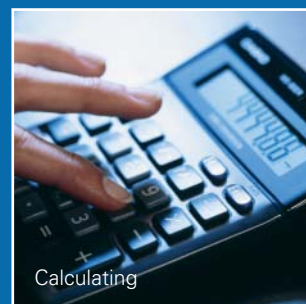


Intelligent Installation Systems





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1. Difference compared to the conventional electrical installation

The so-called conventional electrical installation requires not only

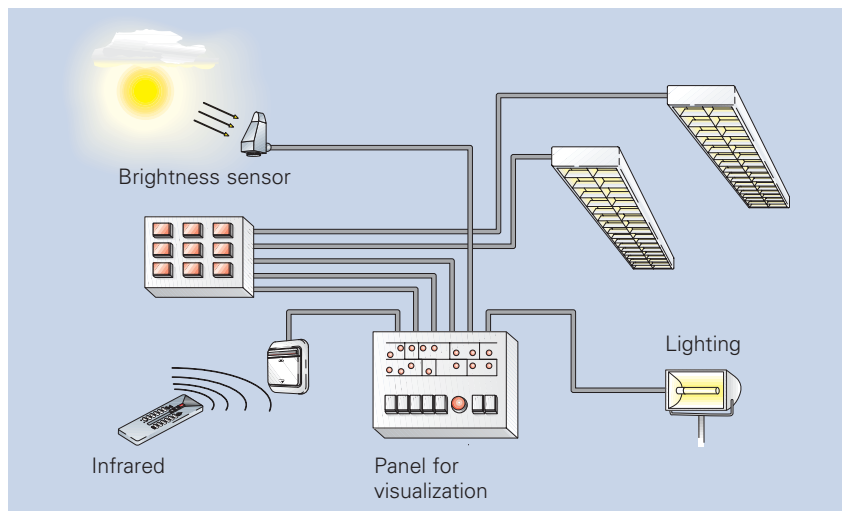
- supply lines for power transmission,

but also a separate line or wire

- for every switching command,
- or every measurement,
- for every message,
- for every controller or regulator.

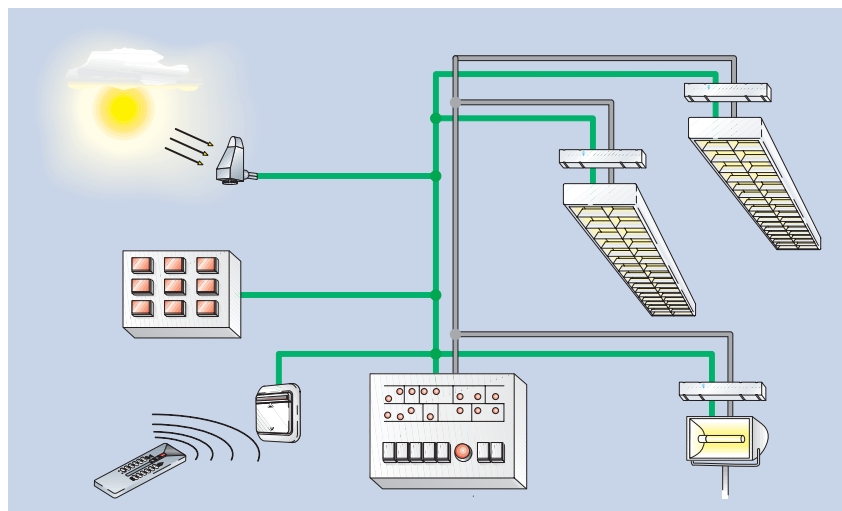
! All lines which are not required for power transmission are replaced by a bus line in the ABB i-bus® EIB.

Without EIB



With EIB

— Bus line
— Power transmission line



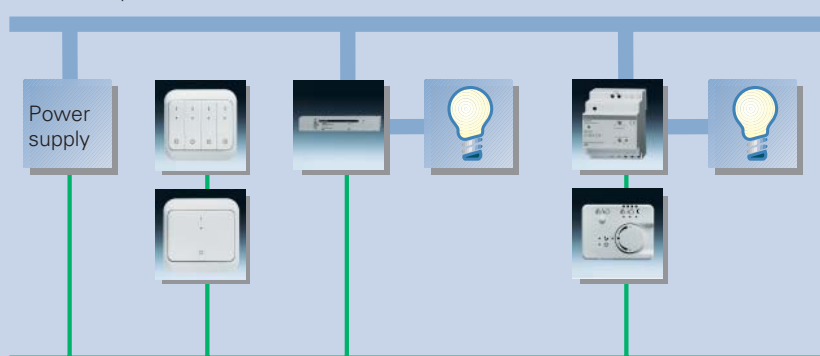
The following illustration makes this clear:

- The bus line is connected to an EIB power supply and all the other stations.
- The 230 V line (or the 400 V line) is not required for the control stations

(sensors). It is only required for the power supply to the consumers.

- As a consequence, there are 2 supply systems; one for power transmission and one for information transmission.

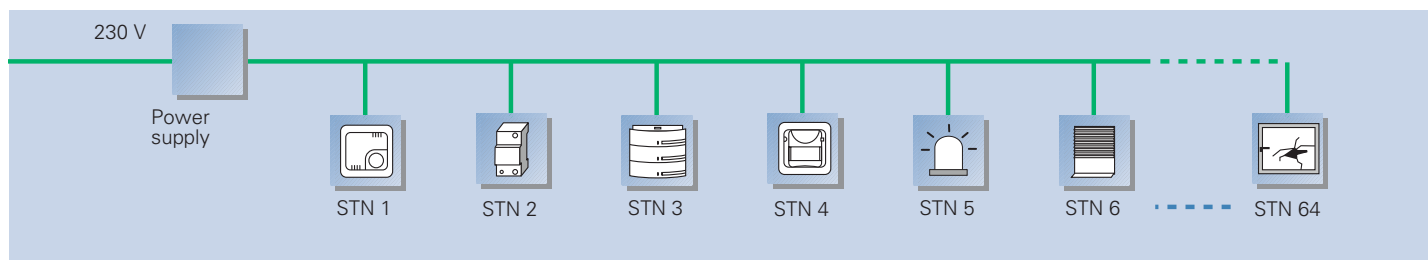
230V 50Hz power cable



Bus line e.g. JY(ST)-Y 2*2*0.8

2. EIB System Overview

2.1 General



2.1 General

! The EIB system operates decentrally and does not require a PC or any other special control unit after start-up. The “intelligence” or rather the programmed functions are stored in the stations (STNs) themselves.

Each STN can exchange information with any other STN by means of telegrams.

The lowest configuration level is referred to as a line. A max. of 64 stations can be used in one line. The actual number of stations depends on the selected power supply and the power consumption of the individual STNs.

There are four types of device

- **System devices:**

Power supply, data bus, serial interface (RS-232), connectors, choke, line couplers and area couplers

- **Sensors:**

Pushbuttons, transducers (wind, rain, light, heat, etc.), thermostats, analogue inputs

- **Actuators:**

Switching actuators, dimming actuators, actuators for blinds, heating actuators

- **Controllers:**

Sensors and actuators can be logically connected together by means of controllers (logic unit, logic module or similar) for more complex functions.

2 STNs can collaborate with a power supply via the bus line in the smallest configuration. The installation bus progressively adapts itself to the size of the system and the required functions and can be extended to more than 45,000 STNs.

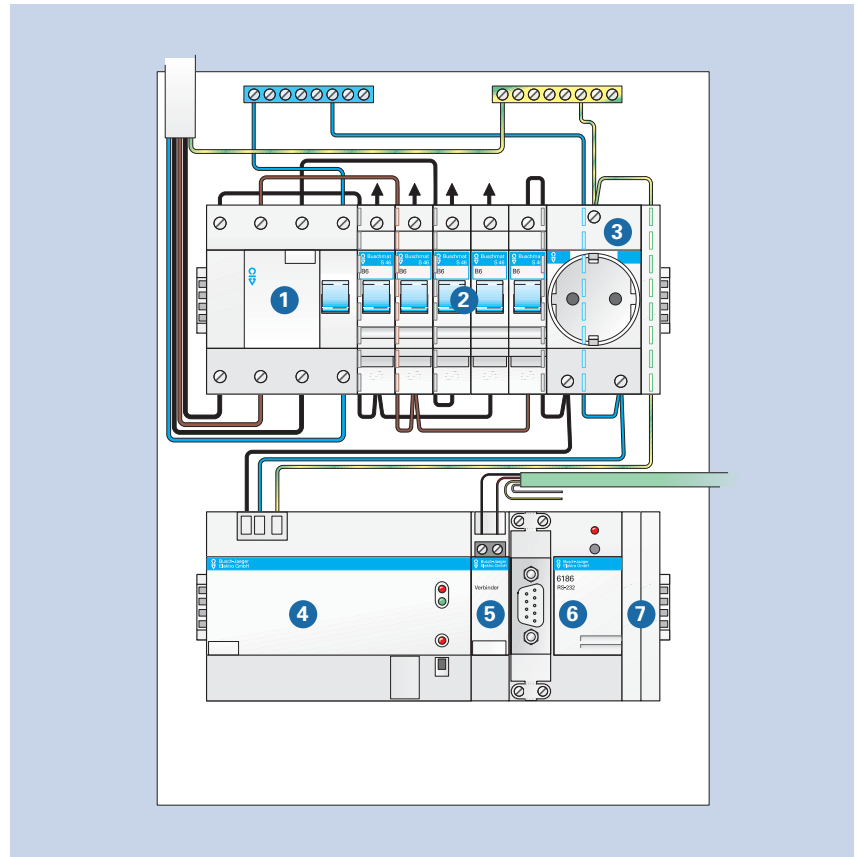
2. EIB System Overview

2.2 Typical distribution structure for one line

2.2 Typical distribution structure for one line

Description of the device:

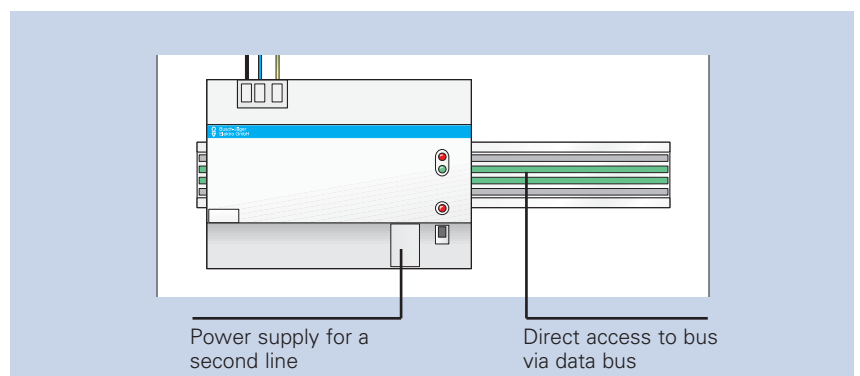
1. Residual-current-operated circuit breaker for sub-distribution board
2. Miniature circuit-breakers; reserve one for the EIB and the service socket
3. Socket for service work, e.g. for a lap-top
4. EIB power supply
5. Double connector (contact to the data bus)
6. RS-232 on the data bus for service work with the PC
7. Filler panel. The data bus can be seen inserted in the top-hat rail



Explanatory notes about the structure:

- There are 2 different sized power supplies, 320 mA and 640 mA. In cases of doubt, select the larger power supply with 640 mA, because some EIB stations consume double or several times the current. Connection is made to the low voltage mains supply (L, N, PE) and to the bus line (24 V).
- All the STNs associated with the line and the power supply are connected via this bus line.

! For service purposes, it is good policy to install a PC interface (RS-232) and a REG socket permanently in the sub-distribution board. The bus line of the PC interface must be connected via a data bus inserted in the top-hat rail. The data bus is typically connected to the bus line by means of a double connector, which is also snapped on to the top-hat rail.

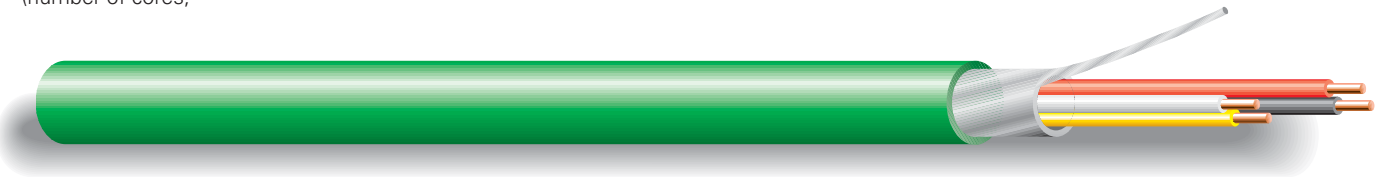


2. EIB System Overview

2.2 Typical distribution structure for one line

2.3 Line topology

- The bus line is led to the remaining stations. We recommend using an EIB-certified bus line. In addition to the requisite physical properties (number of cores, cross-section, isolation voltage, etc.), the bus line can be immediately distinguished from other weak-current lines.



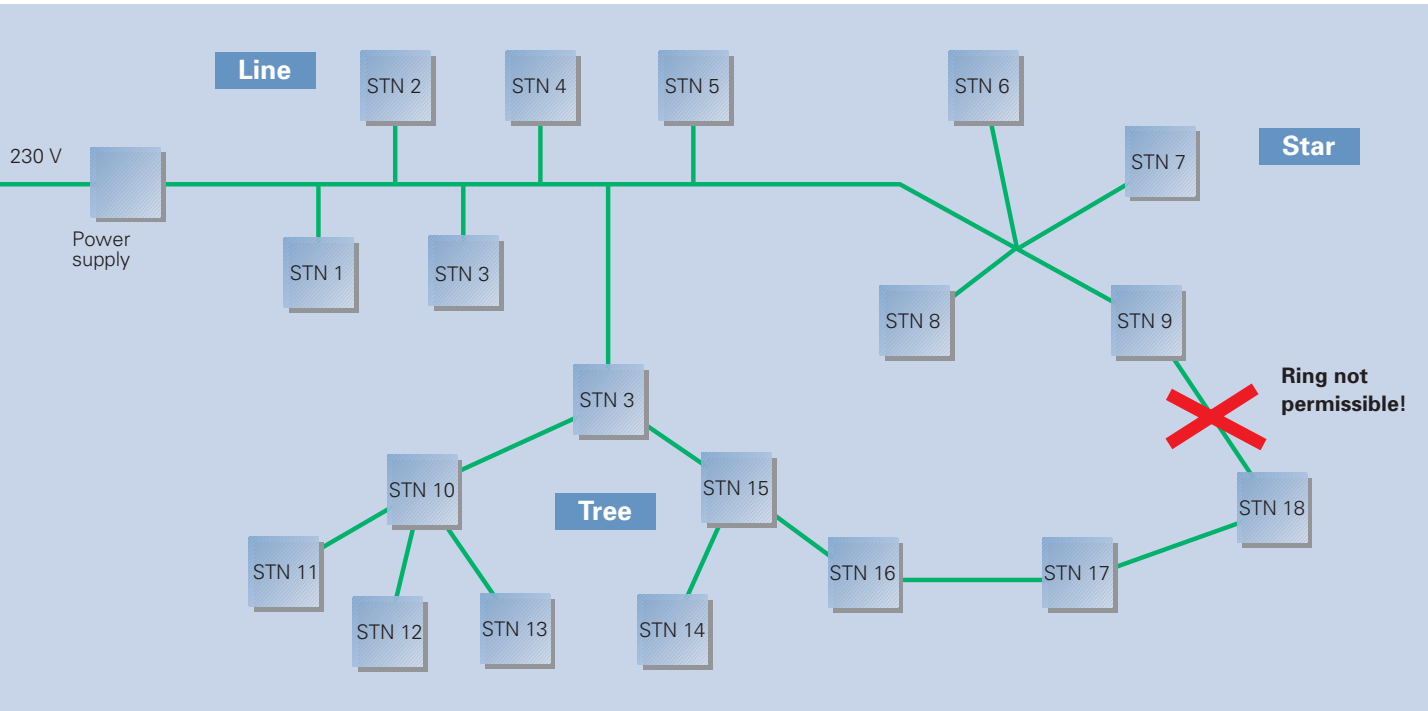
2.3 Line topology

The bus line of the EIB can be laid in almost any manner. The line topologies line, star and tree can be com-

bined. Only rings may not be used. **The EIB does not require a terminating resistor.**

! The maximum line lengths within a line may not be exceeded, however.

| | |
|---|--------------------|
| Power supply to the last station (TLN) | max. 350 m |
| From the first STN to the last STN | max. 700 m |
| Overall length | max. 1000 m |
| Minimum distance between two power supplies | min. 200 m |



2. EIB System Overview

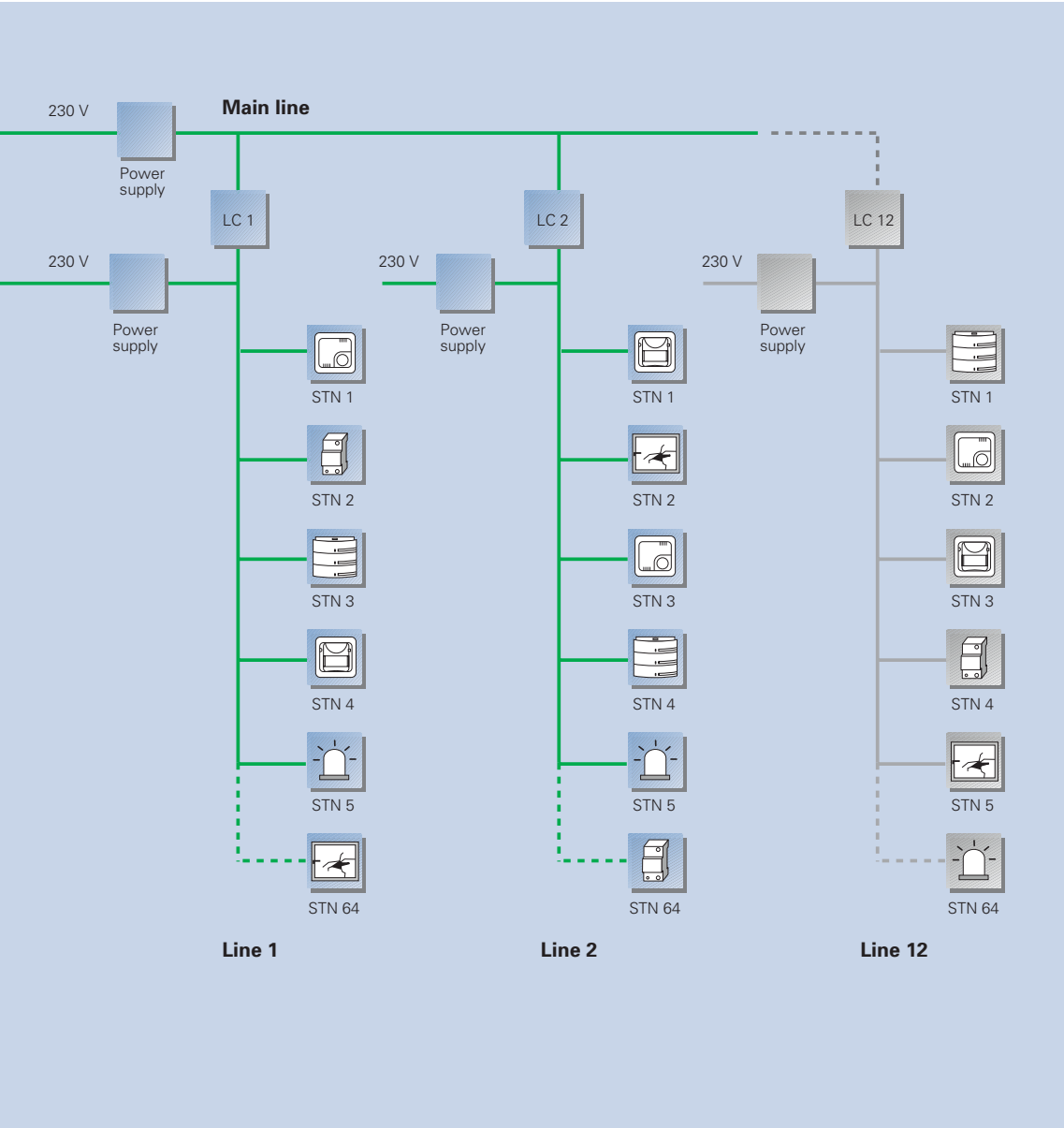
2.4 Distribution structure for several lines

2.4 Distribution structure for several lines

If there are more than 64 STNs, or several parts of the building are involved, with the result that it is necessary to bring in at least a second line, the

lines are connected together by means of a line coupler. The so-called main line, which also requires a power supply, forms the backbone of the line couplers.

Schematically:

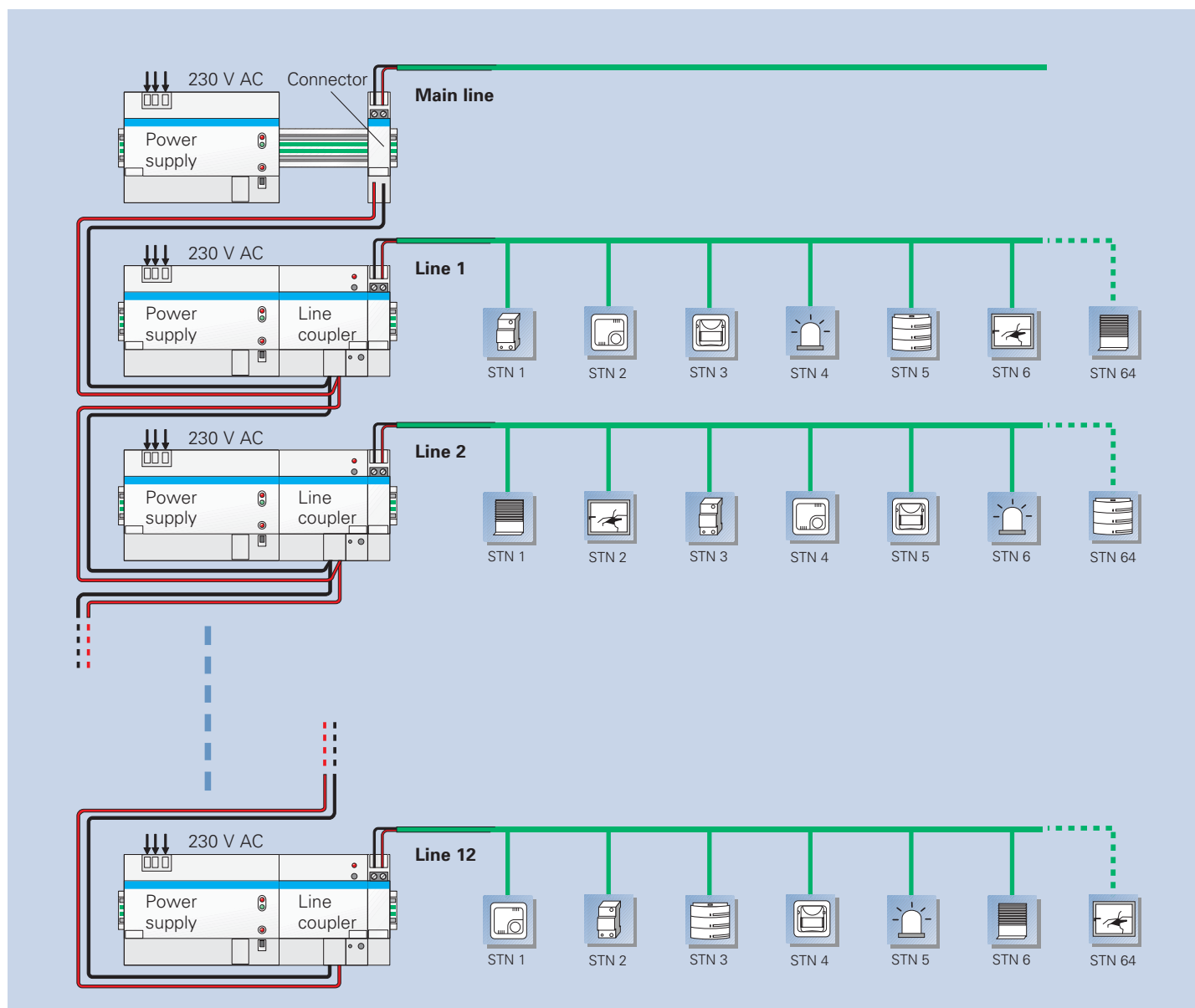


2. EIB System Overview

2.4 Distribution structure for several lines

! In practice, a new line should be configured with far less than 64 STNs, so that the addition of a single STN does not immediately require the installation of a second line.

Wiring:



2. EIB System Overview

2.4 Distribution structure for several lines

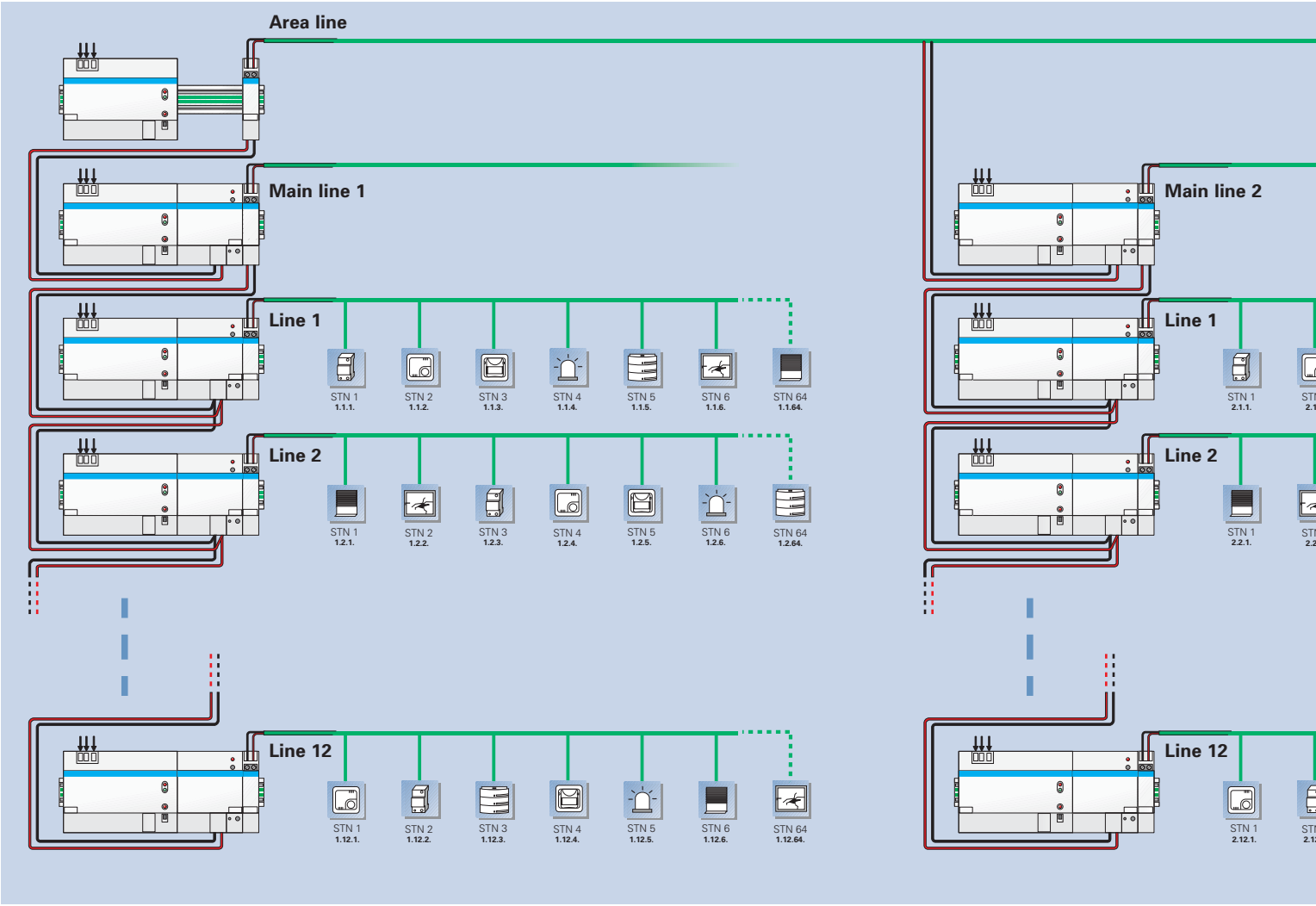
Up to 15 main lines can be combined in an area line if the number of devices required in a project exceeds the capacity of the 12 lines.

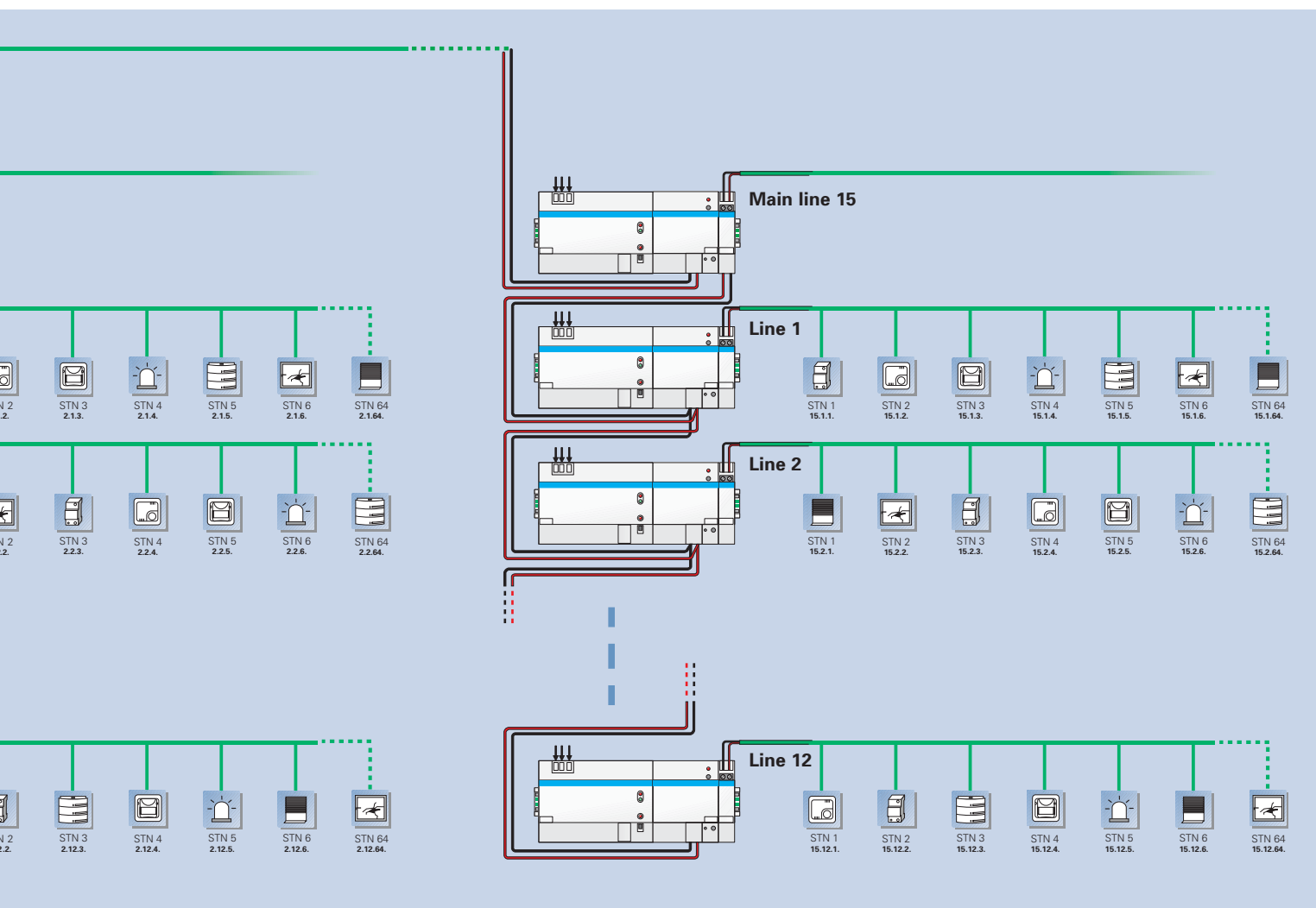
! The maximum number of stations of an EIB installation with 64 STNs per line.

For even larger installations, the topology can be extended **through further measures** to a max. of 255 devices per line. Mathematically, this results in a max. number of 45,900 stations:

$$64 \frac{\text{Stations}}{\text{Line}} \times 12 \frac{\text{Lines}}{\text{Area}} \times 1 \frac{\text{Areas}}{\text{Installation}} = 11,520 \frac{\text{Stations}}{\text{Installation}}$$

$$255 \frac{\text{Stations}}{\text{Line}} \times 12 \frac{\text{Lines}}{\text{Area}} \times 15 \frac{\text{Areas}}{\text{Installation}} = 45,900 \frac{\text{Stations}}{\text{Installation}}$$





3. EIB Cost estimation

3.1 General

3.2 Cost estimation in the preplanning stage

3.3 Cost estimation in the execution planning stage

3.1 General

Simplified cost estimation methods can be applied depending on these construction stages:

- preplanning
- execution planning

The objective is to portray the functionality in relation to cost. The proposed models naturally can not provide exact results that could be used in one form

or another in the final calculations.

Instead, the models illustrate the ability to estimate cost in comparison with conventional technology or other systems. Experience in the field has demonstrated that the costs for EIB in functional buildings generally are not higher than those of an alternative solution, since, even in buildings of lower

standards, the functions have a certain demand for automation.

For private properties, this is usually not the case, which explains the additional cost. In such cases, the end customer has to make a decision by weighing the resulting advantages.

3.2 Cost estimation in the preplanning stage

In terms of the electrical installation, preplanning simply entails estimating the total costs based on the prototype of the building to be constructed.

In doing so, a three-level, flat-rate sum based on the square-metre area of the building is often used to achieve this estimate. The so-called low, middle and raised standards used in this estimation generally do not specify details with regard to the individual assembly groups or their functions. This estimate can be described from the

perspective of the constructor or investor as more or less a rough quote of the costs based on the size of the building and the level of the equipment. Independent of the execution level, it can be said for non-residential buildings that the cost of implementing EIB does not differ from that of alternative solutions if EIB is to be used for automation tasks only. In the case of a lower standard, this can of course mean, for example, that only a few central fault messages or timed switch functions can be taken on. Nevertheless, even such limited implementations

have proved useful, as unforeseeable changes to the requirements profile are made continuously throughout the construction phase. The adaptability of the EIB is, especially in this case, a great advantage.

For private properties, the implementation is worthwhile only if there are increased requirements on the electrical installation. This for example could be the implementation of electric blinds or a high-quality lighting control system with light scenes.



- In functional buildings, it is generally possible during the preplanning phase to start at cost neutrality, even if the costs are estimated flat rate and based on square-metres area.
- For private properties, the implementation of EIB makes financial sense only if there are increased requirements.

3.3 Cost estimation in the execution planning stage

During the execution planning stage, the planner (generally the installer for private properties) determines the functionality of the electrical installation in co-operation with the client or the client's agent inde-

pendent of the system to be used.

The expected costs are then determined based on the functional description determined by the planner and client. Those who are new to EIB frequently find it especially difficult to estimate the costs. A frequent mistake is to base the

estimate on individual devices, which, without detailed context, often appear "too expensive." However, it is possible to come to an estimation that is quite accurate without great effort.

The cost estimate presented here is based on flat rates which have been calculated according to list prices in the € zone.

The estimate is calculated in four steps.

- Determining the costs of active devices
- Determining the costs of system devices including accessories
- Determining the costs of programming and commissioning
- Determining costs for special items

3. EIB Cost estimation

3.3 Cost estimation in the execution planning stage

An example:

This example is intended to clarify the process of cost estimation. A new school is to be built. A meeting between builders and building planners results in the following requirements profile, which includes the implementation of EIB.

Requirements profile:

In the classrooms, the lighting is to be switched off based upon outside brightness. In order to prevent interruptions, this should occur only during breaks. In laboratories and other special-purpose rooms, electric blinds are to be controlled in addition to the lighting. Likewise, the lighting of a break room is to be switched off when sufficient outside light is present. Furthermore, several messages, which have not yet been detailed, shall be provided.

Room list:

| | |
|------------------------------------|----|
| Standard classrooms | 40 |
| Laboratories/special-purpose rooms | 10 |
| Break rooms | 1 |
| Auditoriums | 1 |
| Teacher rooms | 2 |
| Offices | 5 |



1. Determining costs for active devices

Active devices are all actuators and sensors that are part of the EIB. Instead of calculating the actual, concrete device that is to be implemented, flat rates that are based on specific functions are used in estimating the costs.

- Switched loads 120 €
- Dimmed loads 220 €
- Groups of blinds 180 €
- Heating circuit
 - with continuously regulated valves 400 €
 - with electro-thermal valves 260 €
- Message monitoring 60 €

2. Determining costs for system devices

With the presumption that the individual EIB line is equipped with about 50 devices, and while assuming a mean price for active devices, it is possible to assess the costs of the system devices as well.

Costs of system devices =
7% of the cost of active devices

3. Determining the service cost

Based on experience and using flat rates, it is possible to estimate the costs for programming and commissioning.

- Programming 10% of the cost of active devices
- Commissioning 5% of the cost of active devices



Important: The programming can require significantly more time in private houses because each room can be assigned its own individual functions. Simply copying functions from room to room, as is often possible in commercial projects, frequently can not be done. In cases of complex application, programming costs of up to 20% of the cost of active devices can be reckoned with.

4. Special costs

Special costs include those which can not be estimated on a flat-rate basis.

For example:

- Visualisations
- Integration with other systems
- ...

Our example:

Switched loads

50 classrooms each with 2 lighting groups
1 break room with 4 light groups
104 light groups = 12480 €

Blinds

10 special-purpose rooms (assuming each has 2 groups of blinds) 1800 €

Heating

No heating control with EIB 0 €

Message monitoring

Flat rate assuming
5 fault messages 300 €

Total active devices 14580 €

System devices

14580 € * 7% = 1020.60 €

Material costs 15600.60 €

Programming

14580 € * 10% = 1458.00 €

Commissioning

14580 € * 5% = 729.00 €

Service 2187.00 €

Materials + service 17787.60 €

In our example, visualisation of EIB functions is planned from a central location. Because the requirements profile is not very complex, we have chosen a simple touch screen as the visualisation interface in our example.

Material costs

Touch screen approx. 1000 €

Service

Graphic design and integration
of the EIB data points approx. 500 €

Special costs 1500 €

Total cost of our example 19287.60 €

4. Electrical Design (Consulting)

4.1 General

4.2 Installation sheets

4.1 General

Planning with EIB differs little from planning based on conventional techniques. There are two differences, however, which the planner needs to consider.

- 1.The specification (bid) should include a detailed functional description, as the functionality generally can not be determined from the bid devices. This functional description allows the tendering company (usually the installer) to estimate the input required for programming the building being constructed.
- 2.The layout of the EIB should be illustrated in a diagram. This provides additional information on time and cost requirements and illustrates the planned structure of the project. (Refer to "Topology".)

Recommendations for planning with EIB: Field experience has shown that the less experienced tend to offer the EIB as a separate item. This leads to the following disadvantages:

- Only with difficulty can the tendering installer make correlations between the various assembly groups.
- The constructor gets the impression that the EIB is an optional item that can be removed from the bid. This of course is the case only if an alternative system is implemented (which often requires further measures) or if the parties renounce agreed solutions.

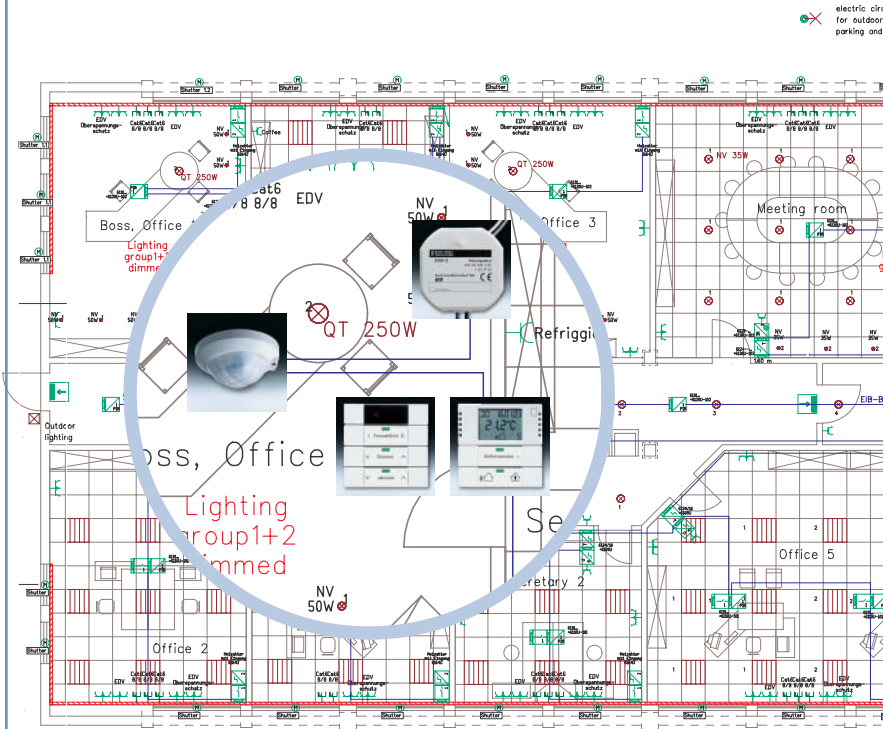
This can be avoided by integrating the planned implementation into the standard segmentation of the specification (e.g. lighting, heating...) bid.

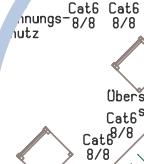
! Note: Programming the devices generally is not included in the planning. Instead, this service is provided by the company carrying out the installation or by a specialised service provider.

4.2 Installation sheets

Like planning using conventional technology, the installation plan provides information on the spatial positioning of the installation devices, the function

can not be mirrored in the plan because the function is ultimately determined when the devices are programmed, not when they are installed.

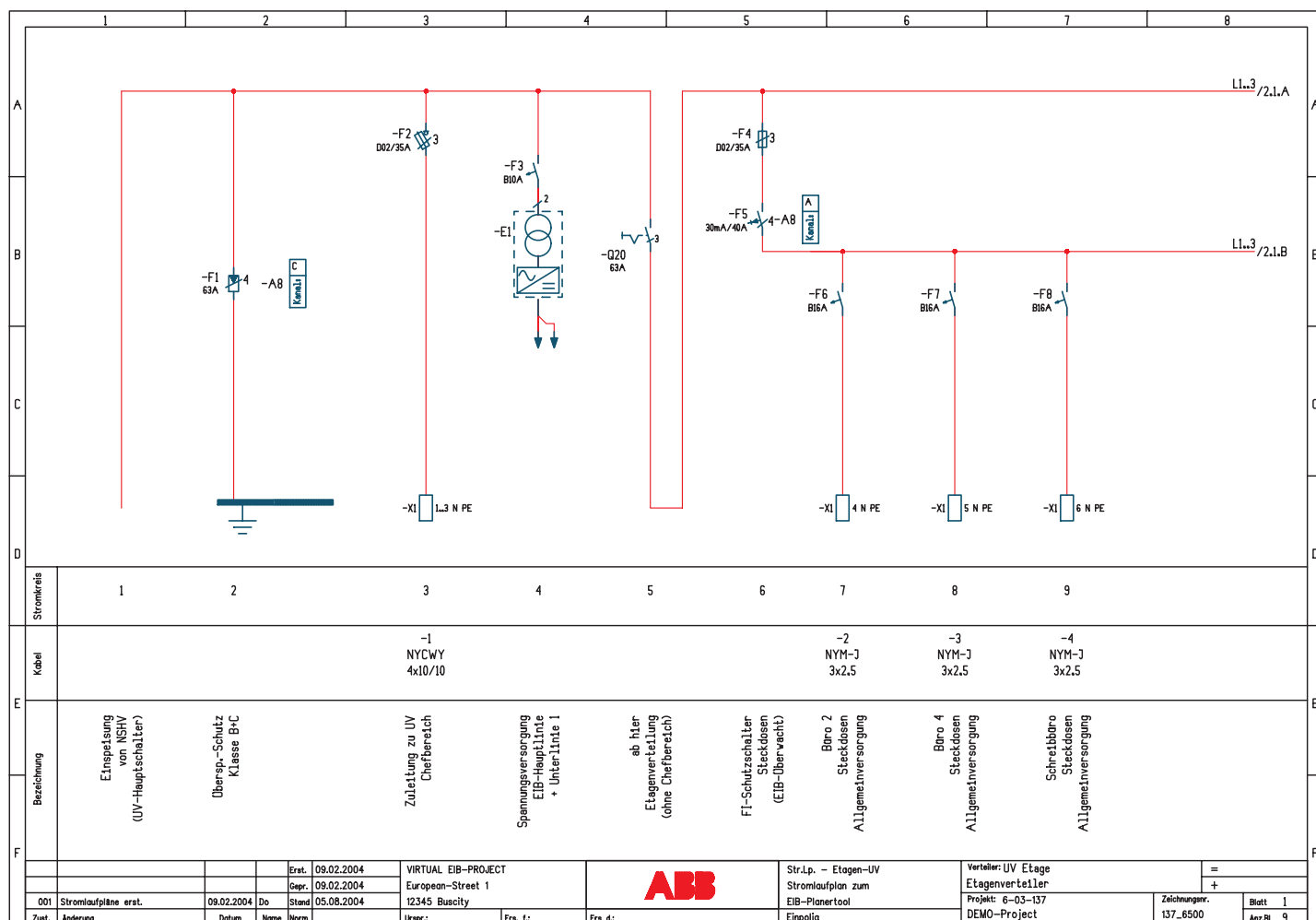


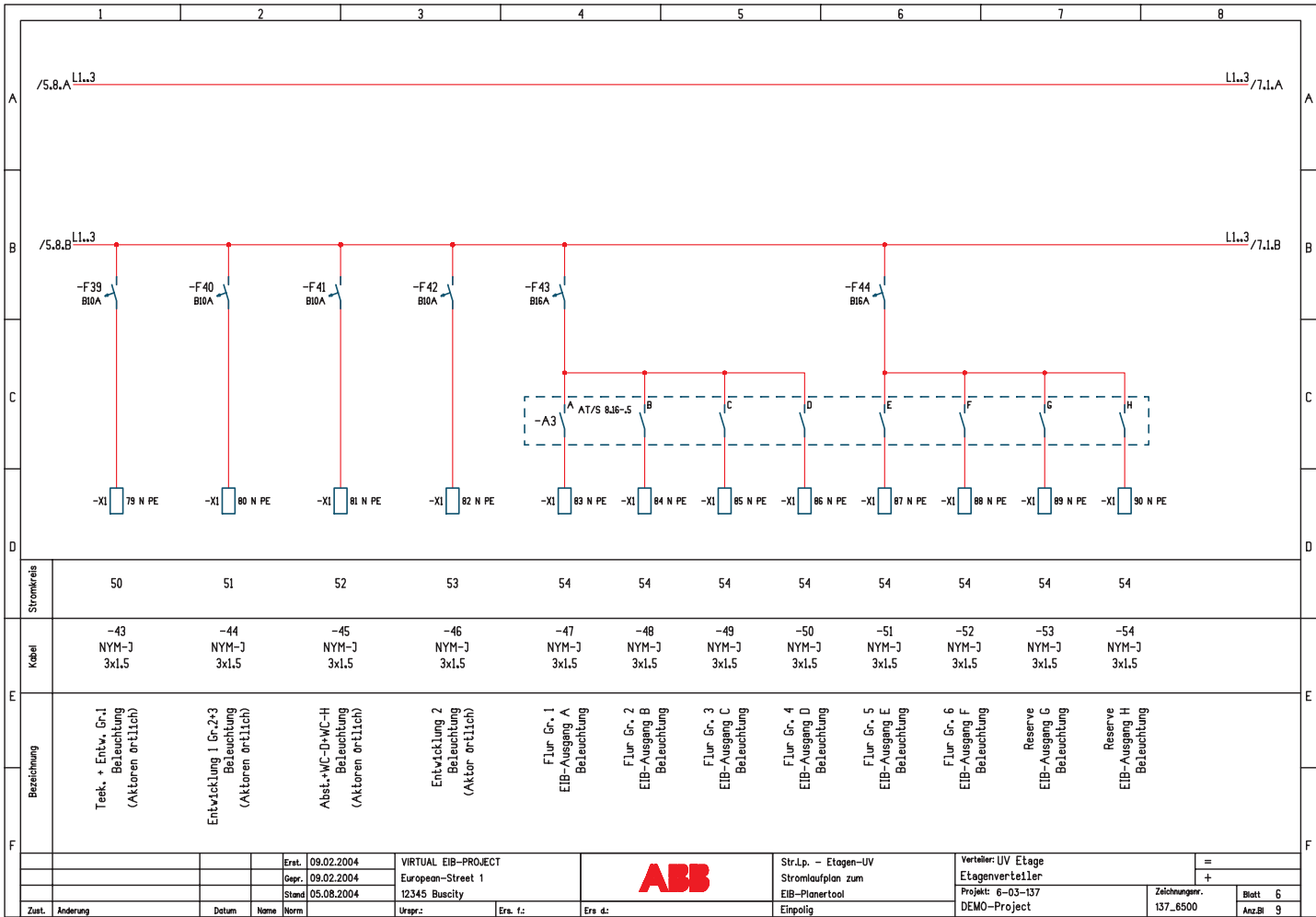


| | | | | | | | |
|--|--|--|--|------------------------|--|----------|--|
| | | | | Station: 150 | | Ordnung: | |
| | | | | Projekt: 6-03-137 | | | |
| | | | | DEMO-Project | | | |
| | | | | Address: | | | |
| | | | | VIRTUAL EB-PROJECT | | | |
| | | | | Wurzburg-Street 1 | | | |
| | | | | 12345 Buacity | | | |
| | | | | PLOT Basement | | | |
| | | | | Excavate, Installation | | | |
| | | | | and lighting | | | |
| | | | | Zeichnungen: 137_6300 | | | |
| | | | | Sheet 01 | | | |

4.3 Circuit diagram

The single-line diagram is the most common in the plan. Multiline diagrams are needed only in special cases and in revision plans.





4. Electrical Design (Consulting)

4.4 Operation chart

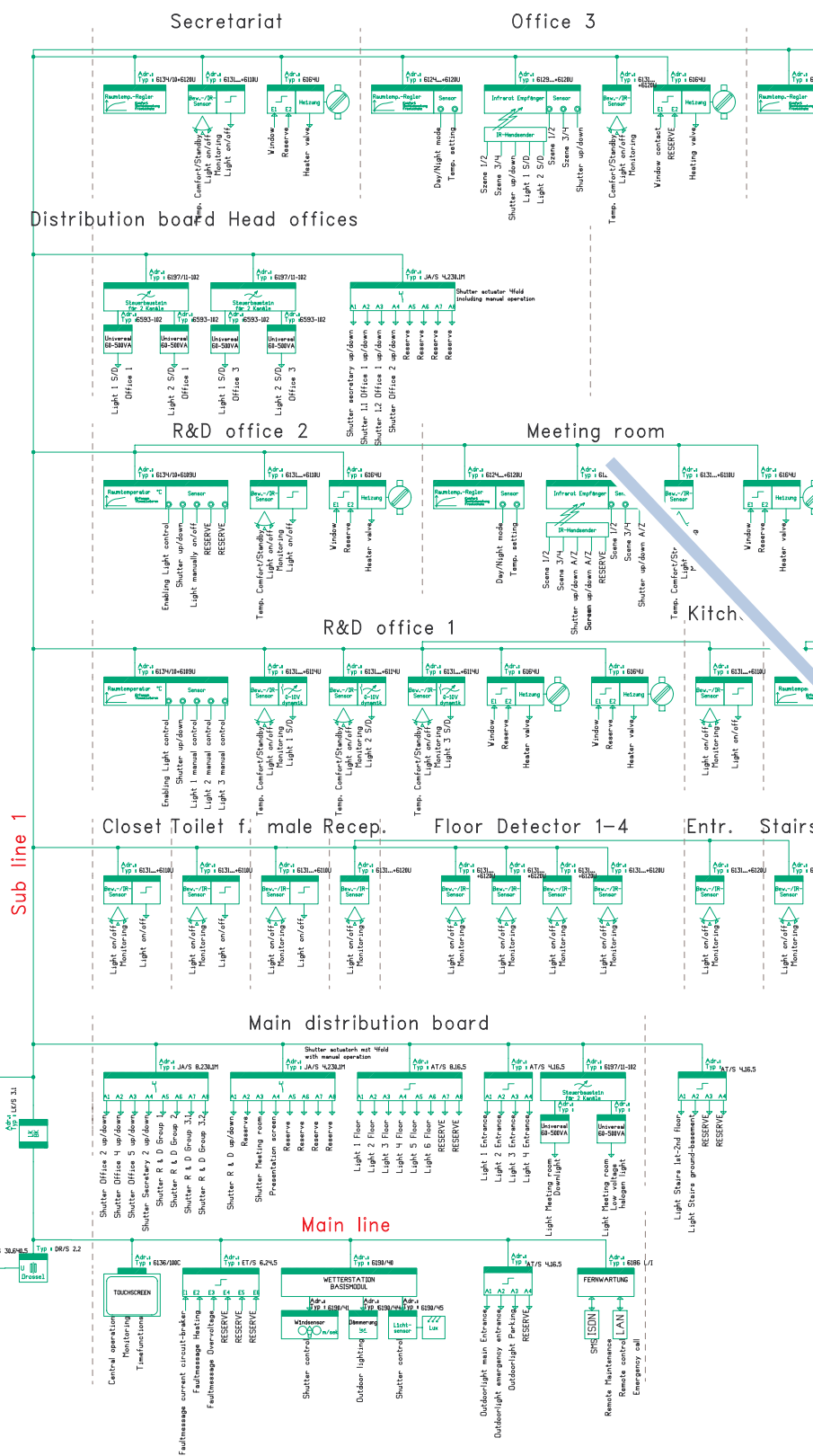
4.4 Operation chart

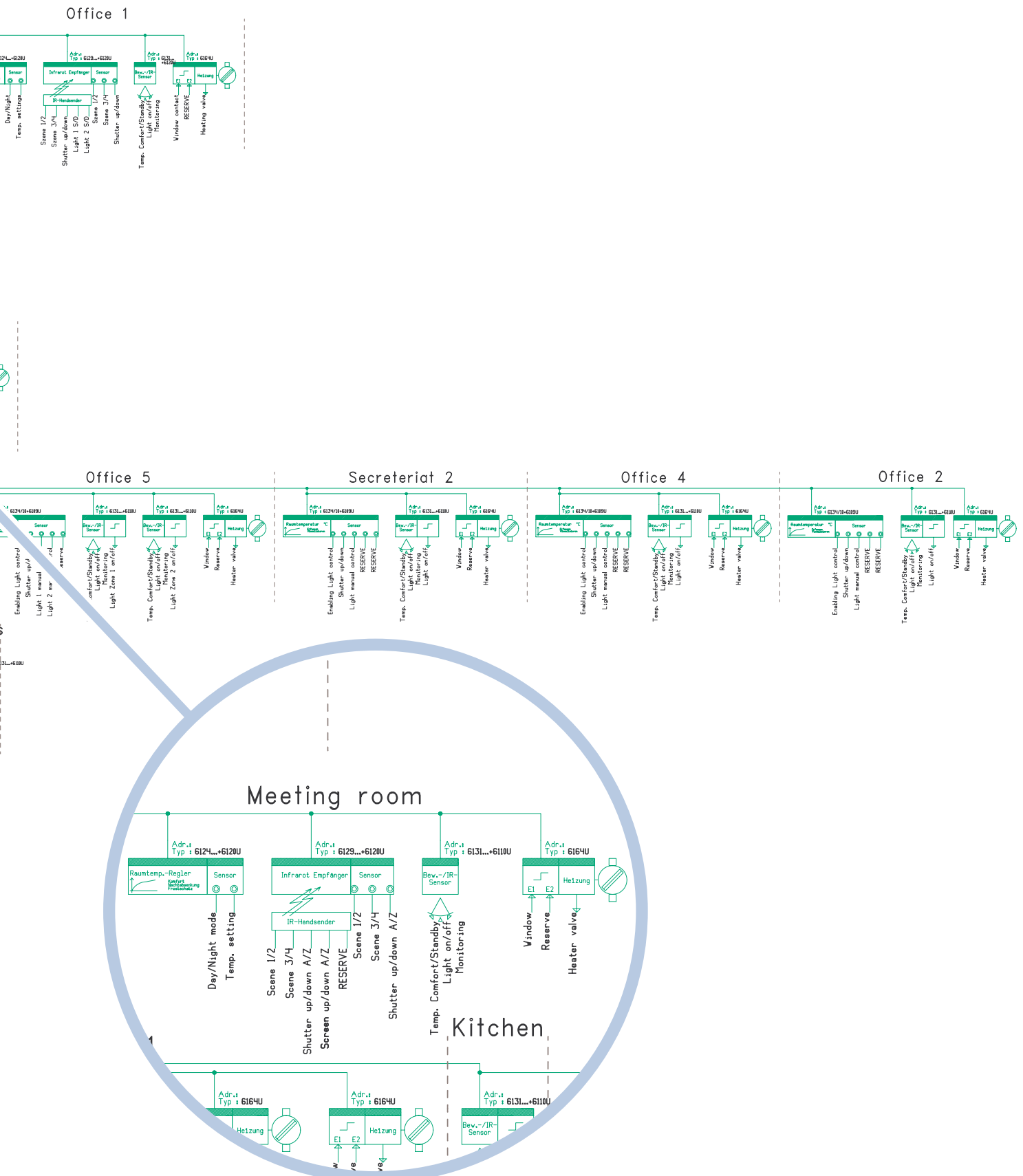
Use of this selected representation:
The representation serves the overview of all in the building contained bus participant.

Even all individual operations by channel can be visualized. Only thereby is a optimized information exchange between planners – contractor and sometimes even to the owner possible.

This pattern is always developed and adapted by the design planning up to the production of the revision documents far!

Fault locating, later extensions and program modifications can take place on the basis this representation also unproblematically without detailed project knowledge!





5. System Engineering

5.1 The European Tool Software (ETS)

5.2 The programming process

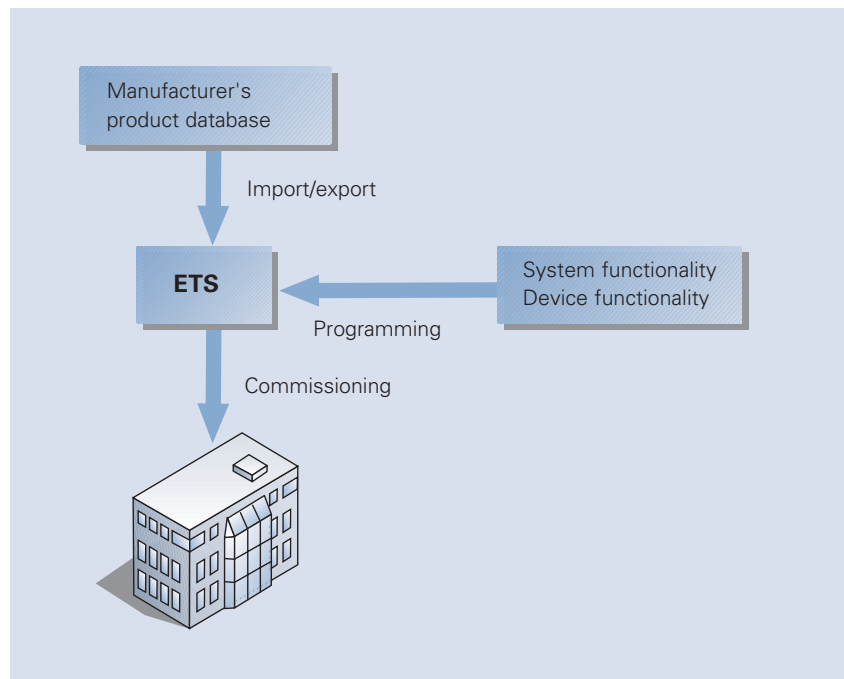
5.1 The European Tool Software (ETS)

The ETS is the standard software used for commissioning the EIB. Unlike other systems, all manufacturers of EIB products use the ETS to commission their devices. This guarantees product compatibility between different manufacturers. The product data can be obtained from the manufacturers free of charge. The product data

can be imported into the ETS by the user without a problem.

The ETS is not free of charge and can be purchased through the EIBA: www.eiba.com/index.html

Training programmes are offered in many countries through certified training establishments. For more information on training, please ask your representative.



5.2 The programming process

Programming the system in the ETS requires several steps.

Create the building structure (optionally)

Building, storeys and rooms/distributors of the project are defined in the form of a tree structure.

Create the devices of the project

The devices required are added into the rooms/distributors and their parameters are defined. Unique "physical addresses" are assigned to the devices (see diagram on the right)

Define the functions in the project

Each function is given a name, which serves as the so-called group address (see diagram on the right)

Create the interconnections

Devices are linked via the group addresses, which is comparable to the layout and connection of control lines in the conventional technology.

5. System Engineering

5.2 The programming process

5.3 The commissioning process

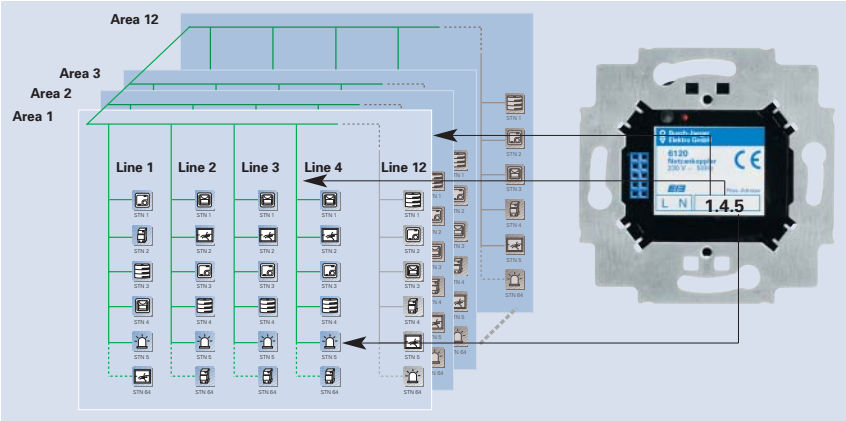
There are two fundamentally different addressings:

- Physical address
- Group address

Physical address

The physical address acts like a telephone number for each individual station. As a consequence, each physical address occurs only once in an EIB project. On the basis of physical address, you can also recognize in which line the STN is located.

Area 1
Line 4
Station 5 } 1.4.5



Group address

The group address also serves as a numbering for the individual functions. A group address occurs in a project at least twice, once for the sensor and once for the actuator. The sensor and actuator are functionally connected by their being assigned with the same group address. The group address sent by the sensor is heard by the actuator,

and the corresponding switching operation is carried out. Division into main and sub-groups has become normal policy. From ETS 2, there is a second method of repre-

sentation on three levels: main group, mid-group and sub-group. Irrespective of the addressing mode, up to 32,768 different group addresses can be assigned in one project.

| | Addressing on two levels | Addressing on three levels |
|---------------------------|---------------------------|----------------------------|
| Main group | 0 – 15 = 16 addresses | 0 – 15 = 16 addresses |
| Mid group | | 0 – 7 = 8 addresses |
| Sub group | 0 – 2047 = 2048 addresses | 0 – 255 = 256 addresses |
| Number of group addresses | = 32,768 addresses | = 32,768 addresses |

5.3 The commissioning process

To commission the system, the programmer's local computer has to be connected to the EIB installation. The following options can be used to achieve the connection:

- Serial COM port
- USB port (with ETS3 and later)
- LAN/ISDN gateway (remote maintenance)

Once one of these connections has been established, the next step is to load the physical addresses into the device. This requires pressing a programming button on the device once. After this is done, the so-called applications (which comprise the actual device program) can be loaded. This takes place via the bus, without having to access the device manually.



6. Tips and tricks

1. Do not plan with more than 40 to 45 stations (STNs) per line when using the Busch EIB Installation Bus, so that a second line is not immediately required in the case of extension.

2. Adapt the bus structure to the building, e.g. one line to each floor. This increases the transparency of the project.

3. A certified bus line has two core pairs. The first core pair (black and red) is required straight away. The second one can be subsequently used for another purpose, as required. It is therefore good policy to wire up this second core pair in each branching box, etc, as well.

4. We recommended providing several programming facilities in larger Busch EIB Installation Bus installations. This means providing a serial interface (for the bus connection) and a socket (e.g. for a lap-top) at several locations.

5. Use a certified bus line. This has the requisite physical properties (number of cores, cross-section, isolation voltage) and can also be easily distinguished from other weak-current lines. Possible cable types are: JY(ST)Y 2x2x0.8 or PYCYM 2x2x0.8.

6. In principle, there are two ways of arranging the actuators in a building; decentralized in suspended ceilings or centralized in sub-distribution boards. Both possibilities have their advantages:

decentralized

- less installation work
- fewer lines and, as a result, lower fire load and smaller cableways
- smaller sub-distribution boards

centralized

- the devices are more easily accessible
- the devices are clearly arranged

