Line 4	Energy zone 4	(Devices 1.4.xxx)
...		
...		
Line 11	General corridors north	(Devices 1.11.xxx)
Line 12	General corridors south	(Devices 1.12.xxx)

Area 2: (South Building) Ground floor		
Main Line		(Devices 2.0.xxx)
Line 1	Energy zone 1	(Devices 2.1.xxx)
Line 2	Energy zone 2	(Devices 2.2.xxx)
Line 3	Energy zone 3	(Devices 2.3.xxx)
...		
...		
Line 11	General corridors north	(Devices 2.11.xxx)
Line 12	General corridors south	(Devices 2.12.xxx)

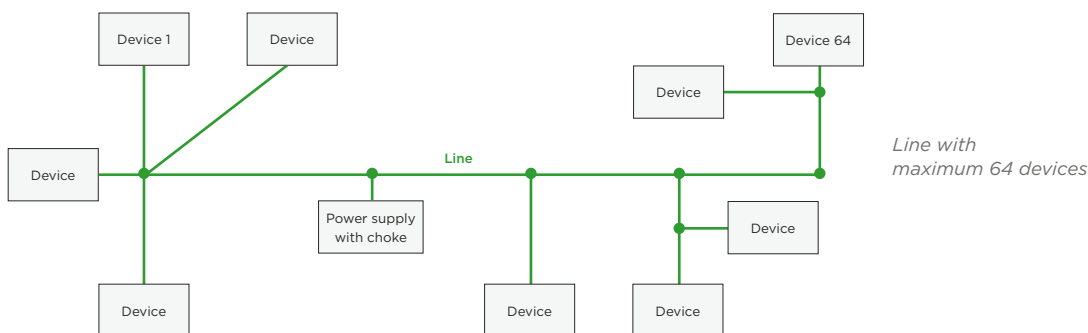
Area 3: (Shop floor)		
Main Line		(Devices 3.0.xxx)
Line 1	Energy zone 1	(Devices 3.1.xxx)
Line 2	Energy zone 2	(Devices 3.2.xxx)
... etc.		

Example: Topology Commercial Building

Number of devices

As a general rule, per area and line (segment of a line) a maximum of 64 devices can be installed. As a result, the required output current of the power supply usually is 640 mA.

However when designing a project, sufficient reserves should be foreseen. While designing the installation, the number of devices in a line should not exceed 60 % of the maximum possible number in commercial buildings and 90 % in residential buildings. The exact power consumption of the individual devices and consequently the resulting maximum number of devices per area/line (segment) can be derived from the technical product data as supplied by the manufacturers of the devices.



Individual Addresses

Theoretically, the Individual Addresses of the individual bus devices in a line could be assigned without any structure. In order to improve the overall overview, KNX recommends the creation of an address structure that is adapted to the project, when assigning addresses.

Example: Address Assignment

The following example should be understood as a proposal that always needs to be adapted to the realities of the actual project.

Possible Structuring of the Individual Addresses

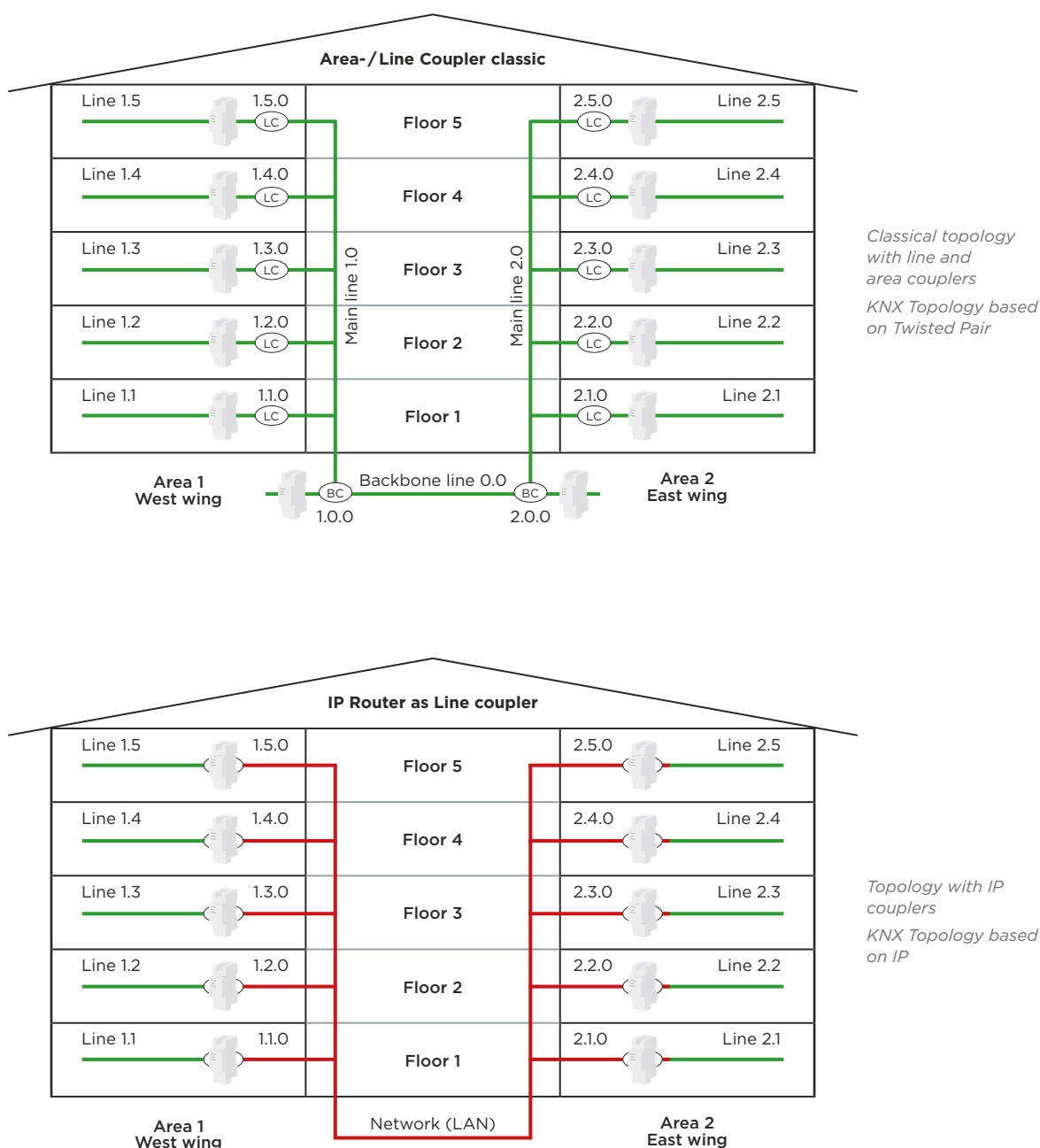
Depending on the number of actuators to be installed in the distribution board, the address range can be segmented as shown below. Yet the shown structure is only suited for smaller projects. The individual areas should be designed with a margin, to have the possibility to insert further devices at a later stage. The following example shows a possible assignment of addresses, as it could be realised depending on the type of project at hand and the number of actuators.

1.1	0	Line coupler
1.1	1 ... 20	Actuators in the distribution board
1.1	21 ... 40	Sensors
1.1	41 ... 62	...
1.1	255	e.g. USB-Interface for programming

Principal Scheme of the Documentation

Especially in case of larger projects, when starting the split-up and structuring of the installation (as regards topology, areas and lines), a principal scheme shall be designed. This ensures an optimum design of the topology of a KNX installation and in this way the logical structure can be realised rather fast. Later the scheme helps to get a quick overview during the commissioning stage of the system or when doing maintenance. The principle scheme is therefore always part of the documentation handed over to the customer after the completion of the project.

Example: Principle Scheme



Labelling Concept

It is important that all parties involved in a project use common terms and have in mind the same meaning of these terms. The easiest way to do so is to have a common labelling concept. The concept below proved its worth in practice and is therefore recommended by KNX. This standard concept has the additional advantage that all involved parties can easily understand the project even if they did not originally design the project themselves. A label as recommended by KNX is composed of the following elements:

- Label for trades and functions
- Room number
- Consecutive number

These elements result a unique identifier, of which an example is shown below:

«LD_E05_01»

This label should now be used by default in:

- the installation plan
- for the electric circuit diagram
- for ETS project design

The detailed format of this label is described in the following pages.

Identifiers for trades and functions as first element

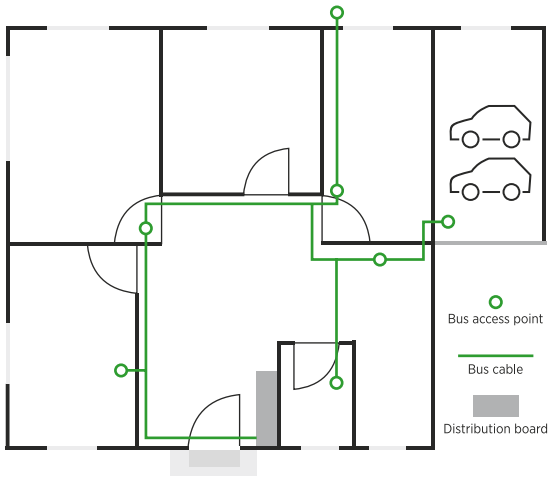
KNX has defined the following identifiers for functions and trades. The list can be amended if required. In addition, the table lists the recommended number of Group Addresses.

Id.	Function	Number Group Address
AM	Alarm-Magnetic contact (Collective alarm/Alarm system)	5
AW	Awning	5
B	Blind	5/10
C	Curtain	5
CL	Clocks	5
BL	Beamer (projector)-Lift	5
DC	Door contact	5
DMX	DMX	5
E	Energy meters and monitoring	10
F	Fans	5
FS	Fly screens	5
G	Garage door (doors in general)	5
GB	Gong/Bell	5
H	Heating	5
HP	Heat pump	10
IR	Irrigation	5
L	Lighting	5
LC	Locking contact	5
LD	Lighting dimmable	5
LDA	Lighting dimmable DALI	5
MM	Multimedia	5
P	Pump	5
PS	Projection screen	5
RL	Roof light	5
S	Socket-outlet	5
SD	Socket-outlet dimmable (attention)	5
SH	Shutter	5/10*
TS	Temperature sensor	5
TVL	TV lift	5
W	Windows	5
WK	Window contacts	5
WS	Weather station	10

* Further information can be found on page 11: Structuring of Group Addresses

**Room numbers
as second element of the label**

Each room requires its own unique number. If numbers have already been assigned to rooms, these numbers can be taken over. The room numbers shall appear in the floor plan and have to be agreed upon with the architect and if necessary with further design experts.

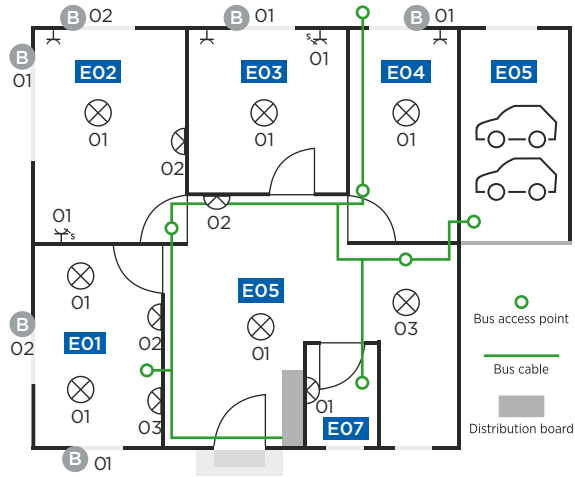


Installation plan without room numbers (initial situation)

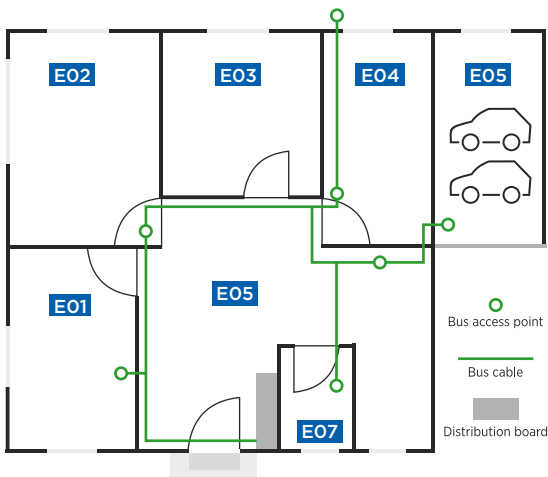
**Consecutive number
as third element of the label**

A consecutive number forms the third part of the label. It is allocated to the electrical appliances per room.

- This number starts in each room with 01,
- and starts again with 01 for each trade.
- Alternatively it can be counted up further for other trades within the room (not shown in the example below).



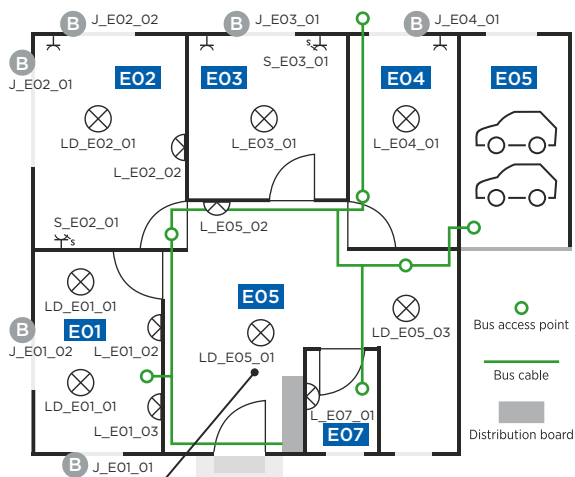
Floor plan with consecutive numbers for each trade



Installation plan with allocated room numbers

Example of an Identification Label

Below a labelling example in accordance with the KNX recommendation for the entrance area (ceiling lamp in room E05).

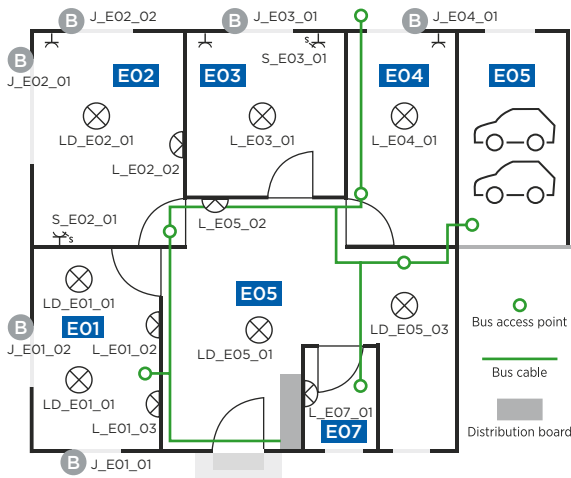


LD_E05_01	Installation plan Electric circuit diagram ETS (with additional info)
Designation of the function	
Designation of the floor/room	
Consecutive number	

Definition of the identification label

Final Example: Identification Concept

Below the final labelling example in accordance with the KNX-recommendation for the given plan.



Additional Marking in ETS

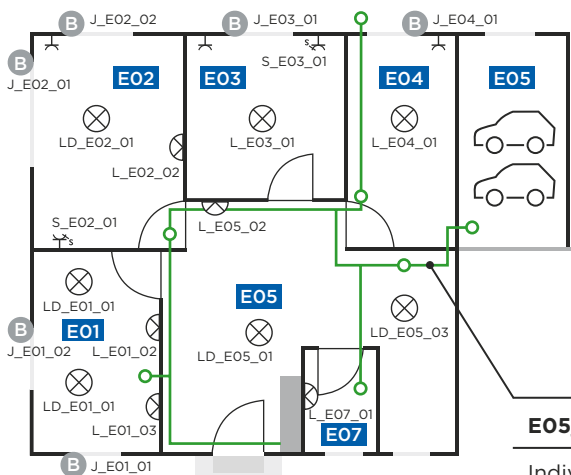
When labelling Group Addresses in ETS it may be useful to add to the label the real room name and if applicable the switching group (in brackets). This helps especially in smaller projects to improve the overview.

Example: Labelling of the group address in ETS

LD_E05_01 (entrance ceiling)

Reference to manual control elements

It definitely makes sense to describe the individual push buttons and their functions in a separate „room book“. The reference to this external document can be made directly by means of the Individual Address or - if not yet defined - by means of a position number especially created for this purpose. Example: “E05-01” means, room 05 - consecutive number.



Example for the corridor with an individual position number

E05_01
Individual Address or
Individual position number

Structures in ETS

Topology in ETS and in the Project

If a project is well structured, the topology corresponds - as mentioned earlier in this document - more or less to the logical structure of the building, such as e. g. to floors, energy zones etc.

Building structure in ETS

The building structure in ETS is helpful for the orientation in the building. Push buttons and further elements are placed into the corresponding rooms or distribution boards. The building view is a sort of filter, it does not influence the allocation of devices within the topology, but simplifies finding devices in the project.

Labelling in ETS

A further important chapter is the proper labelling in ETS. A lot of installers believe that proper labelling of Group Addresses and devices just constitutes a lot of unnecessary work. This is not the case, as one can easily get lost in a project without proper labelling. The time invested when starting the project will pay off many times even up to the stage where the project is finally commissioned. How this is professionally done is shown below.

Project Properties

When starting work, the most important entries in ETS are at least the project name and - if applicable - the internal project number. The date will automatically be created when opening a new project.

Function of the Project Log

The project log that appears when closing ETS should always be active and kept up to date. It shows who did what and when as well as what is the latest current version. If the project log is properly kept up to date, it will later help evaluate more easily when and by whom changes and/or amendments were made.

Labelling of the Group Objects

In practice it is recommended to assign a label to the individual channels (the first Group Object) of sensors and actuators. How to proceed: When a Group Object is selected in ETS, by clicking the right mouse button the name of the sending group address can be taken over for this object. Alternatively this assignment can be done for a whole line. After the allocation of Group Addresses within a line → select this line → determine the object description by → selection of the sending group address → all the addresses will be taken over.

Structuring of Group Addresses

Main Groups

Generally main group 0 respectively 14 or 15 are allocated to central Group Addresses. In total up to 32 main groups (0–31) can be allocated. Attention has to be paid to possible restrictions in case of line couplers, area couplers, plug-ins and gateways.

Main group	0	Central addresses
Main group	1	Basement
Main group	2	Ground Floor
Main group	3	1. Floor
Main group	4	2. Floor
Main group	5	3. Floor
...	etc.	

Group Addresses

Structuring the Group Addresses is an important task. Here again it makes sense to organise the addresses according to a very clear pattern. There are two possibilities to realise this: the two level structure and the three level structure.

Two Level Structure of Group Addresses

If there are more than 50 lighting groups or more than 25 blind groups per floor, Group Addresses can be created according the 2-level-structure offered by the ETS. Accordingly, the sub groups have to be segmented in a structured way. The segmentation and grouping has to be aligned with the project and the used functions. It is an advantage to foresee packets of five and/or ten per luminaire, element, blind, heating, alarm etc. The segmentation can be made similar to the structure of 3-level Group Addresses described below. The difference is that the Middle Group does not exist but allows the sub group address to exceed 255, i. e. it can be between 0–2047. The address 0/0 is a system address and cannot be allocated.


Three Level Structure of Group Addresses

In case of three level Group Addresses, a corresponding Middle Group is available between 0–7 that can also be used for segmentation. The three level group address structure allows sub groups between 0–255. Entries with higher numbers than 255 are not possible. The address 0/0/0 is a system address and cannot be allocated.

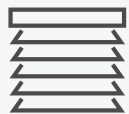
KNX recommends using the tree level structure for smaller projects. This can look like is shown below.

Naming of the Function of Group Addresses


To ensure that the function of each single group address is clearly defined, the following naming scheme shall be used. Depending on the installed devices respectively the needed Group Addresses this naming scheme can slightly deviate from the underneath recommendation.

	ON/OFF	Switch ON/OFF
	DIM	Dim UP/DOWN
	VALUE	Control brightness value
	FB	Status feedback (ON/OFF)
	FB VALUE	Status feedback (Object Value)

Identifiers for the function Light

	UP/DOWN	Move blind UP and DOWN
	STOP or SLATS	Stop blind
	POSITION HEIGHT	Control height of blinds
	POSITION SLATS	Control position of slats
	SHADING	Control position for shading
	BLOCK	Block local manual operation
	STATUS POSITION HEIGHT	Status feedback height of blinds
STATUS POSITION SLATS	Status feedback slats	

Identifiers for the Function Blind


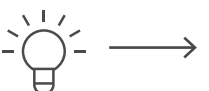
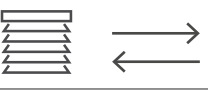



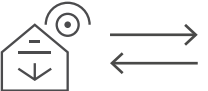
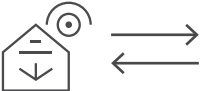
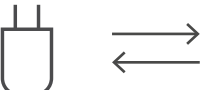
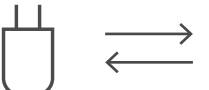
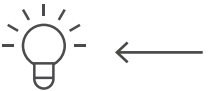

	CONTROL VALUE	Control value for valve (ON/OFF or value)
	CURRENT TEMP	Current temperature value
	BASIC SETPOINT	Basic set-point
	FB	Feedback
	FB CURRENT SETPOINT	Feedback of current set-point
	FAULT	Fault
	STATUS OPERATION MODE	Operation mode of controller
	BLOCK	Block manual operation

Identifiers for the Function Heating

Detailed information to the three level Group Addresses

Definition and Segmentation of the Middle Group

For trades like lighting, awnings, blinds but also for heating different Group Addresses are required. Favorably, these are segmented by means of the Middle Group. Below you will find a list of the most important trades. Further trades can be added at any time according to the pattern below. The KNX Project Design Guidelines offer two alternatives for the segmentation of Middle Groups:

Middle Group	Alternative A	Alternative B
0	Lighting incl. feedback 	Lighting 
1	Blinds incl. feedback 	Blinds 
2	Heating/HVAC 	Heating/HVAC 
3	Alarm 	Alarm 
4	General 	General 
5
6		Lighting Feedback* 
7		Blinds Feedback* 

*) The sub group address of the status feedback for the Middle Groups 6 and 7 complies for each function always with the same sub group address of the switching group (in case of lighting e. g. Middle Group 0). For details refer to the examples below.

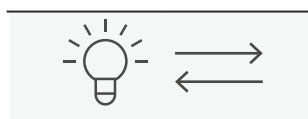
Structure of the subgroups for lighting

The functions of each switching group shall be segmented in blocks of 5 in order to have always the same structure for a lighting group. Objects that are not used are either left empty or a dummy group address is attributed, in order to cater for special functions requiring individual solutions.

Example:

Structure of the subgroups for lighting

According to the segmentation described above two alternatives for the structuring of Group Addresses are possible.



Middle Group 0

1/0/0	ON/OFF
1/0/1	DIM
1/0/2	VALUE
1/0/3	FB
1/0/4	FB VALUE
1/0/5	ON/OFF
1/0/6	DIM
1/0/7	VALUE
1/0/8	FB
1/0/9	FB VALUE
1/0/10	ON/OFF
...	
...	

Alternative A:

Status feedback integrated in the same Middle Group



Middle Group 0

1/0/0	ON/OFF
1/0/1	DIM
1/0/2	VALUE
1/0/3	
1/0/4	
1/0/5	ON/OFF
1/0/6	DIM
1/0/7	VALUE
1/0/8	
1/0/9	
1/0/10	ON/OFF
...	
...	

Middle Group 6: Status feedback

1/6/0	ON/OFF
1/6/1	
1/6/2	VALUE
1/6/3	
1/6/4	
1/6/5	ON/OFF
1/6/6	
1/6/7	VALUE
1/6/8	
1/6/9	
1/6/10	ON/OFF
...	
...	

Alternative B:

Status feedback Middle Group 6 for lighting

Structure of the Subgroups for Blinds

As in the case of blinds etc. other functions are required than in the case of light, other identifiers are needed. Moreover, more Group Addresses are needed for more complex blind controls. KNX recommends for blinds a segmentation in blocks of 10.



Middle Group 1

1/1/0	UP/DOWN
1/1/1	STOP
1/1/2	POSITION HEIGHT
1/1/3	POSITION SLATS
1/1/4	SHADING
1/1/5	BLOCK
1/1/6	STATUS POSITION HEIGHT
1/1/7	STATUS POSITION SLATS
1/1/8	...
1/1/9	...
1/1/10	UP/DOWN
1/1/11	STOP
1/1/12	POSITION HEIGHT
1/1/13	POSITION SLATS
1/1/14	...

Alternative A:
Status feedback part of the same Middle Group



Middle Group 1

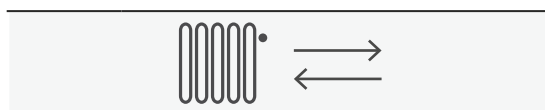
Middle Group 7: Status feedback

1/1/0	UP/DOWN	1/7/0	...
1/1/1	STOP	1/7/1	...
1/1/2	POSITION HEIGHT	1/7/2	POSITION HEIGHT
1/1/3	POSITION SLATS	1/7/3	POSITION SLATS
1/1/4	SHADING	1/7/4	...
1/1/5	BLOCK	1/7/5	...
1/1/6	...	1/7/6	...
1/1/7	...	1/7/7	...
1/1/8	...	1/7/8	...
1/1/9	...	1/7/9	...
1/1/10	UP/DOWN	1/7/10	...
1/1/11	STOP	1/7/11	...
1/1/12	POSITION HEIGHT	1/7/12	POSITION HEIGHT
1/1/13	POSITION SLATS	1/7/13	POSITION SLATS
1/1/14	...	1/7/14	...

Alternative B:
Status feedback as Middle Group 7

Example for subgroups Heating

Because of the needed connections, KNX does not suggest a second alternative for heating. KNX recommends a segmentation in blocks of 10.



Middle Group 2

1/2/0	CONTROL VALUE (ON/OFF or value)
1/2/1	CURRENT VALUE (Temperature)
1/2/2	BASIC-SETPOINT
1/2/3	FB
1/2/4	FB CURRENT SETPOINT
1/2/5	...
1/2/6	...
1/2/7	...
1/2/8	...
1/2/9	STATUS OPERATION MODE
1/2/10	CONTROL VALUE (ON/OFF or value)
1/2/11	CURRENT VALUE (Temperature)
1/2/12	BASIC-SETPOINT
1/2/13	FB
1/2/14	FB CURRENT SETPOINT
1/2/15	...
1/2/16	...
1/2/17	...
1/2/18	...
1/2/19	STATUS OPERATION MODE
1/2/20	CONTROL VALUE (ON/OFF or value)
...	...

Alternative Numbering for Subgroups starting with 1

All examples above start with subgroup 0. Alternatively it is also possible to start with subgroup 1.

Middle Group 0

1/0/1	ON/OFF
1/0/2	DIM
1/0/3	VALUE
1/0/4	FB
1/0/5	FB VALUE
1/0/6	ON/OFF
1/0/7	DIM
1/0/8	VALUE
1/0/9	FB
1/0/10	FB VALUE
1/0/11	...

Marking of Group Addresses

Marking examples for the different Functions

According to the two rules mentioned above (label and function) it is now possible to create a well arranged and unique marking of the Group Addresses.

Example: Lighting

Below is an example of the detailed marking of Group Addresses for the lighting in the bedroom based on the structuring according to alternative A.

Middle Group 0	
1/0/0	LD_E01_01 ON/OFF (Bedroom ceiling)
1/0/1	LD_E01_01 DIM
1/0/2	LD_E01_01 VALUE
1/0/3	LD_E01_01 FB
1/0/4	LD_E01_01 FB VALUE
1/0/5	L_E01_02 ON/OFF (Bedroom wall left side)
1/0/6	...
1/0/7	...
1/0/8	L_E01_02 FB
1/0/9	...
1/0/10	L_E01_03 ON/OFF (Bedroom wall right side)
1/0/11	
1/0/12	
1/0/13	L_E01_03 FB
1/0/14	
...	
1/0/20	LD_E02_01 ON/OFF (Children's room ceiling)
1/0/21	LD_E02_01 DIM
1/0/22	LD_E02_01 VALUE
1/0/23	LD_E02_01 FB
1/0/24	LD_E02_01 FB VALUE
1/0/25	L_E02_02 ON/OFF (Children's room wall)

Example: Blinds

Below an example of the detailed marking of Group Addresses for the blinds in the bedroom based on the structuring according to alternative A. Alternative B can be realised in an analogue way.

Middle Group 1	
1/1/0	B_E01_01 UP/DOWN (Bedroom entrance side)
1/1/1	B_E01_01 STOP
1/1/2	B_E01_01 POSITION HEIGHT
1/1/3	B_E01_01 POSITION SLATS
1/1/4	B_E01_01 SHADING
1/1/5	B_E01_01 BLOCK
1/1/6	B_E01_01 STATUS POSITION HEIGHT
1/1/7	B_E01_01 STATUS POSITION SLATS
1/1/8	...
1/1/9	...
1/1/10	B_E01_02 UP/DOWN (Bedroom garden side)
1/1/11	B_E01_02 STOP
1/1/12	B_E01_02 POSITION HEIGHT
1/1/13	B_E01_02 POSITION SLATS
1/1/14	B_E01_02 SHADING
1/1/15	B_E01_02 BLOCK
1/1/16	B_E01_02 STATUS POSITION HEIGHT
1/1/17	B_E01_02 STATUS POSITION SLATS
1/1/18	...
1/1/19	...
1/1/20	B_E02_01 UP/DOWN (Children's room garden side)
...	...

Project Documentation

The documentation of a KNX project comprises of the following items:

Documents

All documents have to be placed in an indexed folder:

- Principle scheme of the facilities
- Revised electric scheme
- Revised electric plan
- Revised room book
- List of companies, responsibilities
- System specification, customer requirements if applicable
- Acceptance certificate
- Possible test certificate (e. g. calibration of the room thermostat)
- Report of the hand-over to the customer
- Description of logic functions and further details
- Manual/technical documentation of the installed components
- Own documents that could be helpful later on for the maintenance of the system

Software and legal aspects

If requested by the customer, the software respectively the project data (not the ETS Software itself) should be handed over, thereby taking into account all applicable security measures.

- Project data created by the current ETS Software version
- Project data of other used hardware (e. g. visualisation)
- Plug-ins and software of special devices that cannot be programmed directly by means of the ETS.

Guarantee after handing over the software

When handing over the software, the integrator may make additional arrangements with the customer settling the issue of guarantee.

Backup

Moreover it lies within the responsibility of the system integrator to ensure that the customer can access the current project data if requested. The integrator has to take special care that the created project data and all other related data are securely archived by him.

Taking over Software from another Integrator

In practice it may happen that a project is handed over from one integrator to another. It shall be assured that the software is transferred from one integrator to the other exclusively via the building owner/customer. To allow "the new integrator" to continue the project as desired by the customer, the "old integrator" is obliged to hand over the very latest version of the project data to the customer. The "new integrator" has to check the software for completeness immediately after the reception. Always pay attention to preserve the reputation of KNX: KNX is an open bus system and exactly that is its asset.

Additional Benefits for Everyone

If anything should have been forgotten in this document or if anything does not correspond anymore to best practice, handling or your ideas, please inform us. As KNX we would like to keep on improving this document, always with the objective to sustainably optimise and improve the realisation of KNX projects. For inputs please use the E-mail address info@knx.org.

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-

CHECKLIST

Implementing an electrical installation with KNX

Project: _____ Distribution board: _____

Project no.: _____ Date: _____

Distribution board: _____

1. Your question	Customer response
What does your customer want their living space to be like?	
For your customer, what are the most important characteristics that a house should have?	
Who will be living in the property?	
Give your customer a little homework to do: how will the rooms be used, and by whom?	
Basement: <input type="checkbox"/> Storeroom <input type="checkbox"/> Hobby/Craft room <input type="checkbox"/> Utility room <input type="checkbox"/> Laundry <input type="checkbox"/> Gym <input type="checkbox"/> Corridor <input type="checkbox"/> Garage	

Only once your customers are clear about how their various rooms are to be used will you be able to offer them an effective, intelligent building automation system.

Examples:

- Storeroom → Motion sensor
- Hobby room → Vacuum cleaner
- Gym → Air conditioning + air quality
- Laundry → Leak alarm
- Conservatory → Shading, ventilation, temperature control

Ground Floor:

- Hallway/Corridor
- Downstairs toilet
- Kitchen
- Dining room
- Living room
- Lounge
- Conservatory
- Terrace

First floor:

- Corridor
- Bathroom
- Children's bedroom 1
- Children's bedroom 2
- Children's bedroom 3
- Playroom
- Master bedroom
- Walk-in wardrobe
- Balcony

Attic floor:

- Studio
- Gallery
- Room 1, 2, etc.

2. Your query	Results
Define a lighting plan for each room, on the basis of 1): What devices need to be switched? Where is dimming required?	
On the basis of 1), define a plan for controlling blinds, windows, doors and gates, and specify their function.	
Discuss with your customer a safety and security concept, and identify consequences.	
<p>Example: If internal activation is selected, the client must not open the window, because this would set off an alarm.</p>	
<p>Example: If a passive trap system with motion sensors is to be used, there must be no pets in the house.</p>	
<p>Determine whether there are further technical devices that need to be controlled via/connected to the building automation system:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Swimming pool <input type="checkbox"/> Rainwater utilisation <input type="checkbox"/> Heat pump <input type="checkbox"/> Photovoltaic system <input type="checkbox"/> Hot water convectors <input type="checkbox"/> Central vacuum system <input type="checkbox"/> Garden watering systems <input type="checkbox"/> Home cinema <input type="checkbox"/> etc. 	

3. Customer tasks	Results
Ask your customer to define, on the basis of 1), what controls are required in each room. (Explain to your customer that he or she must think in terms of functions rather than in terms of conventional switches).	
Point out to your customer what controls might be needed in the future.	
<p>For example, when the use of a room changes after children have left home, when furniture is rearranged, or if family members move in who have special care needs.</p>	

4. Together with your customer, define operating philosophies	Results
E. g. for push-button sensors: left for on, right for off, central functions always at the bottom. Also: Use of status LEDs	
Remote controls	
Central control panels/touch displays/visual displays	
Room temperature controllers	
Date and signature, installer:	
Date and signature, customer/user:	

SUPPLEMENTARY SHEET

other possible applications

(list not exhaustive)

1. Switching and lighting (all lamp types)

-
- 1.1. Switching from one or several locations.
-
- 1.2. Central switching, e.g. light off, iron off and cooker off at entry door.
-
- 1.3. Dimming from one or several locations.
-
- 1.4. Staircase switching – time-delay switch-off.
-
- 1.5. Toilet switching – time-delay switch-on and switch-off of fan.
-
- 1.6. Switching on and off of devices via timer programmes.
-
- 1.7. Switching on and off of sockets for temporary or potentially dangerous devices (e.g. rotary iron), but also to reduce power consumption by appliances in standby (TV, stereo, etc.).
-
- 1.8. Motion-dependent switching for corridor area, side rooms and outdoor areas.
-
- 1.9. Daylight-dependent switching on and off of lighting via internal or external light sensors helps to save energy.
-
- 1.10. Preset scenarios allow several switchable or dimmable groups of lights, other devices or blinds to be changed to a predefined status at the touch of a button. Scenarios can be defined by the system integrator or the user.
-
- 1.11. Panic button, e.g. by the bed. When this is pressed, predefined lights are switched on to deter any intruders.
-
- 1.12. Status notification: depending on the actuator, statuses of devices can be displayed on e.g. push-button sensors, displays or visual displays.
-

2. Screens, shading and light deflection

- 2.1. Raising and lowering of blinds and adjustment of slats. The advantage of bus technology is that several blinds can be controlled via a single push-button sensor. This increases transparency and saves space. Light and blind functions can also be controlled via a push-button sensor.

- 2.2. Central raising and lowering of blinds or shutters – for an individual facade, floor, or for the entire house.

- 2.3. Preset positions at the touch of a button, e.g. to protect against glare when watching TV, or at PC workstations in studies or in children's rooms.

- 2.4. Weather-dependent control: protection of awnings, sun shades and other facade elements against damage by wind, rain and frost based on evaluation of weather data. For example, the awnings will retract if wind speeds are too high, and manual operation will be prevented.

- 2.5. Solar shading: brightness and/or temperature sensors close the shutters or blinds far enough to prevent excessive heat from entering and to protect plants/furniture from damaging UV radiation, but keep them open wide enough to allow sufficient daylight to enter.

- 2.6. Control of facade elements via timer controls – with no need for additional cabling.

- 2.7. Scenarios allow roller and other blinds to be moved to specific positions at the touch of a button, often in combination with lighting. e.g. dim lights and move blind to relevant position when watching TV.

- 2.8. Status notification: depending on the actuator, the statuses of facade elements/blinds can be displayed on e.g. push-button sensors, displays or visual displays.

3. Windows, skylights, doors etc.

- 3.1. Opening, closing and selection of intermediate positions for (roof) windows and skylights. The advantage of bus technology is that several windows can be controlled via a single push-button sensor. This increases transparency and saves space. These functions can also be combined with light or blind functions.

- 3.2. Central opening and closing of (roof) windows, skylights and doors for each side of the building, a particular floor, or for the entire house.

- 3.3. Weather-dependent control: protection of windows and roof windows from wind, rain, frost. Protection of rooms, e.g. by automatically closing roof windows when it rains, is also possible.

- 3.4. Brightness, temperature or air quality-dependent switching, for example to automate the functions of a conservatory. If the temperature exceeds a preset value, the shading will be activated and the ventilation windows opened. The ventilation windows can also be opened if the concentration of CO₂ reaches too high a level.

- 3.5. Windows, skylights and doors can be opened or closed at specified times via timer control. Timer controls can be used in conjunction with measured internal and outdoor temperatures in order to achieve automatic night-time ventilation.

- 3.6. Status notification: depending on the actuator, statuses (open, closed or specific intermediate position) can be displayed on e.g. push-button sensors, displays or visual displays.

4. Heating/Cooling

- 4.1. With individual room regulation, a target value can be defined and modified for each room. If the resident is out of the house for a short time (shopping, doctor's appointment, etc.), the room temperature can be reduced by e.g. 2 °C, or e.g. 4 °C at night. (A reduction in room temperature of 1 °C corresponds to an energy saving of 6 %).

 - 4.2. Integration of window contacts: when a window is open, the room temperature controller switches to frost protection mode. This ensures that no energy is used to heat the outside air and, particularly in winter, that the room is protected against frost.

 - 4.3. The amount of energy used can be reduced by connecting the individual room controllers to the heating/cooling system: thus if only one or two rooms need heating, the supply temperature can be reduced (for heating) or increased (for cooling).

 - 4.4. Incorporation of various energy sources (fossil and renewable): limit values can be defined in order to allow the most favourable energy source to be used automatically. The system can thus determine whether the temperature of the solar panels is higher than the water temperature in the hot water tank. If so, there is no need to use fossil energy for the water heating. For cooling, the application described under 3.5 can be used.
-

5. Ventilation

- 5.1. Automated, monitored ventilation of living space, e.g. for low-energy or passive houses. Can also be implemented in conjunction with CO₂ sensors to maintain optimal air quality.

 - 5.2. Measurement of indoor and outdoor temperatures allows, for example, the thermal energy of the outlet air to be recovered in case of low outdoor temperatures.

 - 5.3. Control of air extraction devices in kitchens, bathrooms, toilets and hobby rooms on the basis of motion sensors or in combination with lighting control.
-

6. Alarm functions

-
- 6.1. Monitoring of the outer shell of the building via magnetic contacts on windows, doors and gates, or via glass breakage sensors.
-
- 6.2. Monitoring of the interior by motion sensors.
-
- 6.3. Monitoring of the area around the house by motion sensors.
-
- 6.4. Incorporation of room sensors into the alarm system.
-
- 6.5. Via a panic button, a silent alarm can be triggered in case of a break-in, in order to send a notification to e.g. the guard service by retransmission (by telephone, SMS or email).
-
- 6.6. Presence simulation creates the impression that the house is occupied when it is in fact not. Depending on the time of day and/or brightness, or for example at dawn or dusk, specific lights can be switched on or blinds can be opened or closed.
-
- 6.7. Via a push-button, for example by the bed, all preset lights can be switched on in order to deter intruders.
-
- 6.8. If the alarm is triggered, all lights inside and outside the house will switch on, and all blinds will be opened.
-
- 6.9. Activation devices allow the alarm system to be activated either internally or externally. External activation can be combined with a sequence of further functions to activate “leave house” status. This can include switching off critical appliances, blocking controls, reducing room temperatures and/or activating presence simulation. When the alarm is deactivated, the “coming home” sequence can be activated, whereby all the functions activated when the alarm is armed are negated and, for example, a basic level of lighting is activated.
-
- 6.10 Pictures from video cameras displayed in visualisation interfaces show who is at the door.
-

7. Comfort and safety functions

-
- 7.1. The use of SELV* supply voltage for the bus system serves to reduce electromagnetic radiation compared to conventional 230 V or Powerline installations.
-
- 7.2. Switch relays can be used to disconnect circuits automatically in order to also prevent these lines from emitting electromagnetic radiation.
-
- 7.3. Automatic watering of the garden is possible, with activation via pumps or valves. This can be controlled by a timer or on the basis of measurements of the dampness of the soil.
-
- 7.4. Potentially hazardous devices (irons, rotary irons, cookers, external power sockets, etc.) can be disconnected simultaneously via central switch-off.
-
- 7.5. Notification of the status of intelligent household appliances (washing machines, dishwashers, refrigerators, freezers, etc.) to a display element. This allows malfunction to be detected quickly.
-
- 7.6. In the future: measurement of electricity, gas and water and automatic comparison of energy suppliers' prices allows appliances such as washing machines or dishwashers to start only when the most favourable rate is available.
-

* SELV = Safety Extra Low Voltage

8. Overview of available control and display options

- 8.1. Push-button sensors with up to eight different controls on a surface area of a normal switch.

- 8.2. Use of the status LEDs on push-button sensors – particularly to display status, in cases where no biofeedback is available.

- 8.3. Infrared remote control units for room-specific execution of commands.

- 8.4. Radio remote controls for inter-room execution of commands.

- 8.5. Backlit LCD displays of the size of a push-button sensor can be used to manage devices and display their statuses.

- 8.6. LCD touch displays are available for large-format, comfortable overviews and for controlling individual subsections of the house automation system.

- 8.7. PC-/IP-based visual displays provide extensive overview and control functions.

- 8.8. Remote access can be set up online.

9. Ports and gateways

Via ports and gateways, applications and functions which are not provided by bus components can be integrated into the KNX system.

Examples:

- Conventional mechanical contacts via push-button interfaces
 - Ethernet via IP interfaces
 - DALI via gateways (subordinate lighting control system)
 - Applications and functions, which are not provided by bus components can be integrated into the KNX system via ports and gateways
 - Stereo/TV via manufacturer-independent gateways
-

CHECKLIST

handover of an electrical installation with KNX

TASKS	EXECUTED			REMARKS
	Yes	No	Not required	

1. Visual Inspection

All branch and connection boxes closed				
Connections for customer's on-site lights are at least insulated or fitted with a temporary lampholder				
All push-buttons are labelled as specified by customer and have been cleanly and securely fitted				
Distribution boards are fully labelled and cleaned				
Distribution diagrams with distribution boards				
Bus components including push-buttons are labelled with the physical address				
Network sockets are labelled				
System and equipment descriptions and operating instructions are provided in a separate folder				
Maintenance documents, plans, diagrams and specifications are also provided in a separate folder				
System documentation left with customer				

TASKS	EXECUTED			REMARKS
	Yes	No	Not required	

2. Functional check

Installation checked and all measurements performed (E-CHECK, network, etc.)				
Lighting, dimmers, blinds, central switch-off, scenarios, etc. checked for correct functioning				
Window contacts checked				
Intercom checked				
Interfaces with third-party systems checked (music, alarm, ventilation, etc.)				
Room-specific calibration of room temperature controllers				

3. Customer Induction

Customer briefed on the installation				
Customer briefed on the location of specific devices, e.g. wind sensors, central controls, etc.				
Customer briefed on safety/security applications and alarm control point				
Switching, dimming and blind functions explained to customer				
Content and navigation of touch panel menus and visual displays explained				
Customer briefed on setting of timers and operation of other customer-relevant functions, e.g. calling up and saving of scenarios				
Customer briefed on operation of room temperature controllers and other room control panels				
Customer action in case of bus/supply voltage failure and restoration discussed				
Further issues relating to the installation raised by the design engineer/system integrator				

TASKS	EXECUTED			REMARKS
	Yes	No	Not required	

4. Handover of System

Handover of project software, system documentation and all manuals				
One-off subsequent programming after approx. 3 months arranged for (date)				
Customer service telephone number given to customer, maintenance contract signed				
Acceptance report signed as per the specifications or DIN 18015 Part 4				

Date and signature, installer:	
Date and signature, customer / user:	

CHECKLIST

Increased security and privacy in KNX installations

1. Were the following measures taken into account during installation?

Are devices and applications fixed mounted? Is it ensured that devices are properly protected against dismounting (e. g. use of anti-theft protection measures)?

Is it ensured that unauthorized persons have limited access to distribution boards with mounted KNX installations (e. g. always locked or located in locked rooms)?

Is it difficult to access devices in external areas? (e. g. mounted at a sufficient height)?

In case the KNX installation can be operated from areas in buildings that are public and not surveilled, did you contemplate the use of binary inputs (mounted in distribution boards) or push button interfaces?

Are KNX Touch panels password protected (user, group or guest mode)?

2. Is Twisted Pair used as communication medium?

Is the cable anywhere in- or outside the home or the building protected against unauthorized access?

In case the twisted pair cable is used in areas requiring extra protection measures, have you taken the measures as given in item 6?

3. Is Powerline used as communication medium?

Have band stop filters been installed?

If Powerline is also used outside the building, have you taken the same measures for the media coupler as given in item 6?

4. Is IP used as communication medium?

-
- Have the network settings been documented and handed over to the home owner or the LAN administrator?
-
- Have switches and routers been set in such a way that only known MAC addresses are able to access the communication medium?
-
- Is a separate LAN or WLAN network with own hardware used for KNX communication?
-
- Is access to the (KNX) IP networks limited to authorized persons via appropriate user names and strong passwords?
-
- For KNX IP Multicast communication another IP address as the default address should be used (normally 224.0.23.12). Was this IP multicast address changed?
-
- Was the default SSID of the wireless access point changed? Was the periodic transmission of the SSID after installation deactivated?
-
- Have ports of routers for KNX been closed towards the internet and was the default gateway of the used KNXnet/IP router set to 0? Was the (W)LAN installation protected by an appropriate firewall?
- If internet access to a KNX installation is needed, check the possibility to implement:
1. Establishing a VPN connection to the Internet Router
 2. Use of manufacturer specific KNX Object Servers
-

5. Is Radio Frequency used as communication medium?

-
- Have you taken the same measures for the media coupler as given in item 6?
-
- Does each RF domain have a different domain address?
-

6. Have you used couplers in the installation?

-
- Were individual addresses of devices assigned according to their place in the topology?
-
- Do you prevent via the setting of appropriate parameters in the couplers that incorrect source addresses are not forwarded outside the line?
-
- Do you block Point-to-Point and Broadcast communication across couplers?
-
- Have the filter tables been loaded correctly and have settings been made in such a way that filter tables are taken into account by the couplers?
-
- Have you considered the measures as given under item 7 for the couplers?
-

7. Have devices been locked against re-configuration?

-
- If not, enter a BCU key¹ in the ETS Project.
-

8. Do you use KNX Secure² devices?

-
- For group communication that needs to be secured, use the foreseen authentication and encryption mechanisms of the device.
-

9. Do you suspect unauthorized access to the bus?

Record telegram traffic and analyse it. In the case of KNX Secure devices, read the Failure Logs. Document the time and observed effects (what happens, what does not happen, why and when)? Disable the internet connection of the KNX system and check, whether the effects disappear or not. Contact the hotline of the manufacturer: are the effects or security problems known at the manufacturer, are updates available?

Read the PID_Device_Control³ from devices and check whether devices are sending using the same Individual Address.

Read the PID_Download_Counter³ from devices and check whether the device was downloaded again after your configuration.

10. Have devices been locked against re-configuration?

When KNX is coupled to security installations, was this realized in any of the following ways?

1. Via KNX devices or gateways certified by national loss insurers?
 2. Via potential free contacts (binary inputs, push button interfaces, ...)?
 3. Via appropriate interfaces (RS232, ...) or gateways: was it ensured that KNX communication is unable to trigger security relevant functions in the security part of the installation?
-

11. General Security Measures

Is ETS up to date?

1. Is the PC, on which the ETS is installed, secure (up to date virus scan, newest operating system update)? It is recommended, to use a dedicated device for KNX design and commissioning.
 2. During the installation, it shall be avoided to hook other untrusted data storage devices up to the PC (USB, external hard drive, ...).
 3. ETS Plug-ins and Apps shall preferably be installed prior to the installation
 4. Backup the project file after the installation (ideally on a secured USB stick, which is stored safely) and delete the project from the PC.
-

Is the firmware of the used devices up to date?

12. Further Privacy measures (GDPR)

Installer and customer shall sign a privacy declaration.

In order to fulfil the GDPR regulations, the installer shall hand over a copy of the ETS project file to the customer.

¹ Not all devices can be protected against re-configuration - contact the relevant manufacturer

² Available from ETS 5.5 onwards

³ Is not supported in all devices



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