Transmission via bus lines

2.6 Electrical installation

The electrical installation for the application areas described in chapter 2.2 is carried out by skilled electricians in accordance with the regulations for setting up power installations, with particular regard to the standards of the DIN VDE 0100 series.
In addition, it is also necessary to observe the technical requirements, such as for example, adhering to the maximum number of bus devices per line, maximum line lengths or the correct address allocation.
In conventional installations, the wiring and how it is arranged as well as the number of lines and devices have all determined the function of an installation. With *EIB* however, the function is determined by the application program of the device with its parameters and group addresses. The same installation can for example be used for other functions if the usage changes or if there are any extensions.
The *EIB* is laid together with the mains installation and operated with SELV low voltage (24 V DC). The bus installation requires no additional tools, devices nor measuring and testing equipment.
The same installation conditions for the mains installation are valid for the bus lines and bus devices. This is also true for conditions in special rooms or locations. If for example protection level IP 44 according to DIN VDE 0470-1 is prescribed for an installation in humid rooms, then the bus devices must also correspond to these regulations or they must be installed in suitably protected housings.
The current practice of installation is described in many documents and manuals. References are given in AppendixE.

2.6.1 Intersections and adjacency

2.6.1.1 Intersections with and adjacency to power installations

2.6.1.1.1 Intersections and the adjacency of lines

In order to avoid the formation of loops, the bus lines should be laid directly next to the mains power lines, i.e. no separation between the two (see chapter 2.5.3.4).
Bus lines, e.g. YCYM 2x2x0.8 (*EIB* specification, Appendix G, DIN EN 50090-2-2), may also be laid together with cables and lines in pipes and channels according to DIN VDE 0100-410 (HD 384.4.41.S2).

2.6.1.1.2 Intersections and adjacencies in distribution panels

Mains power lines, bus lines and other associated installation devices may be installed next to each other in distribution panels. To ensure protective separation of the bus line and power networks, the requirements of chapter 2.6.1.1.1 must be met. The following points should also be taken into consideration:

– Insulated wires of the plastic-sheathed mains lines and the installation bus lines can be laid without a separating gap (see Fig. 2.6-1).
– Insulated wires of the installation bus lines must be laid at a distance from the plastic-sheathed mains lines. The conditions illustrated in Fig. 2.6-2 are valid.
– Insulated wires of the installation bus lines and mains lines must be laid with a minimum separation equal to 4 mm or with an equivalent insulation using a separator or flexible insulating tube around the wires of the bus line (see DIN VDE 0110-1, base insulation and Fig. 2.6-2). This is also valid for the wires of lines from other circuits that are not SELV or PELV circuits.

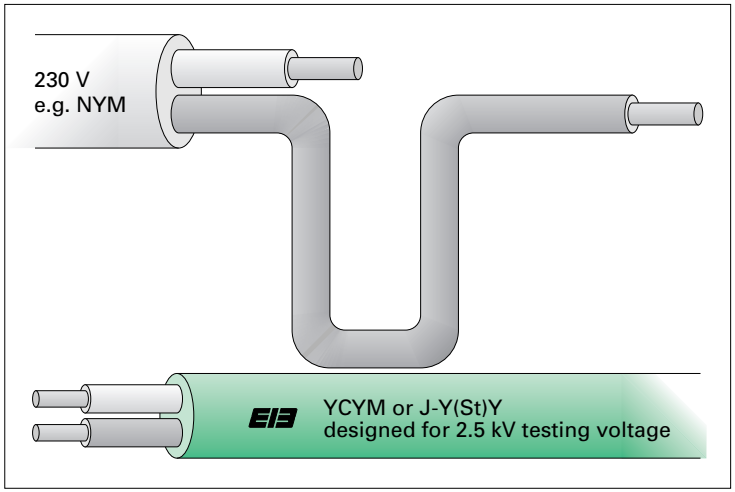

Fig. 2.6-1 *Insulated 230 V wires next to the casing of the bus line (schematic representation)*

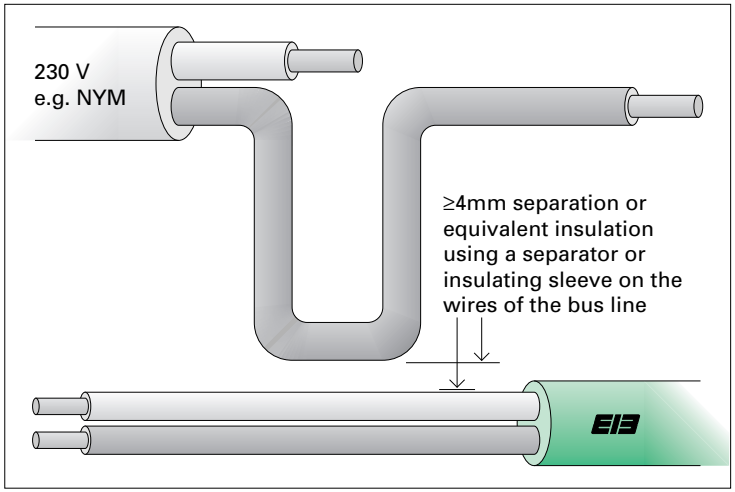

Fig. 2.6-2 *Adjacency of individual wires (schematic representation)*

– Exposed sections of data rail must be covered with suitable cover strips. This avoids any accidental contact with loose mains wires or with wires from other lines, whilst at the same time protecting the data rail from dirt.

2.6.1.1.3 Intersections and adjacencies in installation sockets

Bus and mains line wires may exist in the same installation socket, if there is a secure means of separation between the two sets of wires. If installation sockets with fixed terminals are used, then it is also possible to use installation sockets without fixed separating walls. The conditions outlined in chapter 2.6.1.1.2 must be taken into account.
Otherwise, separate installation sockets must be used for bus and mains lines (see Fig. 2.6-3).

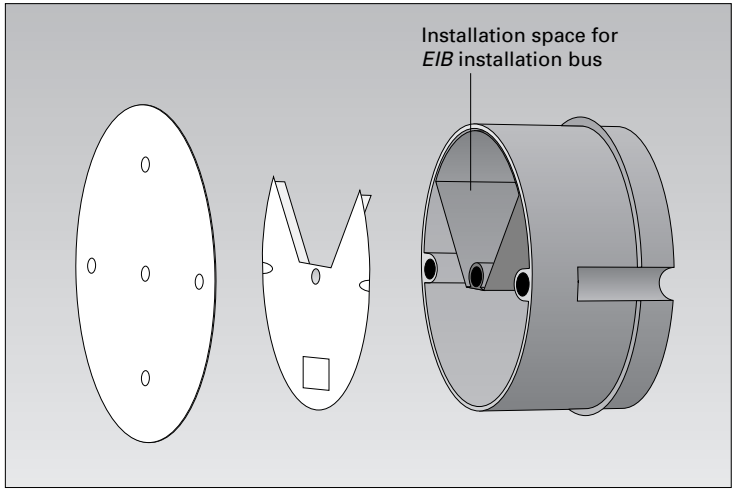

Fig. 2.6-3 Installation socket with separator/separating wall

2.6.1.1.4 Adjacency in flush-mounted combinations

If bus and mains power devices are used together in flush-mounted combinations, the mains part must remain protected against direct contact once the covering has been removed (e.g. by a separate covering).
The “protective separation” in flush-mounted combinations of bus and mains devices must be guaranteed by the way in which it is constructed. The advice of the manufacturer must be observed. This is particularly relevant when using under difficult conditions (surge voltage category, contamination level).

2.6.1.2 Intersections and adjacency to public telecommunications systems

As regards public telecommunications systems, the bus network and its components must be treated as power installations (see FTZ 731 TR1).

2.6.1.3 Intersections and adjacency to other low-voltage networks

The conditions described in chapter 2.6.1.1.2 hold true for the circuits of telecommunications systems that are not SELV or PELV.
With the SELV and PELV low-voltage circuits, it is necessary to guarantee a basic insulation according to the voltage load.
All SELV/PELV circuits can be laid directly next to the bus lines.

2.6.2 Laying the bus line

The procedure of laying the bus line is described in detail in chapter 2.5.3.4 and chapter 2.6.1.1.

2.6.2.1 Stripping the bus line

Tracer

The bus lines have single wire conductors, which do not require any special preparation for the connection.
The casing should only be removed from a point after it enters the installation socket. The shielding tracer must not be damaged. The exposed shielding film can be removed.
The used bus wires are usually stripped to a length of 10 mm and always plugged into a bus terminal.

2.6.2.2 Securing the free wires and the shielding tracer

The wires that are not used together with the tracer can be rolled up or bound back as shown in Fig. 2.6-4. They must not be cut off.
These free wires and the shielding tracer must not come into contact with live parts or earth potential (using the second wire pair, see chapter 2.5.1.2.2).

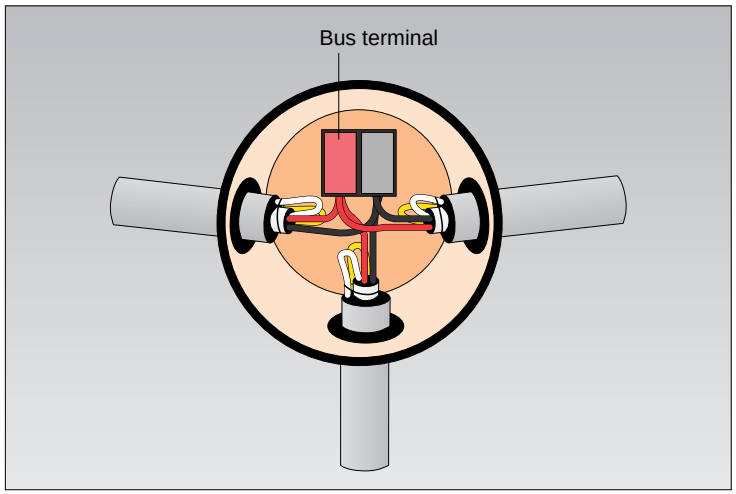

Fig. 2.6-4 Installation socket

2.6.2.3 Connecting the bus line, junctions

Fig. 2.6-4 illustrates an installation socket. Up to a maximum of four lines can be connected to the bus connection terminal. When using the non-screwed variant of the bus connection terminal we recommend using it for one termination per connection only (possible uncertainty in the contact after releasing the wire from the terminal and reinserting it).

2.6.2.4 Laying in electrical installation channels and conduits, surface mounting, flush mounting

Reliable methods of laying the bus lines are given in the associated data sheet (see Table 2.5-2). If there is any danger of damaging the bus lines, mechanical protection such as installation channels or conduits should be provided.

2.6.2.5 Identifying the lines

Identification of the bus lines is strongly recommended. The term "BUS" or "*EIB*" should be clearly marked. The code used must be unique, permanent and legible – please refer to DIN VDE 0100-510 (see Fig. 2.6-5).

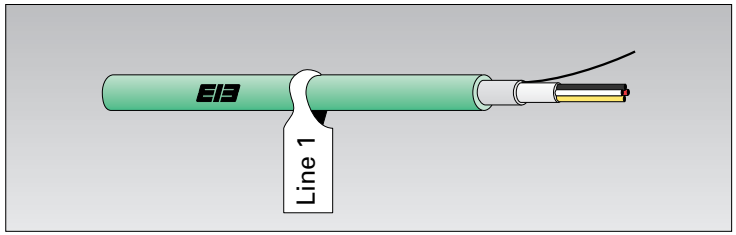

Fig. 2.6-5 Example of a line identification

2.6.3 Preparatory work in the distribution panels

The self-adhesive data rail is fixed into the DIN rail. The bus lines are connected to the data rail via data rail connectors. Contact with the data rail is achieved by snapping on the connector. The bus line is connected to the terminals of the connector.
During installation the following should be taken into consideration:

- Before attaching the data rail, the DIN rail must be clean and free from grease.
- The data rail must be kept clean. Remove the protective foil before snapping on the DIN rail mounted units.
- In order to guarantee the necessary air gaps and creepage, the data rail must not be cut or changed in any other way. Nothing should be soldered onto the metal strips. Length should be specified when ordering.

2.6.4 Checking the line network

2.6.4.1 Line lengths between bus devices

Line length

As the length of a line is limited and there are maximum allowed line lengths between bus devices which must not be exceeded, the line lengths established during planning must be compared with the actual line lengths. Table 2.5-1 specifies the threshold values, which must be observed. The total length of a line is the sum of all sections, including any branching (see Fig. 2.6-6).

2.6.4.2 Prohibited connections

Prohibited connections are those between two lines in addition to the connection via the line coupler or area coupler.

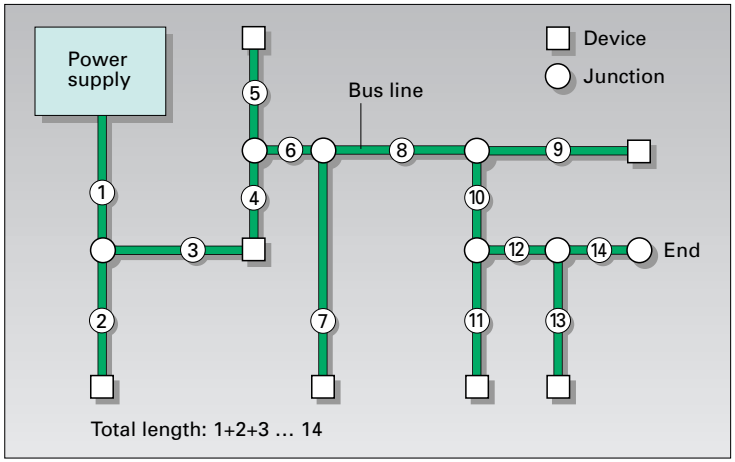

Fig. 2.6-6 Establishing the line lengths in the EIB-TP bus network

2.6.4.3 Checking continuity, short circuit, polarity, prohibited connections and adherence to maximum line lengths

Within an *EIB* installation, the procedure is as follows for each individual line:
The line to be checked is connected to an *EIB* power supply or to a short circuit proof constant voltage source (6-15 V DC, current limitation approx. 1 A). The voltage and polarity of all bus line ends and bus terminals are checked with a d.c. voltmeter (see Fig. 2.6-7). Prohibited connections are discovered by checking the voltage at the wire ends that belong to other lines. If the wiring is correct, there should be no voltage.
The bus line lengths and separations are most effectively checked when laying the lines. All line ends of a bus line (including any branching) should be marked accordingly. The procedure is the same for main and area lines.
Basically, the regulations according to DIN VDE 0100-610 must be observed.

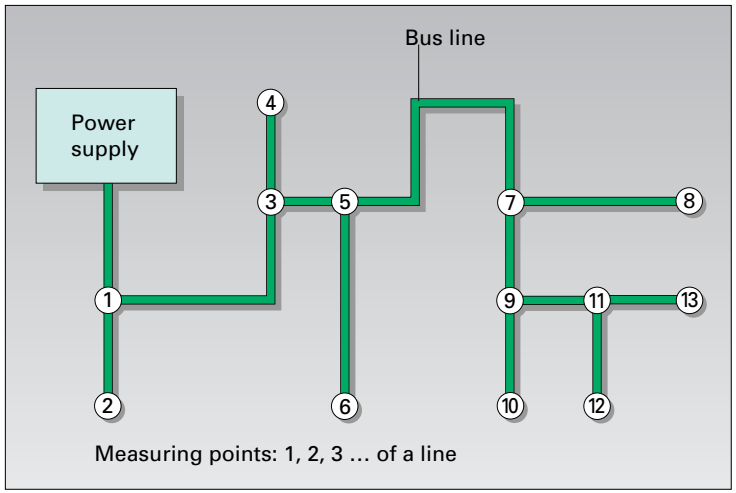

Fig. 2.6-7 Measuring points

2.6.4.4 Measuring the insulating resistance

The insulating resistance of the SELV circuit must be at least 250 kΩ, testing voltage 250 V DC.
If lightning arresters (primary protection) and/or surge arresters (secondary protection) are installed, then they must be disconnected before beginning with the measurement of insulating resistance.
The results of all tests should be logged (see Fig. 2.6-8).

2.6.5 Identifying, installing and connecting the bus devices

Before installing the devices, the lines must have been laid right up to and into the installation sockets and circuit distributors, identified, connected with bus terminals and checked.
During the project design stage, all bus devices are assigned a physical address (see Fig. 2.6-9). The location sites are documented in the equipment list and the ground plan. The

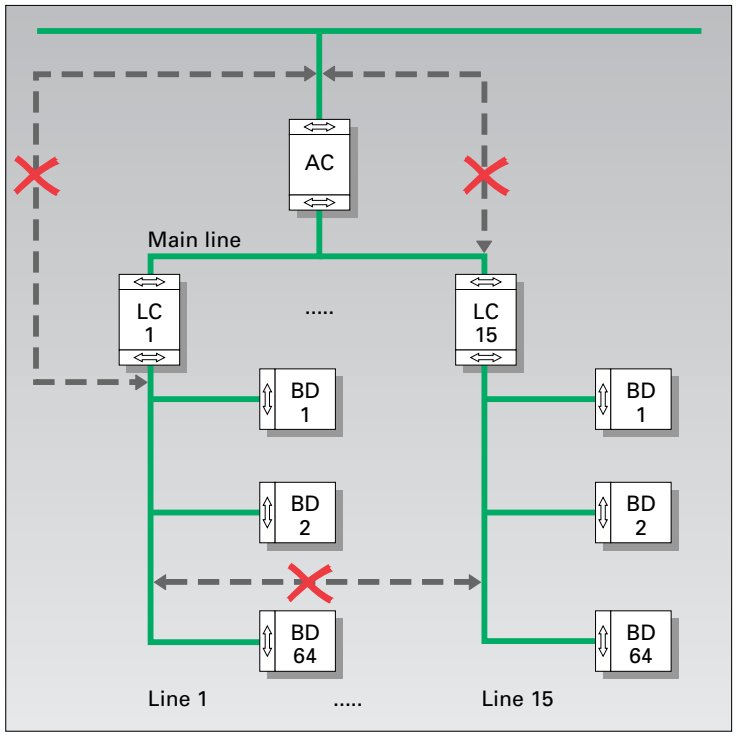

Fig. 2.6-8 Prohibited connections

physical address can be loaded into the bus device either before installation, e.g. in the workshop, or after installation during the commissioning stage. After the physical address has been loaded, the bus device should be marked with it. This ID must be unique, adequately permanent and legible (see DIN VDE 0100-510).
Bus devices, into which the physical address has been loaded prior to installation, must be installed at the planned location.

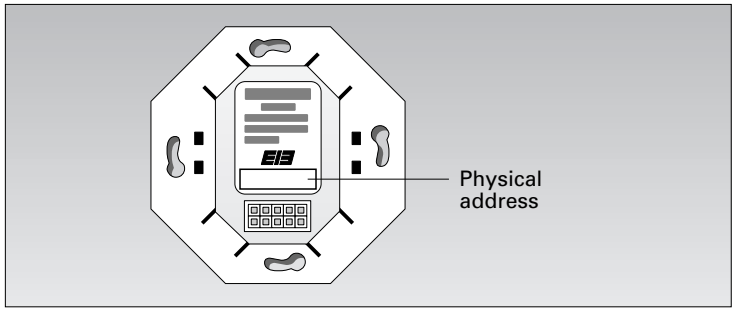

Fig. 2.6-9 Identifying the bus devicess

2.6.5.1 Bus devices for flush mounting

First of all, the bus terminal with the connected bus line is fitted onto the bus coupling unit (BCU). The bus coupling unit is secured by screwing the mounting frame (supporting ring) to the installation socket.
After programming, the application module is fitted onto the bus coupling unit.
In order to guarantee that e.g. after painting , the application module is fitted back into the assigned bus coupling unit, both the bus coupling unit and application module should be marked with the physical address.

2.6.5.2 DIN rail mounted units

DIN rail mounted units are either compact or modular devices, which can be clipped onto the DIN rail with built in data rail, by means of which they are connected to the *EIB*.
Exposed sections of the DIN rail with built-in data rail must be provided with covering strips.
The general layout of distribution panels with bus and mains components is described in chapter 2.5.2.2.6.

2.6.5.3 Surface-mounted units and equipment with in-built bus devices

These devices are installed according the manufacturer's instructions. Bus and mains lines are connected to the specific terminals provided.

2.6.6 Earthing and potential equalisation

To avoid electrostatic discharging, every line must be connected to earth potential via the protective impedance that has already been built into the *EIB* power supply by the manufacturer. To achieve this, connect the *EIB* power supply terminal marked earth to the nearest earthed terminal. This connection is green-yellow.
The bus lines are shielded. These screens are not earthed and should be included in the potential equalisation. The screens are not connected through line sections. It is necessary to ensure that the screen does not come into contact with earth potential or any live parts.

2.6.7 Test log

Test log

Before commissioning an *EIB* installation, a test log should be recorded containing all the tests described in chapter 2.6.4. In particular, it must include the results of the following tests (test certificate):

a) Arrangement of the installed bus devices, installation sockets and circuit distributors.
b) Laying of the bus line.
c) Continuity and polarity
d) Insulating resistance of the bus line.
e) Designated names of the bus lines.
f) Designated names of the lines in the circuit distributors.

An example of a typical test log is given in Fig. 2.6-10.

Originaldaten der Prüfprotokolle liegen uns nicht vor !!!

Fig. 2.6-10
Example of a test log

2.7 Commissioning

A prerequisite for commissioning is the completion of both the bus and power installation. The bus devices must be supplied with power.
A PC with the ETS software (*EIB* Tool Software) is required for commissioning the bus devices.
The manufacturer's instructions should be taken into consideration during commissioning.
The devices must always be marked with their physical addresses, in order to be able to uniquely identify them during installation, in the case of extensions or when servicing the system (see chapter 2.6.5).
Conventional installation devices are commissioned in the usual way. This well-known procedure is therefore not covered in this manual.

2.7.1 Loading the physical address

Chapter 6.7 includes a detailed description of the process of loading the physical address. It also lists possible causes in cases where an address cannot be successfully loaded.

2.7.2 Loading the application programs with group addresses and parameters

Chapter 6.8 outlines the process of loading the application programs with group addresses and parameters.

2.7.3 Loading the filter tables

Applying and handling filter tables is described in chapter 6.9.

2.7.4 Programming the line couplers and area couplers

The integration of line and area couplers is described in chapter 6.10.

2.7.5 Advice on the preferred procedure

The basic procedure for commissioning is outlined in chapter 6.11.

2.7.6 Partial commissioning

Partial commissioning involves the self-contained commissioning of part of the building with all programmable functions. The same safety aspects must be observed as in the case of a general commissioning process. When dealing with multi-storey buildings or those that are spread over a large area, installation can be carried out floor by floor or section by section. In functional buildings and in many larger private buildings, connections to external sensors are also required which are possibly installed at a later date. It is not always possible therefore, to immediately implement all planned bus functions for a building.
The situation may arise in which it is necessary to change the group addresses for the implementation of an intermediate solution. These changes should be reversed at the final and complete commissioning stage of the project. The EIB therefore does facilitate the partial commissioning of individual functions with little extra effort.

2.7.7 Function tests, official acceptance and documentation

2.7.7.1 Function tests

The system functions should be checked and compared with the functions required by the specification. The results should be documented.
The line network must be checked in accordance with chapter 2.6.4. A test log should be recorded, as described in chapter 2.6.7.

2.7.7.2 Acceptance and documentation of the power installation

The power installation is carried out according to the recognised procedures in accordance with the valid technical requirements of the respective electric power company (ZVEH acceptance report according to DIN VDE 0100-610, VBG4).
The power installation should be documented in the usual way (circuit diagram, mimic diagram etc.).

2.7.7.3 Documentation of the bus installation

Documentation

The results of the design stage form the basis for the documentation of the bus installation, bus devices, addressing and programming. It is necessary to ensure that the documentation is an exact representation of the status of the installation at all times. The aim is to ensure that after delivery and acceptance of the overall system, the complete up-to-date documentation is available in written form and on disk at both the customer/system site as well as at the electricians/planners. If necessary, this should be specified in contractual form and signed by the individual parties. This is the only way to ensure that problems do not arise for subsequent extensions and service work.

2.8 Extending existent *EIB* installations

In the course of modernisation and extension, electrical installations are subject to change. A simple extension of the system may be necessary when a change in the division of a large office area demands additional, separately controlled lights. With previous installation technology this would have meant extensive cable laying right up to the new switching point. If however, the electrical installation has been achieved with *EIB*, it is only necessary to extend the power line or the bus line up to the additional lights. At the switching point itself, the single switch might be exchanged, for example, for a multiple switch and the allocation is established with the software. This means that there is no need to modify the wiring at the switching point.

Upwards compatibility

The upward compatibility means that new components are able to communicate with the existent bus installation.

The ease of making changes does not alter the fact that the documentation must be constantly updated. Documentation should be provided in both written form and on disk.

The comments made in the preceding chapters must be observed when extending *EIB* systems. In particular, when adding a bus device to a line it is necessary to ensure that the total number of bus devices for that line does not exceed 64. You must also make sure that the maximum line lengths of 350 m between the power supply and bus device and 700 m between two bus devices are not exceeded. Including the extension, the length of the entire wiring body within the line must not be more than 1000 m.

Commissioning the bus devices with the ETS software is described in detail in chapter 6.

The principal procedure when planning, designing and installing an extension to the *EIB* installation corresponds to that of a brand new installation.