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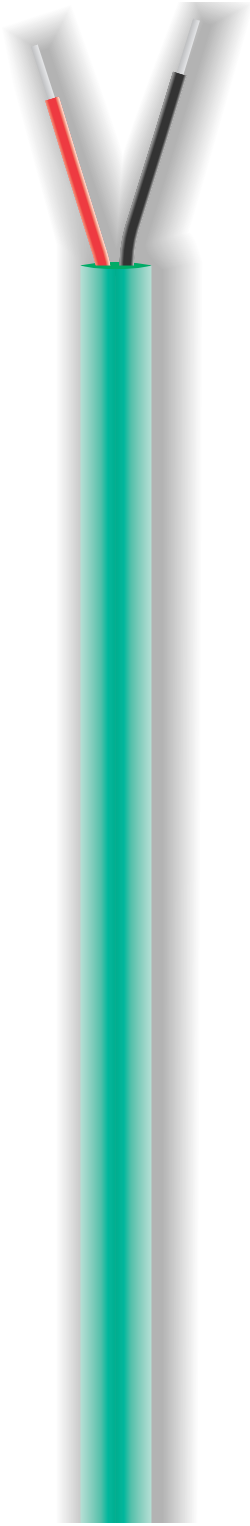
Project Engineering for EIB Installations Basic Principles 4th revised edition



European Installation Bus

Project Engineering for EIB Installations

Basic Principles

4th revised edition

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Project Engineering for EIB Installations

Basic Principles

4th (revised) edition

Foreword

Higher demands on security, flexibility and comfort with regard to electrical installations, combined with the need to minimise energy requirements have led to the development of building management systems.
The bus technology used here is based on a common European concept, the European Installation Bus (*EIB*). Manufacturers across Europe are united within the framework of EIBA, the European Installation Bus Association.
The member companies of EIBA guarantee that bus-compatible products are available world-wide and that electrical installations designed with the *EIB* installation bus can be combined across different building disciplines (e.g. gas and plumbing), without complications.
The "Project Engineering for *EIB* Installations, Basic Principles" document is an essential element of the implementation of this concept. Independent of their respective companies, electricians, planners, manufacturers and operators are introduced to systems and basic applications and informed about the fundamental considerations during planning, installation, commissioning and extensions.
With the rapid, world-wide spreading of *EIB*, the on-going innovative developments have led to a completely revised 4th edition. This new edition incorporates recent experiences from practical operation, as well as consistent developments such as the *EIB* Tool Software (ETS), the HomeAssistant® and new transmission techniques via the mains supply network and radio.
The expansion possibilities in terms of application, production, functionality and services open up additional fields of activity and market opportunities for manufacturers, electrical industries and electricians. Practical examples of applications are given in the separate document entitled, "Project Engineering for *EIB* Installations, Applications".

In the writing of this document we would like to extend our sincerest thanks to the commitment and competence of those employees involved in the ZVEI/ZVEH "manual" and "training measures" work groups, without whom the realisation of this common concept would not have been possible.

Günther G. Seip
President of EIBA
Member of the Board of ZVEI

Karl Hagedorn
President of ZVEH

Dr. Siegfried Wacker
Chairman of the German Association
of Electrical Industries

Contents

1. Introduction

For decades now, customary building installations have simply been oriented around the distribution and switching of electrical energy. This technique is long outdated.
The demands on modern building installations have changed and increased with regard to

- Comfort
- Possibilities of flexible room usage
- Centralised and decentralised controls
- Security
- Intelligent linking of the building disciplines
- Communication possibilities
- Environmental considerations
- Energy and operating cost reductions

At the same time however, electrical installations have become more complex and the systems more extensive.

The consequences:
Tangled wires, a vast number of devices and components that cannot communicate with one another, immense planning needs and costly installation.
With customary electrical installations it is impossible to deal with the minimised planning and installation costs that are required today.
The solution to these problems is the *EIB* Installation Bus System with the EIB® registered trademark of EIBA scrl Brussels (**E**uropean **I**nstallation **B**us **A**ssociation). For the sake of simplicity, and because this technology is already well established among the experts we will only refer to "*EIB*" in subsequent chapters.
Within the scope of EIBA, leading European companies have come together in order to implement a common in-

European Installation Bus Association

dustrial standard for *EIB* on the market and to incorporate this into the corresponding European and national standardisation processes.

Twisted pair

Chapter 2 of this manual discusses the familiar technology of transmission using a twisted pair. This technology should be implemented for new installations and renovations. It offers a high degree of functional security as the data is transmitted via a separate control line network (bus).

Powerline

Chapter 3 is concerned with the system description for data transmissions using an available 230/400 V supply (power line). Power line technology is most suitable for updating in functional and residential buildings.

Radio transmission

We also briefly cover *EIB* conformant data transmission using radio (see chapter 4).

The planning involved in a building installation that uses *EIB* is no different, in principle, from the planning of a conventional electrical installation project. The only added necessity is the use of software tools, which are needed to program the *EIB* devices and thereby implement new functionalities.

EIB TOOL SOFTWARE

For planners and installers of electrical systems the ETS software (***EIB*** TOOL SOFTWARE), which has been designed for the specific requirements of building systems engineering, represents an effective design, commissioning and diagnostic tool for *EIB*. Chapter 6 describes the layout, function and application of ETS 2.

The decision to use *EIB* is a decision for the future. The flexibility that is won is advantageous in functional buildings when usage requirements change and in the private sector because it offers step-by-step extension of the overall system. The competence that is incorporated into EIBA guarantees that both devices and software will be available well into the future allowing installations realised with *EIB* to be extended and modified. *EIB* satisfies the requirements of the DIN EN 50090 and DIN V VDE 0829 standards.

The recommendations outlined in this book correspond to the current technology and the relevant experiences of

manufacturers of bus-compatible devices and systems at the time of printing.

This manual is aimed at technically qualified persons, who we assume know and observe the necessary laws, rules, regulations and standards of this technology both mentioned and understood.

Comments:

2 Transmission via bus lines

2.1 System description

2.1.1 Tasks of building systems engineering

Technical systems in functional and residential buildings have similar tasks to fulfil, such as for example

- Controlling lights, shutters and awnings
- Controlling the heat in individual rooms, central heating systems, air conditioning and ventilation
- Load management
- Building monitoring
- Monitoring, displaying, reporting and operating
- Communication with other systems

Building systems engineering

Until now, separate individual systems have been used to control functional processes. This results in a greater number of wires and with that increased fire risk as well as ever more complex wiring arrangements. It is scarcely possible to extend existing electrical installations in the case of renovations and changes to usage and there is no practical possibility of linking up the individual component systems. Today however, *EIB* offers a future-safe solution to building systems engineering (see Fig. 2.1-1). The use of a separate, independent twisted pair as the transmission medium offers high reliability.
This produces an upwards-compatible, flexible and cost-effective system for a range of widely differing applications in residential buildings up to more extension applications for use in functional buildings. The entire system, from the laying of cables through assembly and installation of the bus devices right up to commissioning and maintenance,

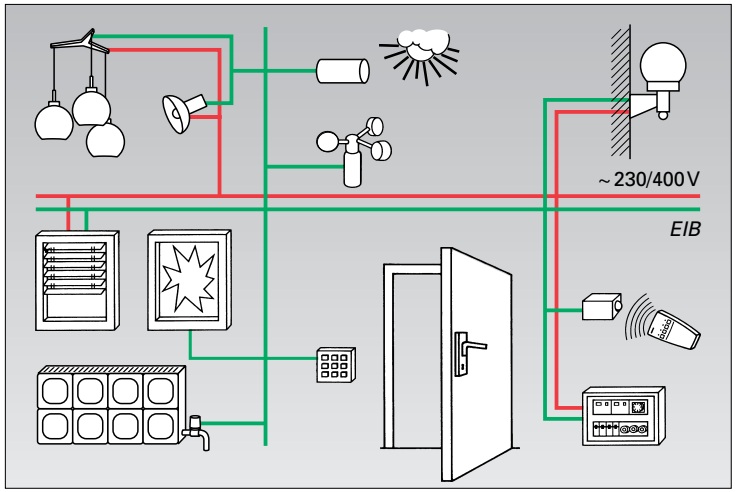


Fig. 2.1-1 EIB in electrical installations

is perfectly tailored to the electricians trade. Of particular note are the:

- laying of bus lines in parallel to the power circuit, i.e. simple arrangement of wires,
- use of conventional distributors and installation sockets,
- decentralised layout independent of the size of the system,
- ability to adapt the functions to changed usage without changing the wiring.

2.1.2 Topology

Line

Because *EIB* must be economically applicable from the very smallest system to more complex systems in functional buildings, it has a hierarchic structure. The line forms the smallest installation unit (see Fig. 2.1-2).

Line coupler

Up to 64 bus devices can be operated on every line segment. A line can consist of a maximum of 4 line segments. Using a line coupler (LC) it is possible to combine up to 15 lines in one area (see Fig. 2.1-3). If it is necessary to connect more than 64 devices to one line or it is not possible to uphold

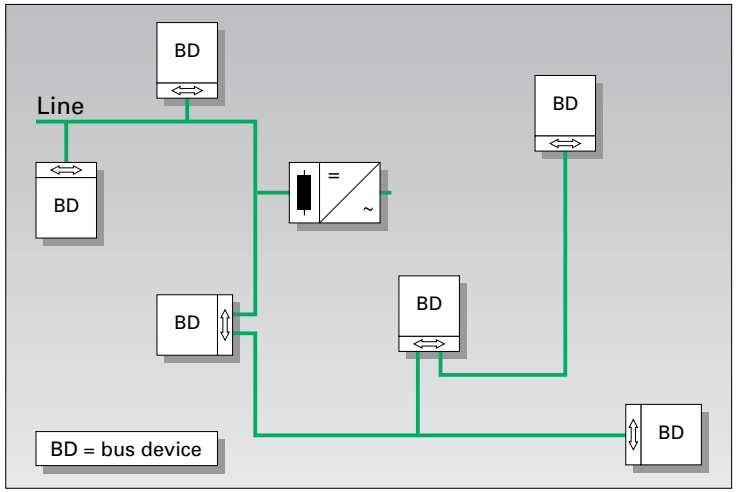


Fig. 2.1-2 EIB topology, line

the line lengths specified in chapter 2.5, repeaters can be implemented allowing further bus devices to be connected to the line or larger distances to be bridged. The repeater forms an additional line segment. Every line segment requires an *EIB* power supply with choke. In view of the number of bus devices and the line lengths, the same statements are valid for the additional line segments as for the first line segment. A maximum of three repeaters may be connected in parallel to any one line (see Fig. 2.1-4). Repeaters are not permitted in the main or area line.

Area coupler

Using an area coupler (AC) it is possible to connect up to 15 areas (see Fig. 2.1-5). And furthermore, suitable interfaces allow the *EIB* to be connected to other systems of the building systems automation.

EIB power supply

Every line has a separate *EIB* power supply (PS) and is galvanically separated from the other lines. This means that if one line fails the remaining system continues to operate unaffectedly.

Telegrams

The division of the *EIB* into areas and lines is further advantageous because it means that the local data traffic on one line or area does not affect the data throughput on any other

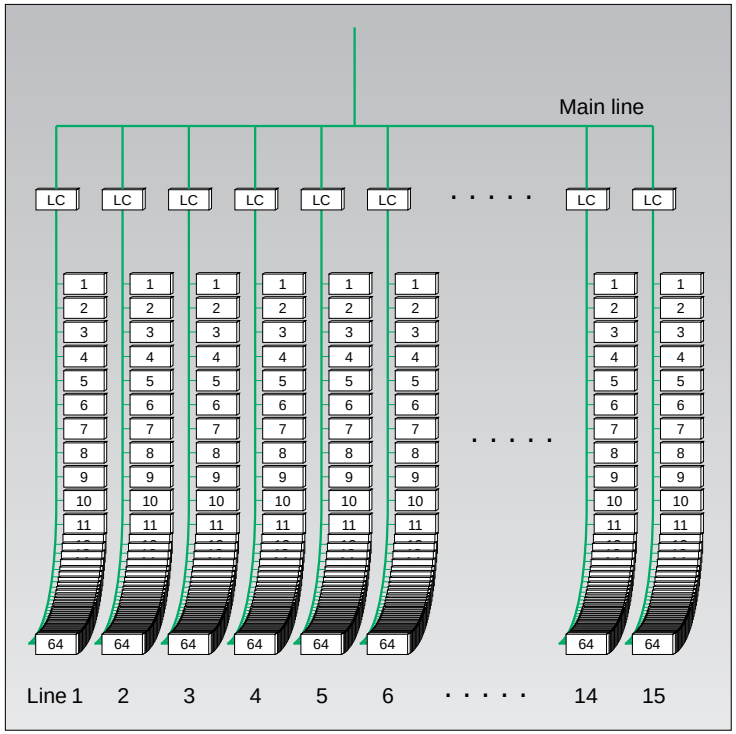


Fig. 2.1-3 EIB topology, areas

line or area. The line coupler prevents telegrams, which only concern the devices in its line, to enter into other lines. At the same time it ignores any telegrams from other lines or areas which do not concern devices within its own line. This facilitates simultaneous communication processes within several lines that are completely independent from one another. The same goes for area couplers.

Application controllers

Application controllers can be used/implemented for superordinate functions. These devices offer functions such as:

– time functions,
– event-controlled processing of control procedures,
– logging,

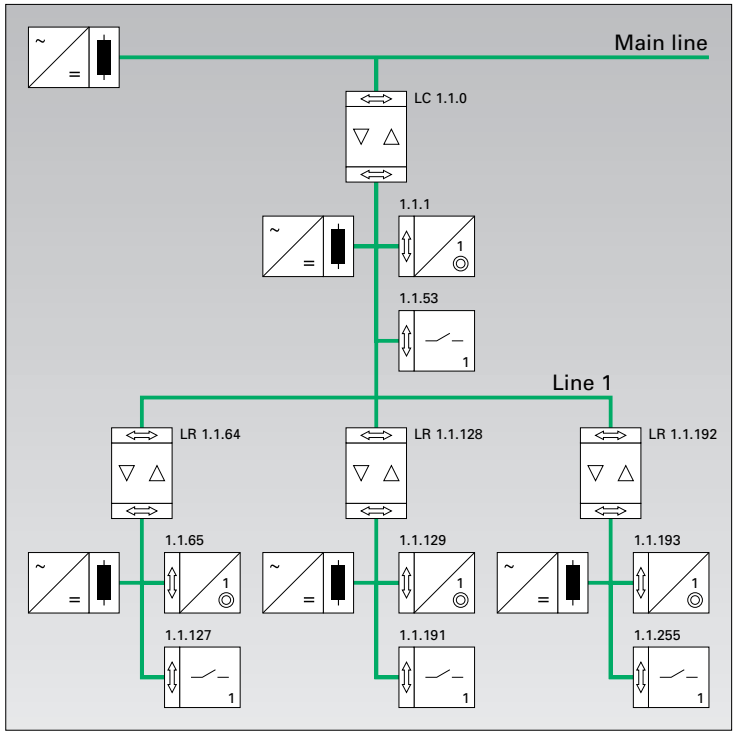


Fig. 2.1-4 Maximum extension of a line using repeaters

– connection to diagnostic and programming devices.

Thanks to the hierarchic division into areas and lines, the *EIB* installation also remains easily comprehensible for commissioning, diagnostic and maintenance purposes. Beginning with one or a small number of lines at the initial installation, it is possible to extend in a step-by-step manner as and when the requirements demand, e.g. in view of the number of devices and system line lengths.

Multimedia PC HomeAssistant

For residential buildings there is a special indication and operating unit, a standard multimedia PC with the HomeAssistant software. This enables all systems and devices in the house or apartment to be controlled and monitored.

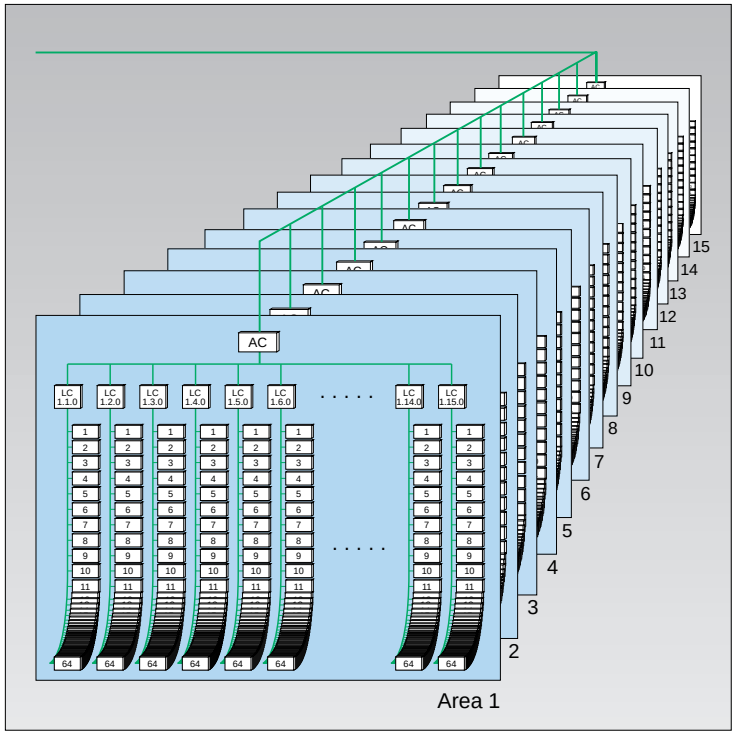


Fig. 2.1-5 EIB topology, area

These systems include heating systems, blinds, alarms and lighting as well as domestic appliances right up to the garage doors. Essentially, the tasks of the HomeAssistant are as follows:
Using suitable graphical symbols it represents all devices installed within the *EIB* system and in this way makes operation of these devices very simple. The house owner has a clear on-screen picture of the various devices within the different rooms, and is able to call up and control their respective functions via the user-interface. It is important to note here that every device works and can be controlled independently from all others.

2.1.3 Transmission technology

Transmission speed

The information, e.g. switching commands and messages, is exchanged between the individual bus devices in the form of telegrams. In terms of the transmission speed, pulse generation and reception the transmission technology is such that no terminating resistor is required for the bus line and any desired topology is possible. The information is transmitted symmetrically on the bus line, i.e. as a potential difference between the two bus wires and not as a potential difference with respect to earth (see Fig. 2.1-6). Interference that affects both wires therefore cannot influence the transmission of information.

Transmission rate

The transmission rate is equal to 9600 bit/s, the average transmission time with send and confirm is equal to approx. 25 ms.

2.1.4 Bus access

To guarantee an ordered exchange of information between the bus devices, the telegram traffic and with that the bus access must be regulated accordingly. With *EIB*, the individual packets of information are transmitted on the bus line

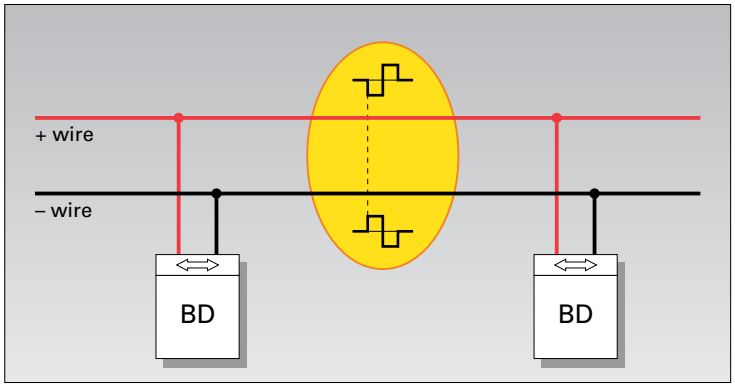


Fig. 2.1-6 Signal transmission on the bus line

in series, i.e. one after the other. This means that there is only ever information from one bus device on one line at any one time. To ensure reliability, a decentralised bus access procedure is used, where each device decides independently whether and at which of the appointed times it accesses the bus.

Decentralized bus access

In the case of devices on a particular line which access the bus independently of one another, conflicts can arise. A special bus access mechanism ensures that no information is lost and that the bus is operable at all times.

Event controlled data exchange

Thanks to an additional priority mechanism in the telegram, important telegrams (e.g. error messages) are given preference. With *EIB*, information exchange occurs in an event-controlled way; i.e. telegrams are only transmitted when an event occurs that necessitates the sending of information.

2.1.5 Telegram layout and addressing

A telegram consists of a series of characters, in which the characters with associated information are combined to form fields. The resulting telegram layout is shown in Fig. 2.1-7. The data of the control and checksum fields are necessary to ensure smooth telegram traffic and are analysed by the receiving devices.

Control and checksum fields

Source address Target address

The address field includes the source and target addresses. The source address is always the physical address. This specifies the area and line to which the sending device is assigned. The physical address is permanently assigned to the bus device during the project design stage and is only used for commissioning and service functions.

Physical address

The target address determines the communication device(s). This may involve a single device or a group of devices that are connected to the same line, a different line or distributed among several lines.

Group address

One device can belong to more than one group.
The group address determines the communication relationships within the system.

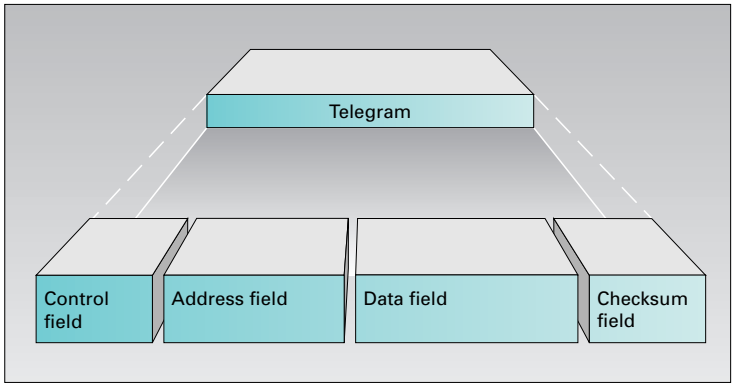


Fig. 2.1-7 Telegram layout

The data field facilitates the transmission of useful data such as for example, commands, messages, set points or measured values, etc.

Data field

2.1.6 Layout of the bus devices

The bus devices consist of the bus coupling unit (BCU) and the application module / terminal (see Fig. 2.1-8). The information to be processed is transferred from the bus to the bus coupling unit (see Fig. 2.1-9). The latter transmits and receives data, guarantees the power supply for the electronics and stores important data such as the actual physical address, one or more group addresses as well as the application program with parameters. Co-ordination of these functions is carried out by a microprocessor, the "brain" of the bus coupling unit. The application module and application program establish the function of the bus device. This may involve sensors such as pushbuttons and binary inputs or actuators such as binary outputs, circuit breakers and dimming actuators or combinations of both, such as for example household appliances.

Bus coupling unit
Application module/ terminal

Application program parameters

Depending on the design of the bus device, the bus coupling units and application modules are plug-in types (e.g. flush-

Physical external interface

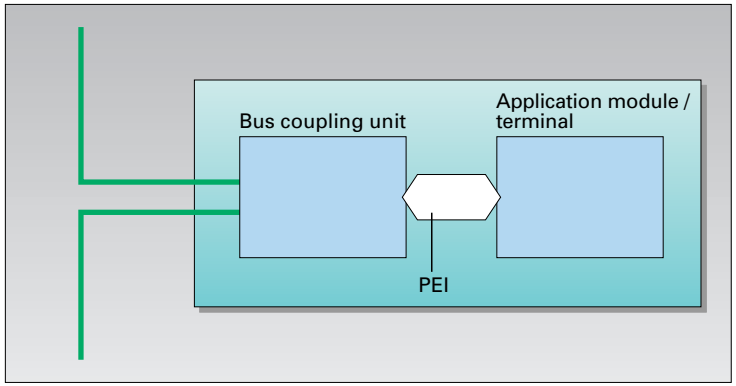


Fig. 2.1-8 Layout of the bus device

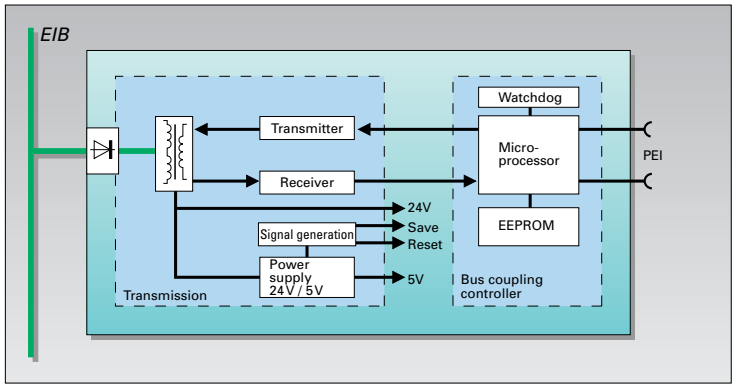


Fig. 2.1-9 Bus coupling unit (BCU)

mounted units and DIN rail mounted units) or they are integrated as permanently connected units within a housing (e.g. built-in and surface-mounted units) (see chapter 2.5.1.1).

2.1.7 Installation

Wiring arrangement

The wiring for the *EIB* is arranged in the same way as the mains supply, in a line, star or tree formation. In a heavily branched installation it is necessary to ensure that no rings are formed; i.e. different lines must not be connected together in ring formations (see chapter 2.5.1.2.2).

The bus devices, e.g. for controlling the various consumers and monitoring the building can either be installed in the distribution panels as DIN rail mounted units, flush-mounted units or surface-mounted units. Alternatively, they may already be contained within the electrical devices themselves (e.g. lights). Furthermore, installation channels permit the incorporation of bus devices in all forms. All these devices are connected together via the *EIB*.

Bus connection terminal
Data rail
DIN rail

The bus devices can always be placed within the installation to satisfy the requirements of the system so that optimum usage of all components is always guaranteed. It is possible to assess the main aspects of the system by the way in which the devices are placed. On the bus side, the DIN rail mounted units are connected via connection terminals or via the data rails that are incorporated into the DIN rail. Contact with the data rail is achieved by snapping the DIN rail mounted unit onto the DIN rail (see Fig. 2.1-10).

Bus line
Tracer

Data rails are connected together via data rail connectors. For all other bus devices, the bus line is carried from device to device via a bus connection terminal, whereby branch lines are also permitted. The bus line is composed of two twisted pairs with shielding and tracer (see Table 2.5-2 and Appendix G).

2.1.8 Electrical safety

SELV
Low voltage

The *EIB* is operated with SELV extra-low voltage up to 32 V DC. With that, the bus is safely separated from the mains supply. It is perfectly safe for the user to touch the bus line. *EIB* satisfies the requirements of the DIN EN 50 090 and DIN V VDE 0829 standards. All bus devices correspond to the specified DIN VDE regulations or EIBA guidelines for situations where no device regulations exist. Bus devices certified by EIBA carry the EIB® trademark. One element of EIBA certification which entitles the device to carry the EIB® trademark is proof of safe electrical separation between *EIB* and other circuits.

EIBA certification

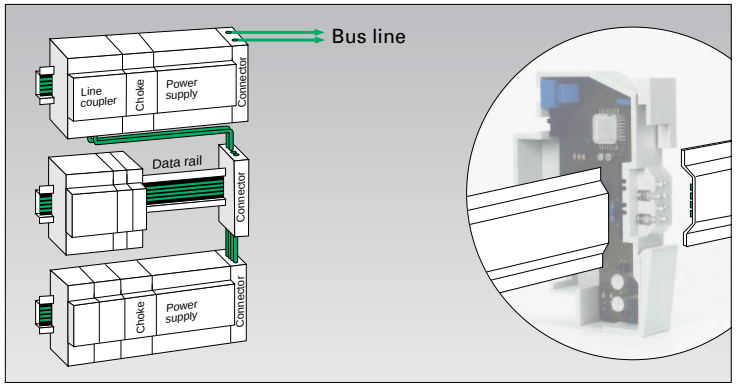


Fig. 2.1-10 *Distributor with bus devices and contact system (DIN rail mounted units)*

2.1.9 System and supply reliability

System and supply reliability comprises the availability of electrical energy and system functionality under all operating conditions. The structure of the heavy current (power) component of the *EIB* installation is the main influencing factor with regard to the availability of electrical energy. The selected topology in addition to the number and arrangement of devices are the primary influences affecting the availability of system functionality.
Here it is necessary to observe the requirements of the customer or operator and also any official and legal regulations or damage limitation guidelines.
The *EIB* permits a hierarchic layout for an electrical installation. The degree of freedom when designing the topology means that the entire bus system can be divided into functional units (lines, areas) (see chapter 2.1.2).
Each line segment has its own *EIB* power supply. If this fails, communication is only disrupted in that particular segment (see Fig. 2.1-11). The function of the remaining system is unaffected.
If the failed line corresponds to a main line or area line,

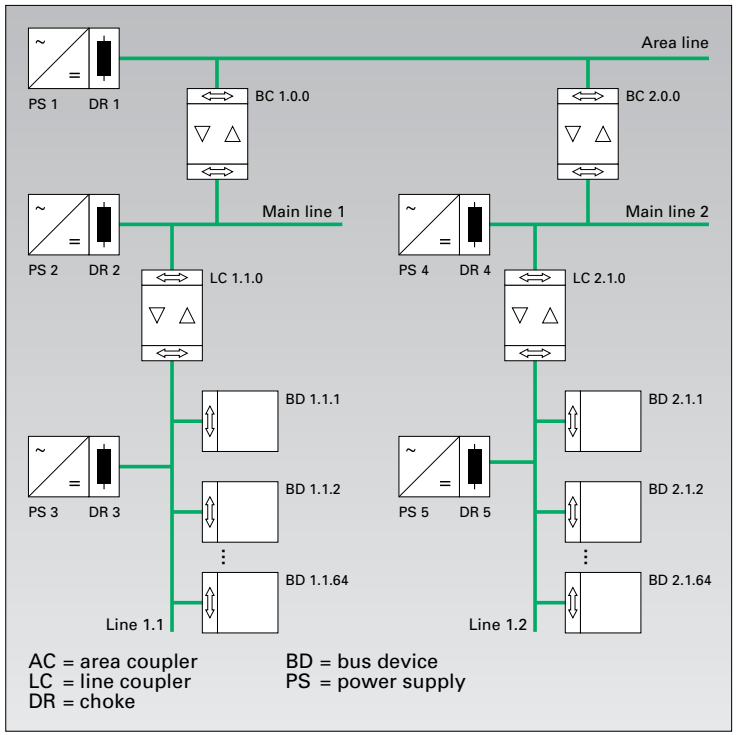


Fig. 2.1-11 *Typical EIB-TP layout*

telegram traffic is not possible beyond this line. The same is valid for a breakdown or short circuit within a line.
The design of *EIB* allows telegram traffic to occur simultaneously in the individual lines, if the telegrams only concern the bus devices within the respective lines and are not transmitted via the associated line couplers.
In this connection, the following questions and answers may be helpful in assessing the layout of the bus system:

– Is increased supply reliability required?
  In this case the corresponding devices should be assigned to a line segment. The *EIB* power supply of the line segment and possibly also the assigned load circuits should

be connected to an uninterruptable power supply or an emergency supply. Within a line segment it is also possible to connect two power supplies in parallel to different active conductors.

– Should it be possible to service sub-divisions of the *EIB* installation without affecting the overall system?
  These sub-divisions must be without power when being serviced. For this reason we recommend that system functions be distributed among several areas of the bus system (e.g. among several lines or several areas). This means that it is then possible to deactivate specific sub-divisions. The remaining system continues to function as normal.

Visualisation

– Is it necessary to cyclically monitor specific bus devices and with that the line for functionality?
  When using visualisation, application controllers or a HomeAssistant it is necessary to ensure, when selecting devices, that they permit status polling.

In the case of disturbances or power failures, the data remains stored in the bus devices and the bus devices themselves revert to the pre-defined status. After the error has been rectified or the power returned the bus devices again revert back to the status defined for this condition.

2.2 Typical applications

The following descriptions illustrate the advantages for the individual applications using *EIB*.

2.2.1 Controlling lights, shutters and blinds

Lighting control
Blind control
Shutter control

The applications for controlling lights, shutters and blinds can be used independently of one another or linked together in various functions.

The equipment itself can be switched and/or dimmed or controlled either

– locally,
– centrally,
– using infrared,
– in a time-dependent manner,
– depending on the brightness,
– depending on the temperature,
– or depending on the wind strength.

Simulation of occupancy

The resulting advantages include:

– Reduction in the energy costs thanks to switching which depends on ambient brightness, time of day and actual need.
– Increased security by the simulation of occupancy.
– Comfortable adjustment of the lighting within a room to meet the requirements using controlled switching of the lights and blinds that is based on ambient brightness, time of day and actual need.
– Increased comfort thanks to selectable states of switching levels and blind adjustment that the users are able to specify themselves.
– Simple and flexible adjustment of the lighting and blind controls when room usage changes, without the need to

modify the existent wiring.
– Existent *EIB* installations can be adapted to suit growing requirements by simply connecting additional bus devices to the available bus line.

Moreover, *EIB* offers the possibility of monitoring and controlling the lights and blinds from a central position. This is in strong contrast to conventional solutions, which would require significant modifications to both the wiring and devices.

2.2.2 Single room temperature control, heating and ventilation control

Single room temperature control

The aim of single room temperature control, heating and ventilation control is to keep the energy requirements for room heating as low as possible whilst maintaining the highest levels of comfort for the occupants.
Optimum operation of the heating system is achieved using "intelligent" control via the *EIB*:

– Set the heating times for each individual room according to the times they are used.
– Individual adjustment possibilities for the temperatures of every room depending on the usage (e.g. a higher temperature in quiet times as opposed to times when there is a body heat contribution).
– Switching off the entire heating system or centrally lowering the temperatures at times when the building is not in use.
– Rotational speed dependent control of the circulation pump.

Sensors

The different applications such as for example blind control, window monitoring and heating control can communicate with one another, which means that the sensors can be used for more than one purpose and relevant data can be

exchanged.
EIB also facilitates incorporation of remote monitoring or remote control.

Remote monitoring

2.2.3 Load management

Load management

The primary aim of load management is the economical and resource-saving use of energy that is provided by the electric power company in industry, trade and the private sector for reasons of environmental, cost and/or security considerations. The term 'load management' also covers measures for avoiding circuit overloads.
The advantages of using *EIB* to provide load management include:

– The otherwise necessary and costly wiring of ripple control receivers, load shedding relays, maximum demand controllers, timers etc. to the individual electrical appliances is reduced to the simple laying of the bus line. This means that it is easy to incorporate large numbers of small consumers into the load management. With conventional solutions this is usually avoided as a result of the effort needed to set up the necessary wiring.
– Whenever there are changes to the operational processes the load management can be adapted accordingly, without the need for rewiring.
– When optimising the load management, logging the operational behaviour of the electrical equipment takes on a great significance as this allows conclusions to be drawn about the modification of priorities. *EIB* offers the advantage here because it allows the operational behaviour to be recorded and visualised for all devices connected to the bus.

2.2.4 Monitoring, displaying, reporting and operating

In both residential and functional buildings it is often nec-

essary to record and report the statuses of the various systems. This applies to the interior as well as to the exterior of the building.

Data includes:

- operational messages (operational status display),
- technical errors and alarms,
- monitoring data regarding the building exterior,
- people monitoring data (movement detection).

The *EIB* has multifunctional properties: All display, reporting, operating and monitoring elements can receive information and transmit commands and messages to other devices via a single bus line. This leads to clear systems and cost savings.
This means that information can be transmitted via the same bus line that is being used to control the blinds or lighting. It is possible to transmit, for example:

- measurements, e.g. inside and outside temperatures, measurements from a weather station,
- messages concerning the closed status of doors, windows and garage doors,
- movement detection inside and outside of the building,
- operational statuses and error messages of the heating system, air conditioning unit and domestic appliances,
- error messages from the lifts,
- level indication values and leakage messages,
- meter values for establishing the use of gas, oil, power, water,
- status of the exterior equipment from the lights to the sprinkler system.

Visualisation program

The multifunctional properties of the *EIB* minimise the necessary cabling.
In connection with a visualisation program, the *EIB* can be

used in functional buildings to display the status of technical equipment on a PC screen. Measured values that are transmitted via the *EIB*, e.g. the room temperature in ∞C, can also be displayed on the screen. Depending on the program, the statuses and entries can be stored on a suitable medium or printed out at a printer. This can be achieved in text or tabular format or in the form of a ground plan. n.

2.3 Communication with other systems

2.3.1 Data interface

Serial data interface

The serial data interface (RS 232 with Sub-D9 plug-in connection) allows devices such as, for example, computers (PC) to be connected to the *EIB*. This interface is used to program the EIB installation, put it into operation and to carry out maintenance or diagnostic work.
In private houses the HomeAssistant is connected via the data interface.

2.3.2 Appliance interface

Application interface

The appliance interface consists of a bus coupling unit and a communication interface, which is attached to the physical external interface. This communication interface is the connection for a six-pin western connector (RJ12). Devices, such as domestic appliances, can be connected via a six-wire signal line (see Fig. 2.3-1). The appliance interface should be installed and parameterised in the same way as every other flush-mounted bus device.

Micro-computer control

Coupling module

The device to be connected via this appliance interface must contain a suitable microprocessor and be equipped with a coupling module. The coupling module is connected via a western connector and is galvanically separated from the device control (see Fig. 2.3-2).

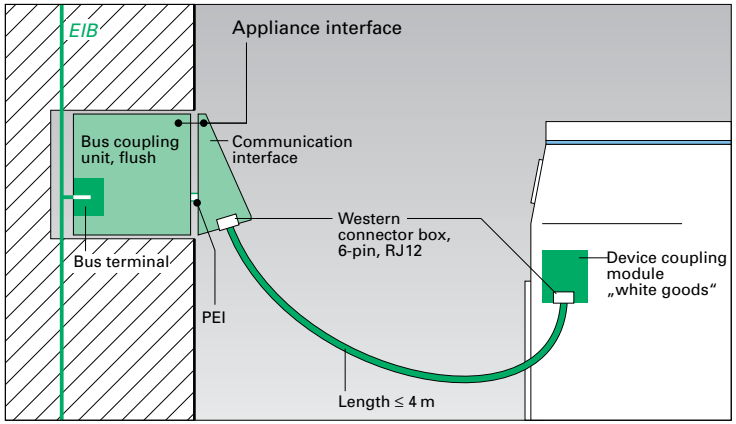


Fig. 2.3-1 *Principles of an appliance interface*

Fibre-optic line

It is clear to see that in the future there will be devices for which both the mains and *EIB* connections are achieved via a single line. This integrated solution demands cables that in addition to live conducting wires also have a fibre-optic line for transmitting data, as well as modified SCHUKO“ plugs and sockets. The bus coupling unit is integrated into the appliance interface (see Fig. 2.3-3).

Communication socket

After connecting the device to the communication socket and to the 230/400 V supply, the appliance interface “signals its presence” to the HomeAssistant (see chapter 5), after

Product CD-ROM

which the user is prompted to insert the product-specific CD-ROM which is supplied with the device and which contains the complete application software. This includes all operating masks and user information, such as for example, the operating instructions for the device.

Integrating such a household appliance into the *EIB* installation can be achieved without additional parameterisation. This is one way of separating different building disciplines (e.g. gas and water) and different areas of responsibility.

In the future, devices that were once logged on via the communication outlet/socket can be connected to other communication outlets/sockets of the existent *EIB* system

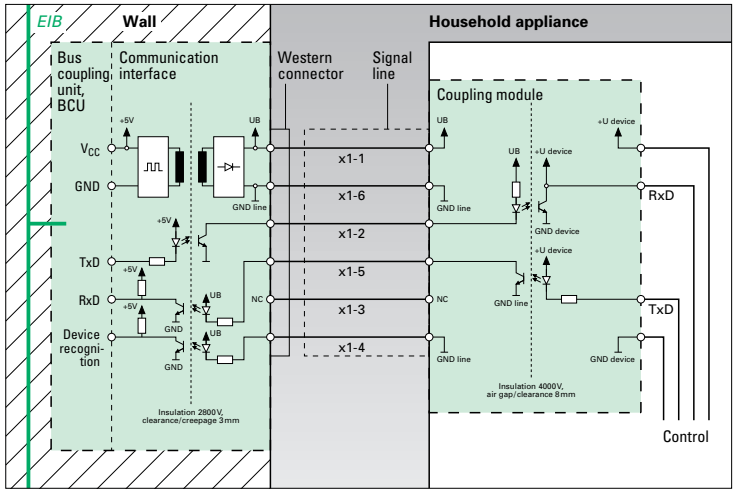


Fig. 2.3-2 *Basic circuit of an appliance interface and coupling module within a housing device*

and be automatically recognised (“connection of portable devices”).

The coupling module for a household device is an add-on unit, which does not affect the normal, conventional use of the device.

The software of the device to be connected must be designed so that useful communication with the HomeAssistant is possible via the communication outlet/socket and the *EIB*.

2.3.3 Interface to communications networks

The *EIB* can be connected with the telephone network via bus-compatible dialling devices. Remote control is also possible.

Communications network

In private homes, one of the many uses of the HomeAssistant is as an interface to the public communications network. From the HomeAssistant it is therefore possible to convey messages and events having arisen in the bus system and been evaluated accordingly, to any desired bus device, which

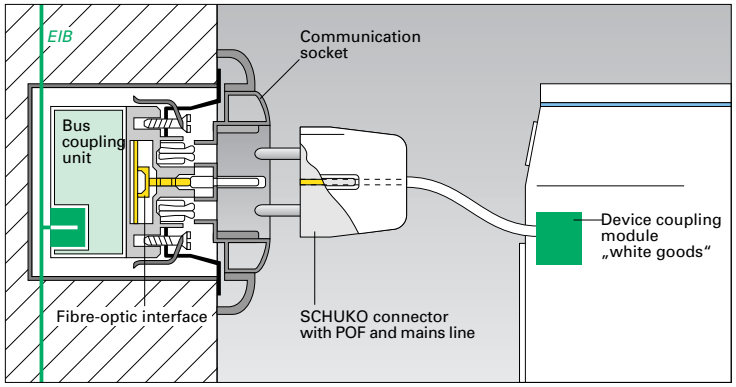


Fig. 2.3-3 Appliance interface with fibre-optic line

Pager

could also be a pager for example, via the communications network.

Video connection

A HomeAssistant can also be used as a TV, if a video connection and a TV card has been installed. In addition to regular TV programs, this connection also allows videotexts to be received, interpreted and used for corresponding actions in the bus system.

2.3.4 Interface between EIB transmission media

For new installations transmission via a bus line (twisted pair) is recommended.
However, transmission via existent power circuits (see chapter 3) and radio (chapter 4) is also possible with *EIB*. Both these latter methods are especially suitable when modifying the *EIB* in existing rooms and buildings.
Gateways are used between these different transmission media.

2.3.5 Interface to the building systems automation

Building systems automation

In functional buildings the building systems automation is responsible for a variety of complex control tasks, such as

for example the control and monitoring of operational systems (heating, ventilation, air conditioning, switchboard systems, etc.). Among other things the building systems automation archives and analyses operational and consumption data. Information can be exchanged between the building systems automation and *EIB* systems via data interfaces/gateways.

Gateway
Data interface

2.3.6 Interfaces to infrared (IR) control systems

IR transmitter
IR receiver
IR decoder
IR receiver/ decoder

Corresponding interfaces are available between the *EIB* and various manufacturer-specific infrared systems.
IR transmitters, IR receivers and IR decoders or IR receivers/decoders are used.
Providing cable-free control of actuators, an IR transmitter sends infrared signals that are received by the IR receiver. These IR signals consist of frequency modulated or digitally modulated infrared light. The IR receiver amplifies the received signals and converts them into electrical signals which are then passed on to the IR decoder. The IR decoder then converts these signals into a standardised bus telegram, transmits it to the bus and with that activates the specified action.

2.4 Planning

Specifications

In determining the functionality and scope of an *EIB* installation the first step involves detailed planning. It is vital to establish the exact needs of the customer and then to reformulate this data in the form of a specifications document or checklist.

Checklist

The mains part of the *EIB* installation must be planned in accordance with the general, established rules of the technology whilst adhering to the various regional connection conditions laid down by the respective electric power companies. Installations such as backup power supplies, security lighting, and "access lighting" etc. must be looked at from the same point of view. The same standards and conditions apply.

Access lighting

As already mentioned in the introduction, it is necessary when planning to make the following fundamental decision – will the *EIB* be based on a twisted pair or will data be transmitted via the existent mains network (powerline)?

Twisted pair
Powerline

Chapter 2 deals with solutions using the twisted pair variant. Each system must be planned separately. The respective requirements determine the topology and design of the *EIB* installation. The system offers a variety of possibilities to meet the actual requirements in a number of different ways.

2.4.1 Establishing the customer requirements in functional buildings

The *EIB* offers the customer a wide range of application possibilities that for the most part cannot be implemented using conventional technology or if they can only at great cost.

These possibilities should be outlined to the customer during the planning phase to allow the most optimum *EIB* installation to be planned in accordance with current and future requirements.

The points listed below can help to clarify the exact needs of the customer.

2.4.1.1 Room and building usage

Usage change

When planning for a room or building it is necessary to consider whether there will be any changes to the usage or modifications to the room size, with the use of dividing walls for example, within a particular time period. The following questions may be helpful here:

- Which areas of the building will be fitted with *EIB* immediately and which at a later date?
  If bus devices are only to be installed in certain areas at a later date the bus lines should still be installed in these areas in preparation.
- Which rooms are subject to changes in usage? What are the smallest units of usage?
  The answer to this question determines the division of lights into switching groups and the division of blinds and heating units into control groups. There is no need to consider changes in usage in the corridors. Aspects such as access lighting and emergency lighting should also be considered when determining the number of switching groups required.
- Are the users of the building not known at the time of planning? Is this likely to cause changes to the installation?
  In these cases it is necessary to plan sufficient reserve in the distribution panels and to combine the appliances into the smallest possible groups.
- In an apartment block should there be a single common EIB system respectively independent units per apartment?
  Separate systems may be necessary when the individual apartments need to function without affecting one another. The design for each apartment should be established as described in chapter 2.4.2. This can be achieved, for example, by providing a separate bus line per apartment

or within a single-family house, per floor. The line couplers function as filters and prevent unauthorised intervention.
– Should bus devices be provided in the external areas?

Such functions can, for example, be implemented by connecting conventional devices in the external areas with bus devices for the internal areas.

2.4.1.2 Applications and functionality

The requirements of the customer determine the functionality of the *EIB* installation and have a direct influence on the scope, design and cost of such a system. The structural possibilities are a further decisive factor. To determine exactly what the customer requires from an *EIB* installation, the following questions should be answered:

– Which functions should be linked together?
  It is possible for example, to link the brightness-dependent lighting control with the blind control or the window monitoring with the heating control.
  More complex interlinking can be achieved with the use of application controllers or special linking elements.
– Are priorities to be considered for specific functions?
  With regard to the lighting, manual control can be given a higher priority than brightness-dependent control.
  The answer to this question is important for establishing the selection of devices and corresponding parameters.
– Should operational statuses or errors be displayed for the entire building?
  For this, suitable interfaces should be installed, e.g. an ISDN gateway.
– Should it be possible to display and/or change important operational statuses at specific locations, e.g. at the main gate?
  To achieve this, suitable sensors as well as indication and operating panels, displays or PCs with the corresponding visualisation software should be provided.
– What factors should the control mechanism be based on?
  Lighting in shop windows for example, can be switched on depending on the ambient daylight and switched off according to the time of day.
– Is it necessary to plan measures to save energy or operating costs?
  Lights can be controlled depending on the level of daylight and/or time of day. Large numbers of smaller consumers can be incorporated into the load management system at no extra cost.
– Are preventative measures to be included to discourage break-ins?

Using time controls or random generators it is possible to simulate occupancy. The lights are switched on and off and the blinds or shutters raised and lowered accordingly.
Movement detectors, which are usually assigned to specific circuits, can be used to control the entire exterior lighting when the property is unoccupied.
Door and window contacts, which are generally only used for display and indication purposes, can also be incorporated into the lighting control.

2.4.1.3 Division of the disciplines

Building disciplines

Different building disciplines (gas, water etc.) are usually planned, managed, installed and commissioned by different companies. The following scenarios are conceivable:
a) The functions of the various disciplines are implemented using independent *EIB* installations and there is no exchange of information between these separate systems.
Advantages:

– logical and physical independence from one another,
– no co-ordination necessary when planning and designing

the *EIB* installations (e.g. any address allocations possible)
– commissioning, diagnosis and servicing independent of the other disciplines
– clear allocation of responsibility

a) For every building discipline there is a separate line or area within the *EIB* installation that can be linked together via couplers allowing an exchange of information.

Advantages:

Absence of interaction

– information exchange between the building disciplines is possible which allows a far greater functionality than in case a)
– multiple usage of the bus devices is possible

a) Different building disciplines are incorporated into one EIB installation using common lines or areas.

Advantages:
– reduced wiring
– reduced numbers of devices (couplers)
– more easily expandable (bus line in the entire building can be used for all disciplines).

System manager

In cases b) and c) one person must be responsible for co-ordinating the various building disciplines during the planning and project design stages. Once the contract has been awarded for the individual building disciplines, a system manager should be named who also acts as the contact person once the work has been completed with regard to extensions, servicing and maintenance. These two jobs can be undertaken by one and the same individual/legal entity.

2.4.1.4 Preparatory cabling

Preparatory cabling involves the intentional laying of bus lines at significant points within the building for the case

in which the scope of the *EIB* has not yet been decided upon or finalised. Preparatory cabling is also a sound investment to allow for any changes to the usage of the building or individual rooms at a later date.

Sill cavities
Floor channels

To achieve the greatest possible degree of flexibility, it is advisable in functional buildings to lay the bus lines in sill cavities, floor channels and in the false ceilings. We also recommend connecting all distribution panels with the bus line and sufficient space should be reserved for *EIB* devices.
Other important points when planning the preparatory cabling include the provision of meter panels for recording the consumption of gas, water, electricity etc. It will be possible, in the foreseeable future, to read this information from a remote location via the telecommunications network in combination with the *EIB*.
It is also necessary to establish suitable locations for the installation of wind, rain and brightness sensors. This data is generally required when blind or brightness controls are to be implemented at a later date.
Within a system the preparatory cabling should be uniformly laid out and 'transparent' enough to ensure that the lines and connections can easily be found years later.
For a future-oriented electrical installation the preparatory laying of cables is an absolute must (see chapter 2.4.2.3.4).

2.4.2 Establishing customer requirements in residential buildings

It is fundamentally possible to design a residential building according to the same considerations as when dealing with functional buildings (see chapter 2.4.1.2) and therefore to plan the same functionality.
In a residential building however, the application possibilities for *EIB* are much more varied. The reasons for this are twofold, firstly there are a much greater number of different devices and appliances and secondly the needs and wishes of the occupants are very different from those of users of

functional buildings. Above all, the demands on comfort are significantly higher.
Customers in the private sector derive their wishes with regard to electrical installations from their experiences with their old and trusted installations. They are not generally aware of the many new functions available with *EIB* and the technical solutions that these entail nor do they need to be. For this reason we recommend that the questions regarding their needs and wants be formulated in such a way that the answers provide a basis for the planning and design. We recommended using a questionnaire that has been developed especially for consultation purposes.

Questionnaire

During consultation it must be made perfectly clear to the private customer that carefully planned preparatory cabling ensures all options are kept open. Thanks to its modular layout, the system can be expanded at any time in a step-by-step manner which means that customers can benefit from all future development and modernisation.
If a private customer has expressed his/her wishes and these wishes go beyond what can be achieved with conventional technology, simply explain that without the use of *EIB* these would only be possible at an extremely high cost and would not be open to flexible expansion. An example questionnaire is included in Appendix A. Chapter 7 gives a step-by-step account of designing a project.

2.4.2.1 Applications and functions in residential buildings

For the private customer the following detailed technical explanations help illustrate the higher levels of comfort, increased security etc. that can be achieved with the use of an *EIB*. The HomeAssistant that is mentioned in the following sub-chapters is described in more detail in chapter 5.

2.4.2.1.1 Lighting control applications

Lighting control

A basic description of the applications for lighting control has already been given in chapter 2.2.1. With the HomeAssistant that is integrated into the *EIB*, the following extras can be offered with the "lighting" software package, designed according to the technology available today:

- display of the lighting situation within the house, as an overview and in detail,
- switching and dimming the lights in the house; it is possible to switch individual lights or entire rooms,
- etc.

The application is operated via two mask types:

- the room selection mask
- the individual room mask; every room in the house which has lights in it is assigned a separate mask.

2.4.2.1.2 Single room temperature control applications

Single room temperature control

The basic applications have already been described in chapter 2.2.2. With the HomeAssistant that is integrated into the *EIB*, the following extras can be offered with the "single room temperature control" software package:

- display of the temperature in the individual rooms,
- changing the temperature in the individual rooms,
- entering temperature time profiles depending on actual usage of the room,
- setting up weekly and monthly programs,
- etc.

2.4.2.1.3 Blind, shutter and awning control applications

The possibilities that exist for these applications have already been described in chapter 2.2.1. With the HomeAssistant that is integrated into the *EIB*, the following extras can be offered with the "blinds and shutters" software package:

- display of the positions of blinds and shutters within the house, as an overview or in detail,
- changing the position of the blinds in the house; they can be adjusted individually as well as by room,
- incorporation into a simulation of occupancy program,
- etc.

The application is operated via two mask types:

- the room selection mask
- the individual room mask; every room in the house which has shutters or blinds is assigned a separate mask.

2.4.2.1.4 Monitoring function applications

Monitoring function

The basic applications for monitoring functions have already been described in chapter 2.2.4. With the HomeAssistant that is integrated into the *EIB*, the following extras can be offered with the "monitoring functions" software package:

- the 'monitoring function' provides the user with an immediate overview of all critical security areas in his house or apartment,
- it actively monitors the security sensors in the house and activates an alarm if one of these sensors is triggered,
- etc.

All door, window and shutter sensors as well as any movement detectors that are connected to the *EIB* can be incorporated into the active monitoring. With the four provided

monitoring programs the user can set the exact configuration of the monitoring system, i.e. the selection of sensors that are included in the monitoring function.

2.4.2.1.5 Telecommunication applications

Remote control
Remote polling

With the aid of bus-compatible dialling devices, the *EIB* can be connected to the telephone network (see chapter 2.3.3). Moreover, remote control (status change), remote indication (error messages) and remote polling (status messages) possibilities also exist.
It will also be possible in the future to link the HomeAssistant directly with the telephone network. Warnings and messages can then be transmitted to the outside world via the telephone network.

2.4.2.1.6 Household appliance applications

If household appliances are connected to the *EIB* via appliance interfaces and the product-specific CD has been loaded into the HomeAssistant, the following extras are possible:

– when cooking:	incorporation into security and energy management; interactive linking with a recipe library;
–when freezing:	alarm functions outside of the operating area; comfortable and energy-optimised "super" freezing;
– when washing up:	increase in the variety of programs; incorporation into energy management (low tariff);
– when washing:	incorporation into energy management (low tariff);
– when heating water:	incorporation into energy management (low energy households);

remote control via *EIB* sensors.

All devices have remote monitoring and remote control possibilities for selective functions, as well as context-sensitive help. They can all be used autonomously without the HomeAssistant software.

2.4.2.1.7 Other application areas

The closed status of doors, garages and gates can be monitored and controlled.
A further application area is represented by the integration of valves for gas, oil and water etc. to avoid any unchecked escapes.
In the future it will be possible to check the status of gas, oil, electricity and water meters and to display the equivalent cost.
Exterior systems are also an important application. In addition to garden lighting, it is possible to monitor and control sprinkler systems and fountains. Other sensors for detecting wind speed, temperature, humidity etc. can be integrated.
And a final area of importance covers communication equipment needed to integrate the following:
- Pendant PAs, info displays, ISDN gateways, radios, pagers, telecontrol units, telephones, door knobs, intercom systems, door video systems, TV, video, video cameras.

2.4.2.2 Division of the building disciplines

In functional buildings, the different building disciplines (gas, water etc.) are usually planned, designed, installed and commissioned by different companies (see chapter 2.4.1.3). This sub-division is also present in residential buildings, but not so clearly defined as in functional buildings.
If we view the wealth of possible devices and equipment corresponding to the installation recommendations, then it becomes clear that for the customer there should only be

Common system manager

one contact person for the entire arrangement, the system manager. This person, who is responsible for the entire set-up incorporating all building disciplines, e.g. an electrician, must assume responsibility for the overall functionality of the *EIB* in the building. He must have the skill to combine the individual building disciplines with regard to the bus control.
The HomeAssistant in combination with the *EIB* is a particularly suitable way for centrally monitoring and controlling devices of different building disciplines. A device, e.g. a washing machine, is connected to the system by simply fitting the communication line between the device and the appliance interface (see chapter 2.3.2) and then loading the associated CD-ROM into the HomeAssistant.

2.4.2.3 Preparatory cabling

As we have already shown in chapter 2.4.2.1, there are many possibilities for updating or extending the *EIB* system. In order to ensure that the preparatory cabling is safeguarded for the future it is vital to establish the short-term, mid-term and long-term requirements of the customer. The suggested questionnaire should be used.
The following points should be noted:

- The preparatory cabling should be sufficiently 'transparent' to ensure that the lines, installation sockets and end points can easily be detected years later (see chapter 2.5.2.4).
- The preparatory cabling should always be planned at the same time as the mains installation, and kept in mind when defining the installation zones and equipment levels.
- Within a system, the arrangement of wires should be uniform.

As a planning aid, the following section contains suggestions for the preparatory laying of bus lines.
In accordance with the star coding of the equipment levels

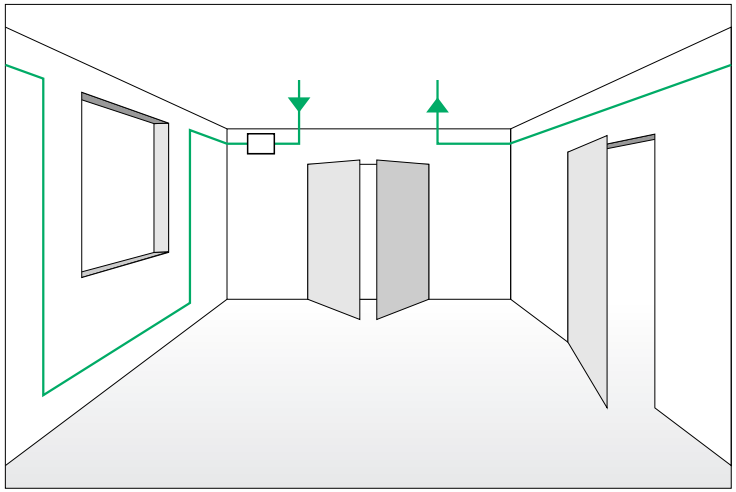


*Fig. 2.4-1 ** preparatory cabling*

Star codes

and the DIN 18015 standard, we make the following differentiation:

* Every room has only one access point to the bus line. A subsequent bus installation only has an effect on the room, but it is extensive. No additional expenditure is required for the stairwell.

** The bus line is available on every wall, especially in the important zones – windows and doors. Installation sockets are already in place for branching. A subsequent bus installation restricts itself to short line sections in the room (see Fig. 2.4-1).

*** The bus line is available at all important points within the room (see Fig. 2.4-2).

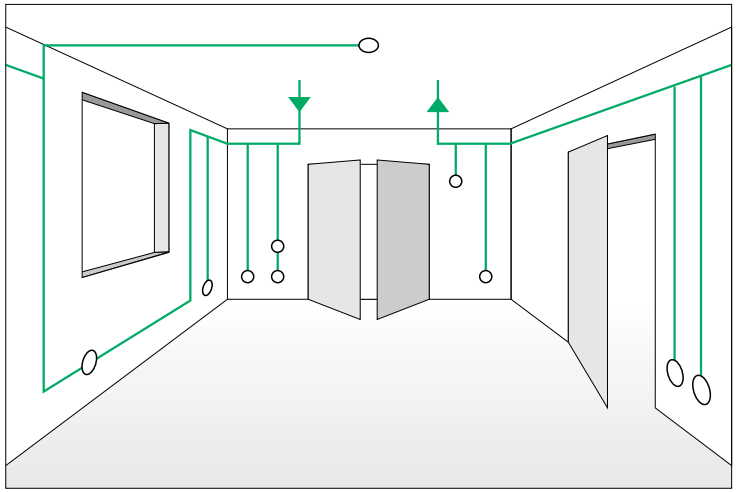


*Fig. 2.4-2 *** preparatory cabling*

Good preparatory cabling reduces necessary work to the absolute minimum. necessary when updating or modernising.
The basics of a three star installation are explored in chapter7.

2.5 Project design

Performance spec

Project design involves converting the concept established at the planning stage into a working performance spec. The scope of supply and scope of functionality are defined, the spatial arrangement, device types and logical links. The mains part of the *EIB* installation is planned in the usual way and is not dealt with in this manual.
When designing an *EIB* installation particular attention should be paid to the bus-specific thresholds concerning the line lengths (see Table 2.5-1) and the guidelines for the topology (see chapter 2.1.2). When selecting the installation locations for the bus devices follow the advice of the manufacturer, e.g. observe the permitted ambient temperature, stipulated protection level etc.

Total length of all wires laid in a line	≤ 1000 m
Line length between two bus devices	≤ 700 m
Line length between two *EIB* supplies including choke and each bus device	≤ 350 m
Line length between two *EIB* supplies (two *EIB* supplies including choke within a line)	≥ 200 m

Table 2.5-1 Threshold values of the wire lengths per line

2.5.1 Bus devices and installation material

2.5.1.1 Bus devices

The bus devices consist of the bus coupling unit (BCU) and the application module / terminal (see Fig. 2.1-8). The information to be processed is transferred from the bus to the bus coupling unit (see Fig. 2.1-9). The latter transmits and receives data, guarantees the power supply for the electron-

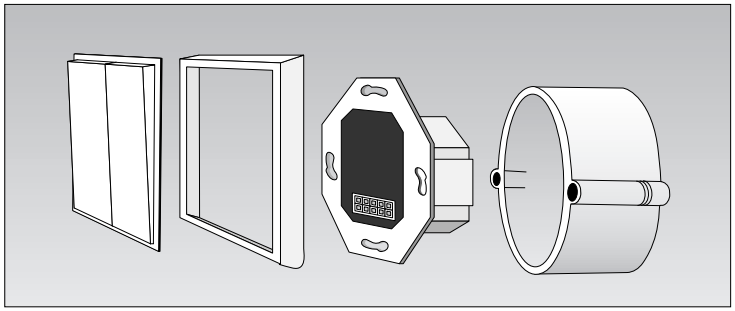


Fig. 2.5-1 Bus devices for flush mounting

ics and stores important data such as the actual physical address, one or more group addresses as well as the application program with parameters. These functions are coordinated out by a microprocessor, the "brain" of the bus coupling unit.

Application program

The application module and application program establish the function of the bus device. This may be a pushbutton, a display or a data interface.
Depending on the design of the bus device, the bus coupling units and application modules are plug-in types (e.g. flush-mounted units and DIN rail mounted units) or they are integrated as permanently connected units within a housing (e.g. built-in and surface-mounted units) (see chapter 2.1.6). The bus coupling unit, application module and application program of a bus device must all be manufactured by the same manufacturer. Bus devices are offered in various designs.

Flush mounting
Rail mounting
Surface mounting
Built-in devices

- Bus devices for flush mounting (see Fig. 2.5-1)
- Bus devices for rail mounting (see Fig. 2.5-2)
- Bus devices for surface and built-in mounting (see Fig. 2.5-3)

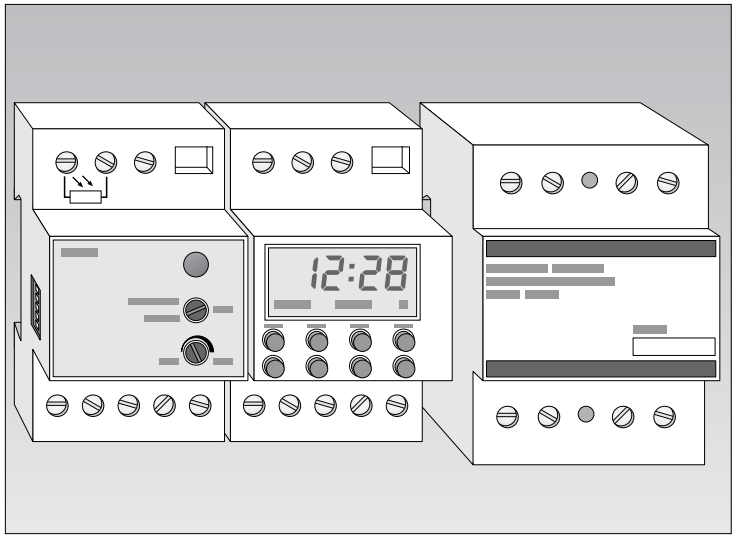


Fig. 2.5-2 Bus devices for rail mounting

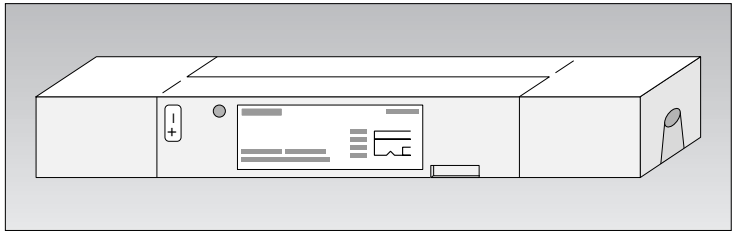


Fig. 2.5-3 Bus device as a built-in unit

2.5.1.2 Installation material for the bus installation

2.5.1.2.1 General requirements

EIBA trademark

Electrical safety on the side of the bus is guaranteed by the use of standardised installation material or that, which has been certified by EIBA; this also guarantees trouble-free communication. EIBA certified installation material is labelled with the EIB® trademark (see chapter 2.1.8).

Type	Design	Installation
YCYM 2×2×0,8	EIBA guidelines (Basis: DIN VDE 0207 and 0851) Wires: red (+EIB) black (–EIB) yellow (free, optimal +EIB) white (free, optimal –EIB) Shielding film with tracer Wires and screen with common casing	Permanent installation: Dry, humid and wet rooms: On, in and flush to the surface and in pipes Outside: If protected from direct sunlight Bending radius: > 30 mm for fixed installation > 7 mm for inputs into sockets and hollow spaces
J-Y(St)Y 2×2×0,8 *EIB* design* *) see appendix	DIN VDE 0815 Wires: red (+EIB) black (–EIB) yellow (free, optimal +EIB) white (free, optimal –EIB) Shielding film with tracer Wires and screen with common casing	Permanent installation: Dry and humid factory offices: surface and flush mounting and in pipes Outside: Built-in and flush mounting Bending radius: > 30 mm for fixed installation > 7 mm for inputs into sockets and hollow spaces

Table 2.5-2 Examples of permitted bus lines

2.5.1.2.2 Bus lines

Bus lines for the *EIB* satisfy two essential requirements:

- Trouble-free communication according to the *EIB* standard (DIN EN 50090-2-1 and DIN EN 50090-2-2).
  This requires shielded bus lines with twisted pairs and a line diameter of 0.8 mm (see the *EIB* bus line specification in Appendix G).
- Protective separation from the mains network (see chapter 2.6.1).
  Examples of permitted bus lines are listed in Table 2.5-2.

The mains cables used in the electrical installation must not be used as bus lines (security, function, and danger of interchanging!).

Halogen-free line

If halogen-free lines are required, the J-H(St)H2x2x0.8 can be used.

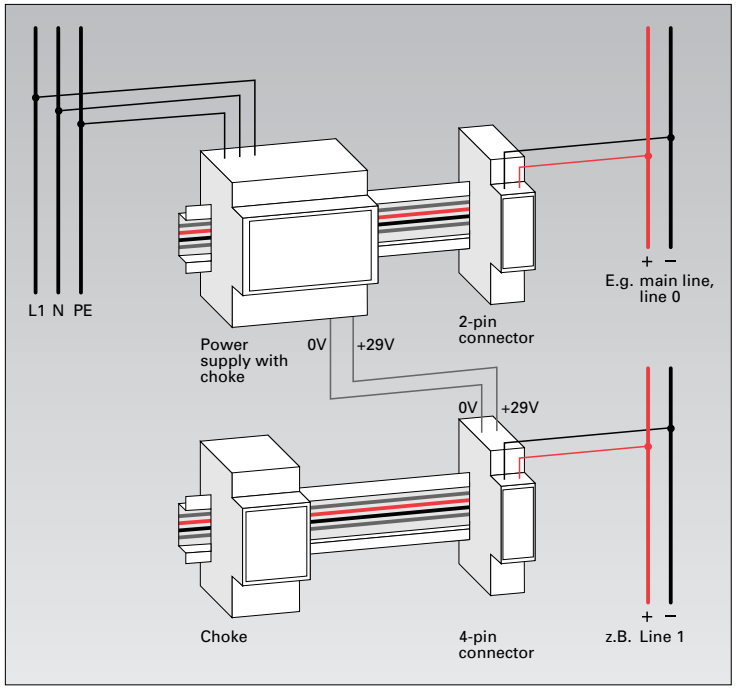


Fig. 2.5-4 *Connection of an EIB power supply with the bus lines*

Underground telecommunications cable

To connect two buildings with the *EIB*, the underground telecommunications cable, A-2Y(L)2Y or A-2YF(L)2Y, can be used, or alternatively the *EIB* bus line can be used providing there is a closed, dry pipe system (see chapter 2.5.3).

Free wire pair

Guidelines for the use of the free wire pair for additional applications:

- extra-low voltage only (SELV/PELV)
- max. 2.5 A constant current; excess current protection (overload and short circuit) is necessary
- voice transmission permitted, but not as remote signalling lines of the public telecommunications network.

The second pair of wires must be used in the same way within a line. It is recommended that the same type of usage is employed for the second wire pair within the entire building.
Moreover, we also recommend that pairs of wires used for additional applications are clearly marked at all conductor ends.
If the second twisted pair is used as a further line, the yellow wire should be used for +*EIB* and the white wire for –*EIB*.

2.5.1.2.3 *EIB* power supply and choke

EIB power supply with integrated choke

The *EIB* is supplied with SELV low voltage via an *EIB* power supply with integrated choke. This device is currently available as a unit for mounting onto the DIN rail.
We recommend using a separate circuit for the mains connection of the *EIB* power supply (security of supply, see chapter 2.1.9) and installing the power supply at the centre of the line's load. On the bus side the *EIB* power supply is current limited and short circuit proof.

Line load centre point

Only power supplies that have been certified by EIBA may be used. Fig. 2.5-4 illustrates the connection of an *EIB* power supply with the bus lines.
Bus connection terminals and data rail connectors for the bus connection are easily fitted, offer high contact reliability and cannot be confused with terminals and connectors for other circuits.

Bus connection terminals

Bus connection terminals

The bus connection terminal connects bus devices with the bus line and facilitates branching, which means that the bus is not interrupted and remains functional whenever exchanging devices (see Fig. 2.5-5).
The bus connection terminal (terminal block) consists of two halves (red and dark grey) that are permanently fixed together and only fit the pins of the bus device (red to "+" and dark grey to "-"). Observe correct polarity.

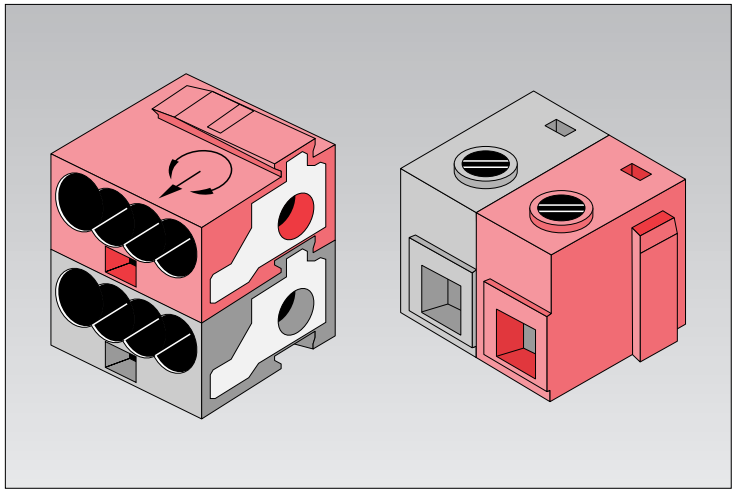


Fig. 2.5-5 Bus connection terminals

Data rail
DIN rail

Data rails and covering

The data rail (see Fig. 2.5-6) fits into the 35x7.5 DIN rail in accordance with EN 50022. It is self-adhesive and with that is easily fixed into the rail. The data rails are available in various lengths.

Free sections of the data rails must be protected by suitable coverings that can be clipped onto the DIN rail.

The bus voltage is supplied to both internal conductors of the data rail via the choke.

The two external conductors connect the *EIB* power supply with an external choke for a second line.

Data rail connector
Spring connection block

Data rail connector

The data rail connector allows bus lines to be connected to the data rail and data rails to be connected with one another. Data rail connectors are connected to the bus via spring connection blocks. The bus line is connected via plug-in terminals or bus connection terminals (see Fig. 2.5-7).

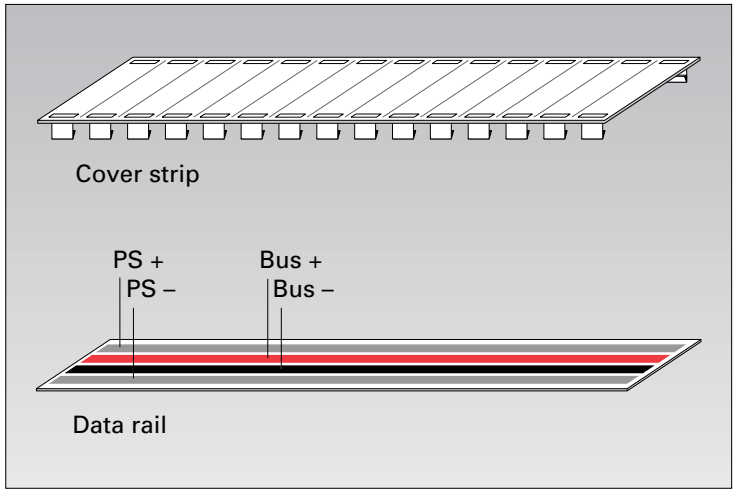


Fig. 2.5-6 Data rail and data rail covering

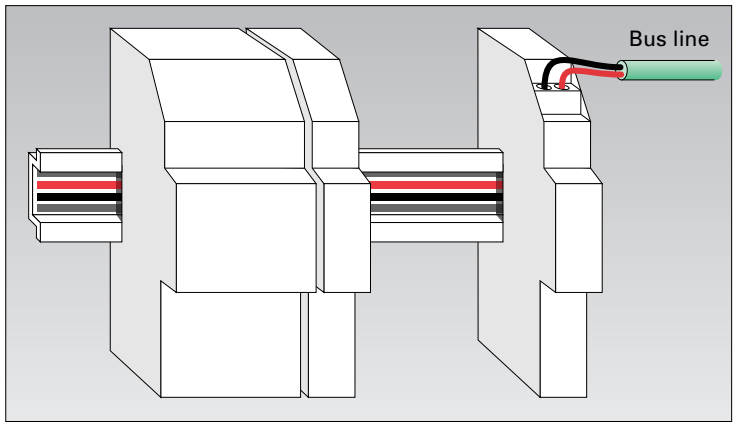


Fig. 2.5-7 Data rail connector

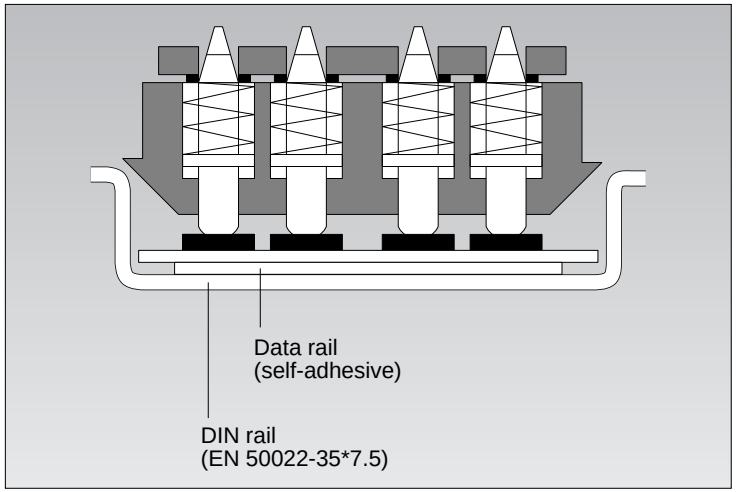


Fig. 2.5-8 *Example of implementing a push contact system for DIN rail mounted units*

Spring connection block
In the case of DIN rail mounted units with a push contact system, this forms the connection to the data rail (see Fig. 2.5-8).

2.5.1.2.5 Installation sockets and distributors

Installation socket

Regular distribution panels and installation sockets can be used for the bus installation. The installation sockets for flush-mounted devices must be suitable for screwed fixing.

2.5.2 Planning the bus devices

2.5.2.1 General advice

With *EIB* installations, the individual bus devices and how they work together determine the functionality.
In order to design an *EIB* installation therefore, the electrical and mechanical properties of the bus devices as well as their application programs and adjustable parameters must be known.
When designing the project we recommend that you first consider the functionality required in each individual room before looking at the more general functions.

2.5.2.2 Selecting and placing the bus devices

Auxiliary supply

It is now necessary to establish the service points within the rooms, if this has not already been achieved in the initial planning stage. When designing the project it must be remembered that some bus devices require an auxiliary supply, usually 230 V AC.
It is also necessary to consider the environmental conditions, i.e. the external influences such as temperature, dust and water.
And furthermore, devices such as “white goods” etc. require the use of a appliance interface (see chapter 2.3.2).
After this and depending on the required function, the devices and application programs are selected, e.g. a two-way pushbutton with the “dimming” application program (application). These devices are usually flush-mounted.
After this you should select the appropriate devices according to the assigned actuator functions. These are available as flush-mounted and surface-mounted devices or as DIN rail mounted units. They also exist as equipment with integrated bus devices, all other functions such as for example, binary inputs for the window monitoring and timers etc. shall now be considered and the corresponding devices

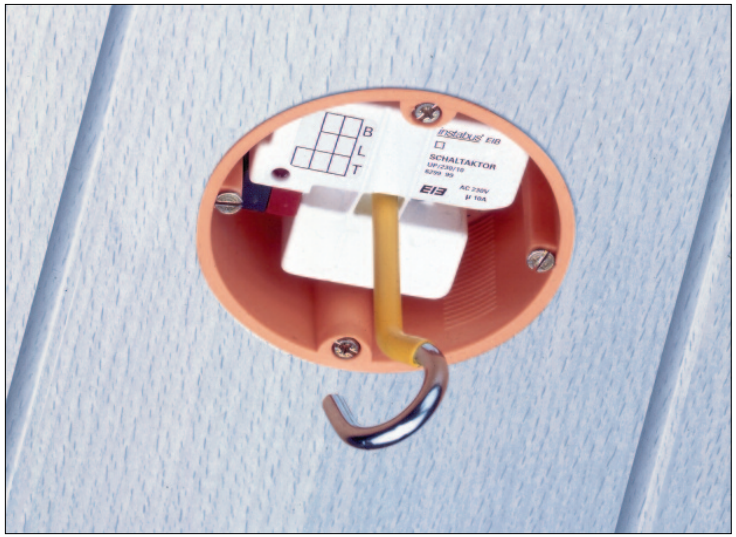


Fig. 2.5-9 Flush-mounted switching actuator in a ceiling socket

selected.

Light intensity switch
Central OFF/UP
Timer

When you have planned the bus devices for each individual room you can then go on to consider the universal functions affecting all rooms, such as for example, light intensity switches, central OFF/UP function, timers etc. and in the same way select the required devices.

2.5.2.2.1 Flush-mounted devices

Installation sockets with screws which comply with DIN VDE 0606-1 or DIN 49 073-1 are required for fixing flush-mounted devices.

Device connection socket

If more than two bus lines are to be used within an installation socket, we recommend allowing for device connection sockets 60 mm in depth. The combination of a bus device in flush-mounted format with a plug socket under the same covering is only permitted if the socket is protected against direct contact or the DIN VDE guidelines have been followed.

Flush-mounted switching actuators can be supplied for

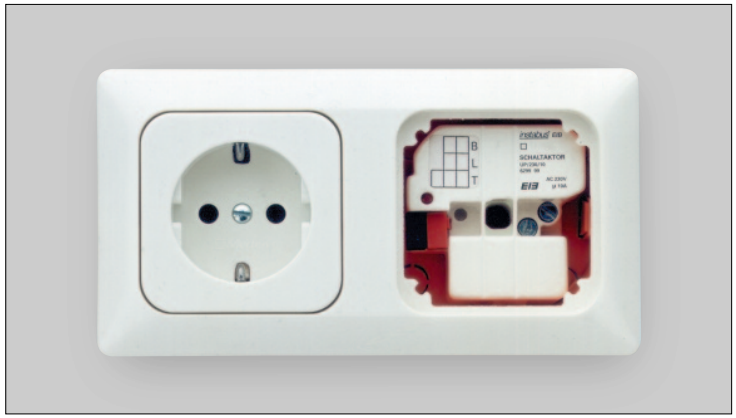


Fig. 2.5-10 Flush-mounted switching actuator combined with a plug socket

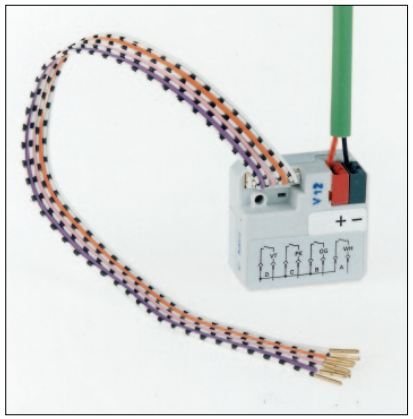


Fig. 2.5-11 Flush-mounted pushbutton interface

Flush-mounted switching actuator

the switching of ceiling lights and hanging lights (see Fig. 2.5-9).

It is also possible to combine plug sockets with flush-mounted switching actuators. This means that it is possible for example, to switch standing lights on and off via *EIB* (see Fig. 2.5-10).

If desired, the flush-mounted switching actuator can be fixed behind a blank covering.

A flush-mounted pushbutton interface (see Fig. 2.5-11) that fits into the 60 mm deep connection socket is available to provide the link between conventional switches and push-buttons and the potential contact.

2.5.2.2.2 Equipment with built-in bus devices

Using equipment with built-in bus devices (e.g. lights with built-in switching actuators) simplifies wiring arrangements and installation.

2.5.2.2.3 Using a HomeAssistant

If the use of a HomeAssistant is planned (see chapter 5), then it is necessary when designing the *EIB* installation to make allowances for additional special connections in addition to the usual requirements of a bus system.
Chapter 5.3 outlines the general requirements for a PC that is to be used for the operation of a HomeAssistant, as well as those for the monitor.

2.5.2.2.4 DIN rail mounted devices

Distribution boards should be planned to secure bus devices with spring connection blocks, used with 35x7.5 DIN rails compliant with EN 50 022. If using DIN rails with a greater depth, it is necessary to ensure secure contact with the inserted data rail.

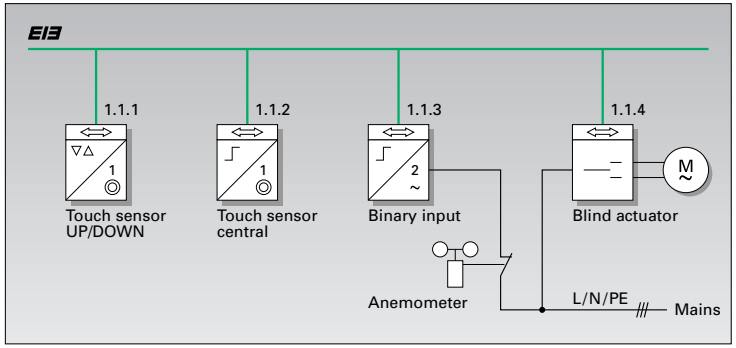


Fig. 2.5-12 Logic diagram

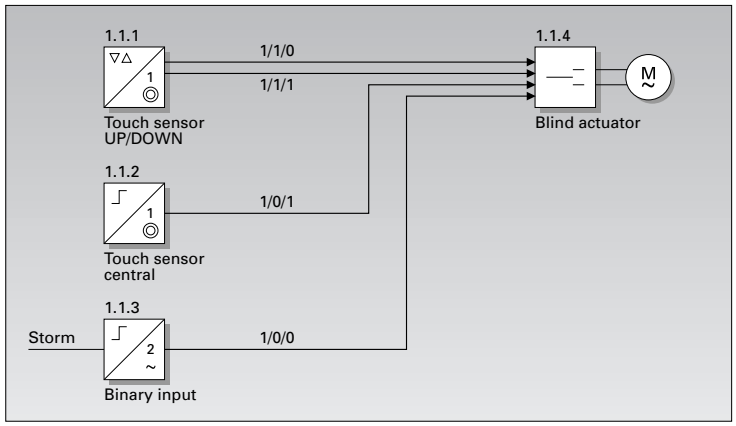


Fig. 2.5-13 Functional diagram

2.5.2.2.5 Functional representations

Logic diagrams, functional diagrams and parameter blocks are used to represent the logical connections in a clear and comprehensible way. These diagrams are extremely useful when dealing with more complex tasks.
They are also helpful when extending or modifying systems as well as during diagnosis and troubleshooting.

Logic diagram
The logic diagram illustrates the symbols of the used bus devices and the physical connection (wire) to the lines. This representation can also be incorporated into the ground plan.

Functional diagram
The functional diagram illustrates the functional links between the devices and how they influence each other.

Parameter blocks
The parameter blocks are a representation of device + application + object + parameter.

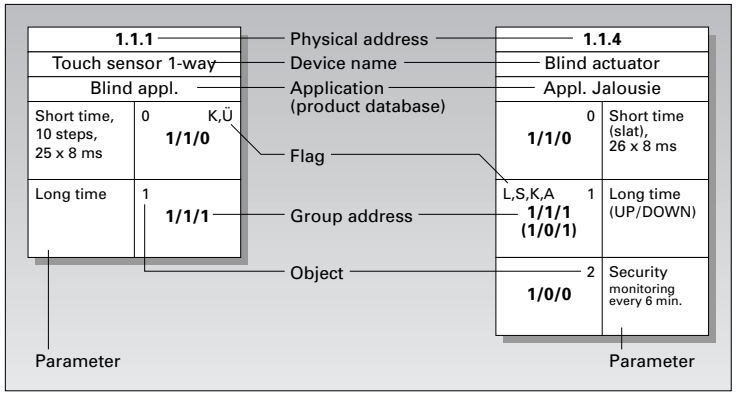


Fig. 2.5-14 Parameter blocks

In the above diagram only the parameter blocks for devices 1.1.1 and 1.1.4 are represented.
The representations and functional connections are independent of the transmission media.

2.5.2.2.6 Design of the distribution panels

SELV
PELV

Bus devices and mains equipment can be installed together in distribution panels. It is necessary to ensure however that all circuits, that are not SELV or PELV low voltage, are securely isolated from the EIB (see chapter 2.6.1.1.2). It may be necessary in some cases to install additional covering or separating walls.
It must also be remembered that any sections of data rail not covered by devices need to be provided with suitable covering. This protects the data rail from dirt and also ensures secure separation.
When using *EIB*, extensions to the system are far easier than with conventional technology, and can therefore be made more frequently. The size of the distribution panel should be selected so that it provides sufficient space for the bus devices and any extensions. The required space

also depends on the topology and form of the implemented bus devices.
Devices with a high degree of stray power should be placed in the upper area of the distribution panel. To improve the clarity, we suggest arranging bus devices and conventional mains devices in separate sections.

2.5.2.3 Dividing the bus devices between lines and areas

After selecting and placing the bus devices, the next step is to define the lines and areas and distribute the devices among these. This is achieved by making entries in the corresponding equipment lists and assigning the physical addresses. When doing this it is necessary to ensure that limits on line lengths and number of devices are not exceeded (see Table 2.5-1).
In designing the project we recommend that a reserve of 20% per line and area is allowed when assigning bus devices, so that the line can easily be extended at a later date.

2.5.2.4 Wiring arrangement

Installation zone

The wiring arrangement of *EIB* is laid out together with the mains power lines in the installation zones established according to DIN 18015-3 (see Fig. 2.5-15 and 2.5-16).
Depending on the structural opportunities, both ceiling-based (see Fig. 2.5-17) and floor-based wiring arrangements (see Fig. 2.5-18) are possible.
The bus lines to the individual rooms are either led separately to the distribution panel, i.e. in a star formation (see Fig. 2.5-19), or they are branched from room to room (see Fig. 2.5-20). The separation into different areas and lines must be taken into consideration.
The distribution panels of a building (main and secondary) should always be connected with a bus line.
Entire floors or larger areas should basically be connected with the (main) distribution panel in a star formation.

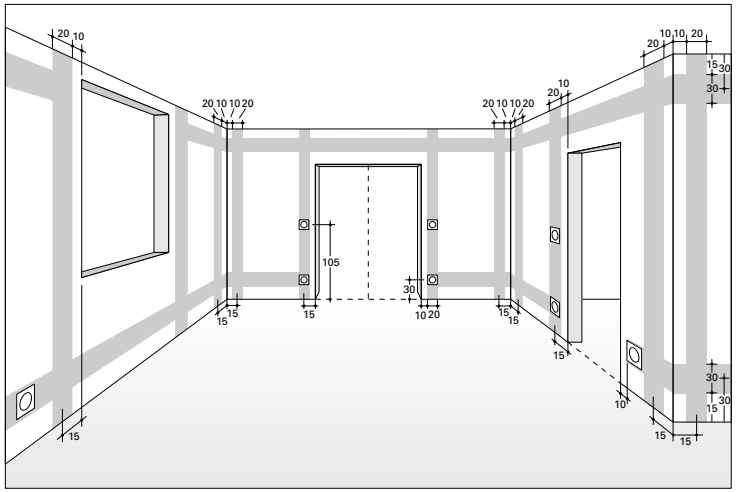


Fig. 2.5-15 *Installation zones for rooms without working surfaces on the walls (taken from DIN 18015-3)*

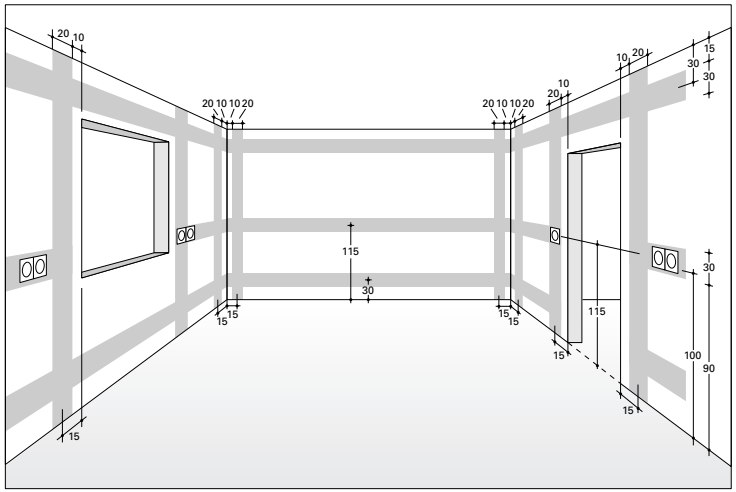


Fig. 2.5-16 *Installation zones for rooms with working surfaces on the walls (taken from DIN 18015-3)*

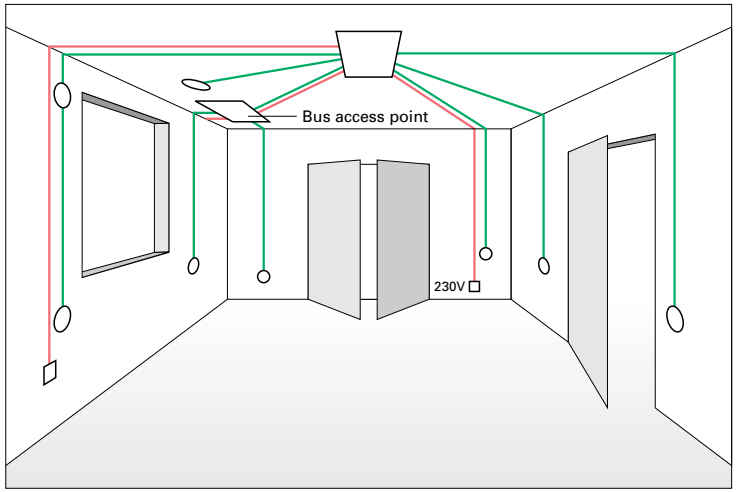


Fig. 2.5-17 *Ceiling-based wiring arrangement*

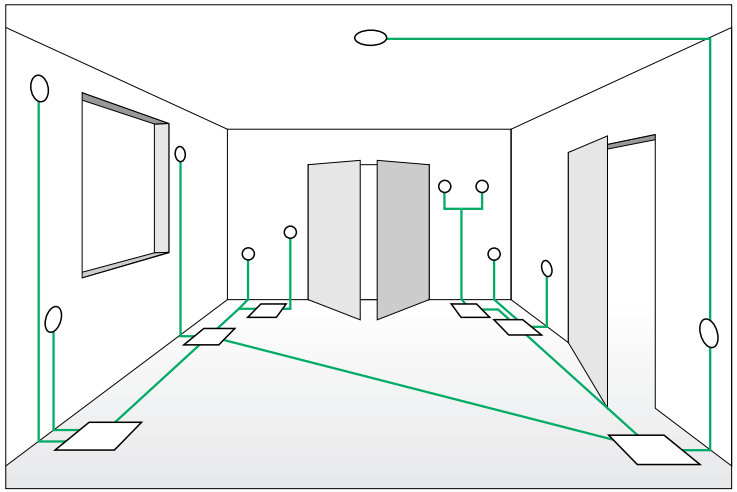


Fig. 2.5-18 *Floor-based wiring arrangement*

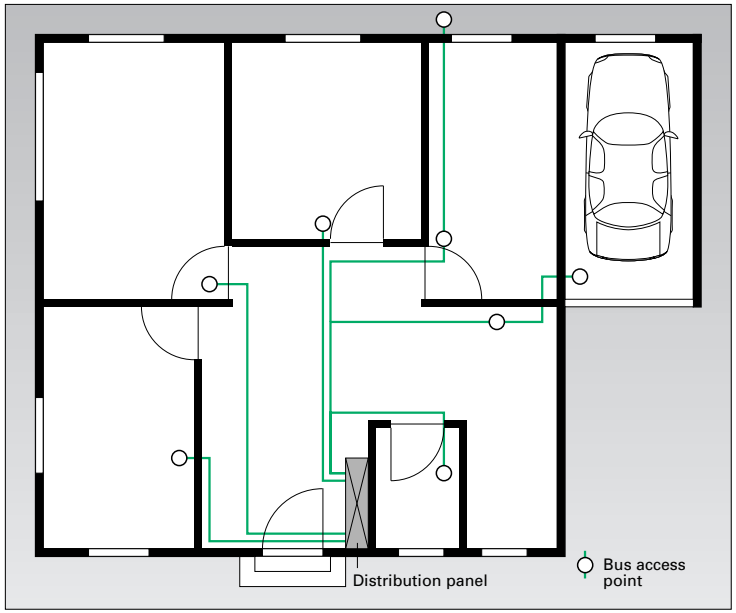


Fig. 2.5-19 Star-shaped wiring arrangement

All networks within the building e.g. 230/400 V mains, *EIB*, TV and telephone, should be accessible in one location in the building (main distribution panel/connection room) and possibly also linked together via gateways.

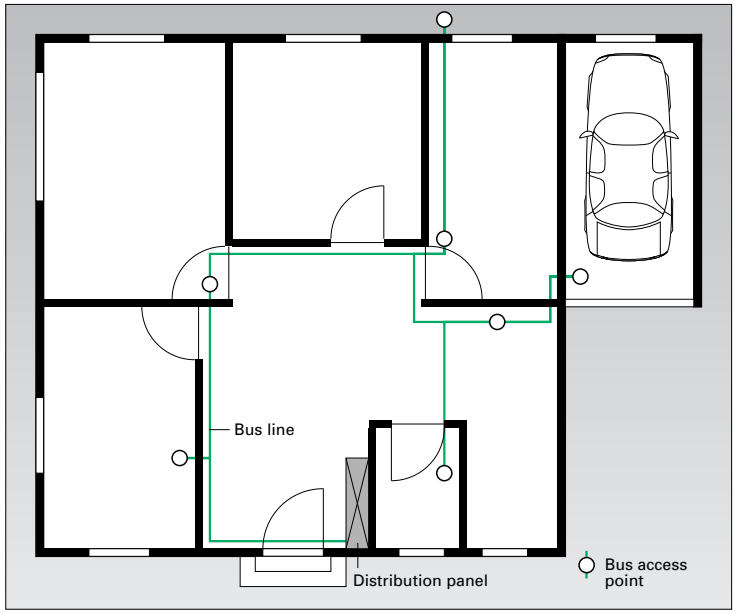


Fig. 2.5-20 Looped wiring arrangement

2.5.3 Protection against lightning and overvoltage

2.5.3.1 The necessity of lightning protection

Lightning protection

The individual regional councils have deemed it necessary to set up lightning protection systems in buildings. In general, the buildings that require lightning protection are "those which depending on position, type or usage are susceptible to lightning or where it may have serious consequences". For public buildings such as schools, lightning protection is a pre-requisite.

Potential equalisation

Lightning arrester

In the standards that are currently valid as regards setting up lightning protection systems (DIN VDE 0185, IEC 1024-1), lightning protection potential equalisation is also a compulsory requirement for active conductors. The link is made indirectly via lightning arresters (see Fig. 2.5-21).

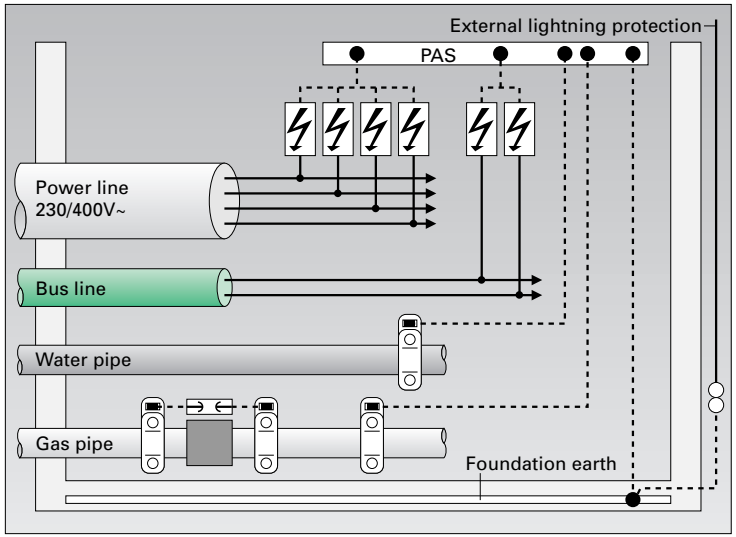


Fig. 2.5-21 *Lightning protection potential equalisation (primary protection)*

2.5.3.2 Design guidelines for protection against lightning and overvoltage

Primary protection

If lightning protection is required, then in accordance with DIN VDE 0185-1 or following DIN V EN 61024-1/VDE 0185-100 connection of the active wires must be achieved with lightning arresters (primary protection).
This is also recommended if, for example
- the building is connected via a low voltage overhead line,
- parts of the building into which lightning can strike are made of metal, e.g. metal flues or antennae,
- there is another building near to the building in question that has a lightning protection system.

When cables are laid to incorporate more than one building, lightning arresters must be installed for the bus line where it enters the building (see Fig. 2.5-22). Alternatively, the bus line that is protected with surge arresters (see Fig. 2.5-23)

must be laid in a metal channel or pipe that is incorporated into the potential equalisation on both sides.
The minimum cross section of the channel or pipe is that which allows a significant percentage of the lightning current to be conducted through it (in accordance with DIN VDE 0185-100: Cu 16 mm2, Al 25 mm2, Fe 50 mm2).

2.5.3.2.1 Lightning arresters (for the primary protection)

Lightning arresters are capable of diverting high-energy component lightning currents in a totally non-destructive way. They must meet the following specifications:

– For the 230/400 V AC network
– Nominal discharge capacity at least 10 kA (10/350).
– Protection level: < 4 kV,
– Lightning arrester class B corresponding to DIN VDE 0675-6/draft 11.89

– For the bus line
– Nominal discharge capacity at least 1 kA (10/350).
– Protection level: < 4 kV,
– Lightning arresters are specified in IEC SC 37A and DIN VDE 0845-2 (draft)

When designing the project, the lightning arresters must be selected to co-ordinate with the overvoltage protection. The manufacturer specifications regarding the use of their lightning arresters must be observed.

2.5.3.2.2 Overvoltage protection for the 230/400 V AC network (secondary protection)

Surge arresters for the 230/400 V AC network are built into distribution panels. Class C surge arresters in accordance with DIN VDE 0675-6 (currently in draft form) should be used which satisfy the following requirements:

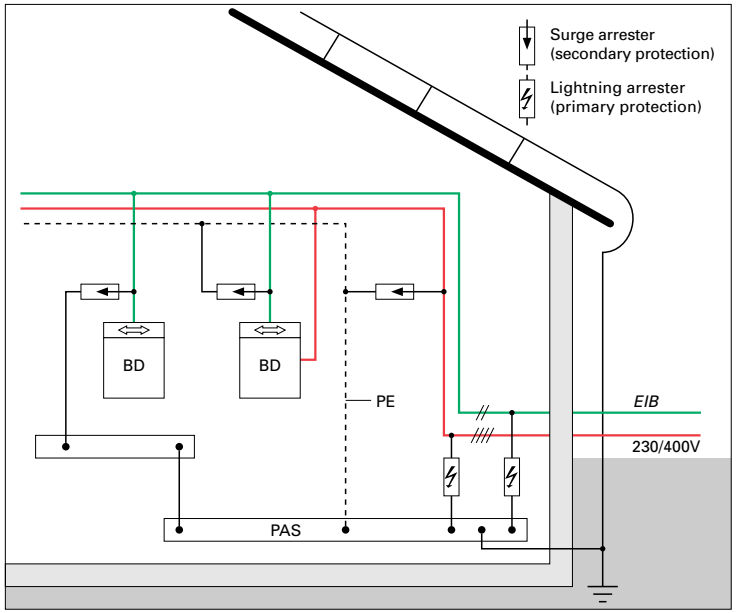


Fig. 2.5-22 *Connection of surge arresters (secondary protection) and lightning arresters (primary protection)*

– Nominal discharge capacity at least 5 kA (8/20),
– Protection level < 2 kV,
– If varistors are used, they must be heat-monitored and provided with a separation device.

Surge arresters that correspond to the above mentioned requirements can be used as charge eliminators for the overvoltage protection. They are also supplied in a format that can be snapped onto the DIN rail. When they are used on DIN rails with built in data rails, it is necessary to ensure that:

– The arresters are completely insulated (base insulation 250 V; for example no open dischargers).
– The DIN rail must not be used to earth the charge eliminators (no metal parts for the snap fastening); the charge

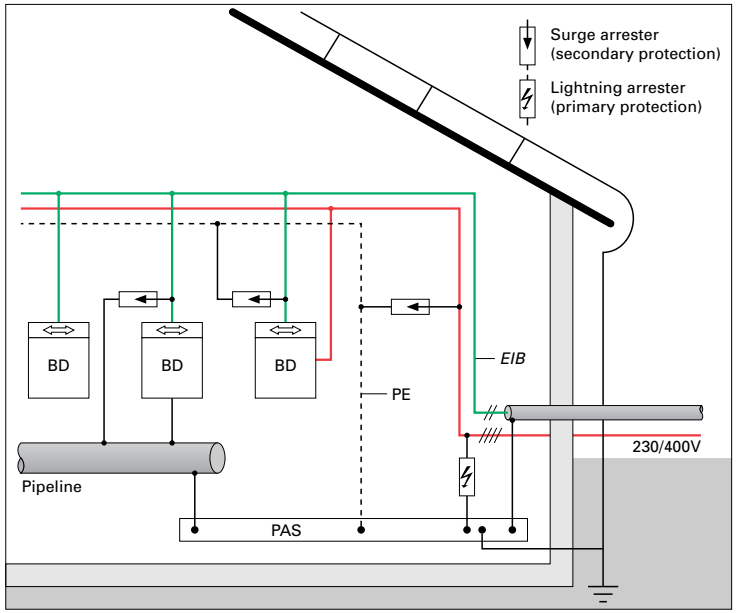


Fig. 2.5-23 *Connection of surge arresters with cables laid in metal channels or pipes between buildings*

eliminators (arresters) must have an earthing terminal, which with the corresponding cross section is connected to the local equipotential busbar.

2.5.3.2.3 Overvoltage protection (secondary protection) for the *EIB*

Surge arresters must satisfy the following requirements:

– Nominal discharge capacity at least 5 kA (8/20)
– Protection level: < 2 kV

Level ratios

The surge arresters are specifically matched to the level ratios in an *EIB* installation.

Surge arrester

Surge arresters have the same dimensions as bus connection terminals (see chapter 2.5.1.2.4). They are distinguished

by colour (the entire terminal is blue) and by the additional earth wire (see Fig. 2.5-24). The surge arrester can be installed in place of the bus connection terminal, whereby it is connected to the next earthing point (for example an earthed conductor).
With this surge arrester, no looping of the bus is possible. Independent of measures for overvoltage protection within the framework of lightning protection, it may be necessary to increase the immunity of the EIB installation by using surge arresters.

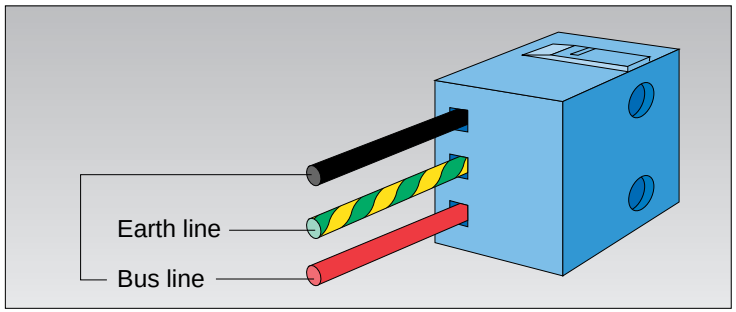


Fig. 2.5-24 Surge arrester

2.5.3.3 Recommendations for installing surge arresters

Surge arresters are recommended for use with bus devices of protection class 1 as well as devices to which a second network is connected (230/400 V AC and/or the heating system pipe network) in addition to the bus line. With that, the earthing point is also given.
It is sufficient in distribution panels to wire every bus line with one surge arrester.

Active and neutral conductors

If the bus lines are wired with surge arresters in the distribution panels, the active conductors and the neutral conductors must also be wired with surge arresters (see chapter 2.5.3.2.2).

With lights that have built-in switching actuators, surge arresters need only be installed if the bus line and mains power line cover a large area.

2.5.3.4 Avoiding overvoltage as a consequence of loop forming

Loops

Loops are often the cause of EMC disturbances through surge voltages as a result of lightning. Such loops therefore should be avoided wherever possible. This should be given particular consideration in the design phase.

Surge voltage

Loops arise when two independent networks are connected to one device. Induced surge voltages lead to breakdowns in the connected devices, which in turn causes damage. The

Loop forming

effect of the loop depends on the overall area. Loop forming must be looked at across the entire installation and all extended conductive parts must be considered (see Fig. 2.5-25).
When designing an *EIB* installation therefore, it is necessary to ensure that the requirements for the proper installation of surge arresters are fully satisfied. This means that it is necessary to provide a connection point for the surge arrester.

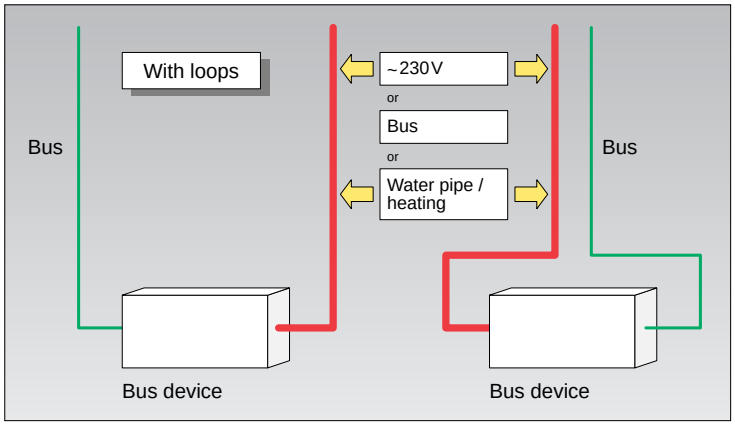


Fig. 2.5-25 Loop formation

The following rules must be observed:

- Bus and mains power lines must always be laid as close together as possible. This is also valid for earthed parts, if the bus devices have operational contact with them (e.g. heating valves).
- Line ends should be as far away as possible from earthed parts and other line ends.
- Keep sufficient distance from the lightning protection system (e.g. from the surge arresters).
- Rolled up cable ends are not loops in the above-mentioned sense.

2.5.3.5 EMC protection management for structural systems

EMC protection management

Supplementary to protection against lightning and overvoltage, it is possible to work out an EMC protection management plan for structural systems, such as for example, computer centres.
If an *EIB* system is installed in such a building, it must be incorporated into the EMC protection management.
The measures associated with this must be discussed in detail with the person responsible for the EMC protection management.

2.5.4 Functional security

If there are any special requirements for reducing risks to employees or objects (functional security), then additional measures must be initiated and these measures must be incorporated into the planning.
The individual devices for the *EIB* are constructed in the same way as conventional devices in that alone they pose no risk. However, the interaction of many devices within a system, or the breakdown of devices or functions can cause certain risks.

These risks can be reduced in a number of ways depending on the system, the application and the wishes of the customer. The action itself however must be independent of the operation of the system and it must always be available. As a guideline, the most important applications, their risks and global measures to reduce these risks are summarised in Tables 2.5-3 and 2.5-4. The measures correspond to the procedures generally employed today and are not specific to the bus, although they can be partially implemented with the *EIB*. Risks of class III and IV do not usually necessitate action.

Application with installation bus		Risk	Risk class		Risk reduction		
			Persons	Objects	Action	Attained risk class	
						Persons	Objects
Heating		Overheating	II	I	Safety thermostat	III	III
		Breakdown	II	II	A+D or C+D	III	III
Air con	Home/building	Breakdown	III	IV	—	–	–
	Storage rooms	Breakdown	–	I	A+D or B+C	–	III/II
Ventilation	Home	Breakdown	IV	IV	—	–	–
	Conf. rooms	Breakdown	IV	IV	—	–	–
	Stockbreeding	Breakdown	–	I	A+D, C+B or A+B+D	–	II/II/III
Fire alarm system		Malfunction	I	I	E.g. damage limitation guidelines	III	III
Smoke detectors		Malfunction	II	II	C	III	III
Security check (For grade 1 & 2, according to CIC/CT 106 SECT 102)		Malfunction	III	II	B+C + UPS	Application specific	III
Load management (No essential functions)		Malfunction	III	III	—	–	–
Energy management (Co-ordination of various energy sources)		Malfunction			Under preparation		
Blind control		Malfunction	III	I	A or C	III/III	III/II
Gate control		Normal function	I	II	Safety switch; safety precautions as part of the gate + D	III	III
		Malfunction	–	II	A	–	III
Check, status message and output of data:							
a) Safety relevant data		Malfunction	I	–	Under preparation		
			–	I	Redundant system	–	III
b) Informative data		Malfunction	IV	–	—	–	–
c) Technical alarm (t safety related)		Malfunction	–	II	A or C	–	III

Table 2.5-3 Functional security, part A

Application with installation bus	Risk	Risk class		Risk reduction		
		Persons	Objects	Action	Attained risk class	
					Persons	Objects
Lighting control:						
- Rooms	Malfunction	IV	IV	—		
- Public access areas	Switched off	II	IV	Lights connected to two independent bus and mains power lines in alternation and pre-set ON command	IV	IV
- Security lighting	Malfunction	I	I	Measures independent of the bus in accordance with the valid regulations		
Medical equipment	Malfunction	I	–	Measures independent of the bus in accordance with the valid regulations		
Emergency off	Malfunction	I	I	Measures independent of the bus in accordance with the valid regulations		
Connected socket	Malfunction	II	II	Identification, warning advice, warning indication		
Lifts for material transport	Malfunction	II	II	Safety switch; safety precautions as part of the lift		
Equipment for disabled persons (non-medical)	Malfunction	II	II	Measure depends on the application		
P.A. systems and internal phone systems						
- Hospitals etc.	Breakdown	II	–	A or C	III	–
- For information	Breakdown	IV	–	—	–	–
Risk classes Acc. to IEC 65A (SEC) 123:	I = Not tolerable III = Tolerable			II = Unwelcome IV = Can be ignored		
Measures:	A = Status message + alarm C = Data output + alarm			B = Separate bus line D = Manual control independent of the bus		

Table 2.5-3 Functional security, part B

2.5.5 Address allocation and design lists

EIB tool software

Planning and commissioning software, the *EIB* Tool Software (ETS) is required for the project design stage and subsequent commissioning of an *EIB* installation.
A detailed description of ETS 2 is given in chapter 6. Recommendations on practical procedures are given in the training documentation.

2.5.5.1 Address allocation

The physical address is the unique identification for a bus device and specifies the area and line in which it is installed. The physical address is subdivided into area, line and device which, when written down, are formally separated by dots. For example, device 3 in area 1 and line 2 is denoted by the physical address 1.2.3.
If the bus devices are only to be programmed after installation, it may be useful to specify the physical addresses within a line at the project design stage. This minimises the necessary work when programming. The physical addresses should therefore be allocated in sequence for neighbouring bus devices.
With *EIB*, the group addresses establish which bus devices work together, e.g. which sensor controls which actuator.

Main group
Middle group
Sub group

Group addresses consist of main, middle and sub groups that are separated by back slashes, e.g. 1/2/16. It is possible to specify up to 16 main groups, 16 middle groups and 256 sub groups.
The structure of the group address can be seen as an organisational feature. In principle, the group addresses can be ordered according to various criteria. In practice it has proven useful to assign main groups according to the application area, and the middle and sub groups according to location/room.

Example:

Main group	Middle group	Sub group	Group address
1 Lighting	2 Central building	1 Stairwell	1/2/1
		2 Underground car park	1/2/2
2 Blinds	3 Office building	1 Room 746	2/3/1

With the group address 1/2/1 one or several sensors can activate one or several actuators with the common function of controlling the lights in the stairwell.

2.5.5.2 Equipment list

Equipment list

The equipment list can be partially drawn up during the initial talks with the customer. It firstly provides a piece list of the necessary components and is also used as the basis for programming the bus devices (see chapters 2.5.5.4 and Fig. 2.5-26 shows the layout of an equipment list that has been tried and tested. The first four columns contain:

- the physical address assigned to the device,
- the bus device type code (e.g. 4-way switching actuator, DIN rail mounted device),
- the manufacturer,
- the installation site.

The remaining columns represent:

- the number of the input/output channel,
- the transmitted and received group addresses assigned to the channel,

Equipment list | Project: | Written: | Last changed: | Page:
Author: | Changed by: | Of:

Physical address	Device type	Manu-facturer	Installation site	Chan.	Sent address	Received address	Remarks

Fig. 2.5-26 Equipment list

- notes on the planned function in the building (e.g. lighting strip 1 switched locally).

2.5.5.3 Function list

Function list

The function list (see Fig. 2.5-27) is based on the group address. It represents the functional interaction of the *EIB* installation; e.g. which sensors control which actuators. The relevant group address is entered in the first column. The next four columns contain

- the physical addresses,
- the available channels of the sensors and actuators.

This provides a line by line representation of the connection between group address and assigned bus devices. It is wise to record the function of the group address in the 'Remarks' column, e.g. lighting in the stairwell or blind in room 746.

Function list | Project: | Written: | Last changed: | Page:
Author: | Changed by: | Of:

Group address	Sensor		Actuator		Remarks
	Physical address	Channel	Physical address	Channel	

Fig. 2.5-27 Function list

2.5.5.4 Software for designing a project

Product database
User manual

The ETS is required when designing the project (see chapter 6). The ETS is used to create the data sets that need to be loaded into every bus device. Every data set consists of the application program, the functional parameters, the physical address as well as the assigned group addresses. At the moment it is only possible to load an application program into a bus device if both are from the same manufacturer. The application programs are included in the manufacturer-specific product database. The manufacturers of the bus devices provide the product data on disk. More detailed information is given in the user manuals accompanying the software. The ETS is also used to document an *EIB* installation

2.5.6 Documentation

The results of the project design stage should be documented. This documentation is required for all further steps (installation, commissioning, and maintenance) and consists of:

- Documents or training documentation in accordance with the standards of the EN 61082 or DIN 40719 series, especially for the given bus devices and bus lines.
- The function and equipment lists created with the planning and commissioning software.
- The project data created with the planning and commissioning software and stored on disk.

If any modifications arise during the commissioning of the *EIB* installation, then the documentation created at the design stage should be corrected accordingly.

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.

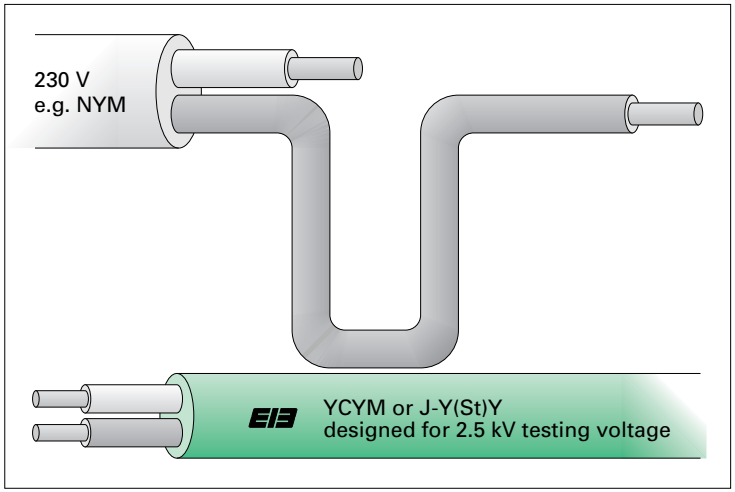


Fig. 2.6-1 *Insulated 230 V wires next to the casing of the bus line (schematic representation)*

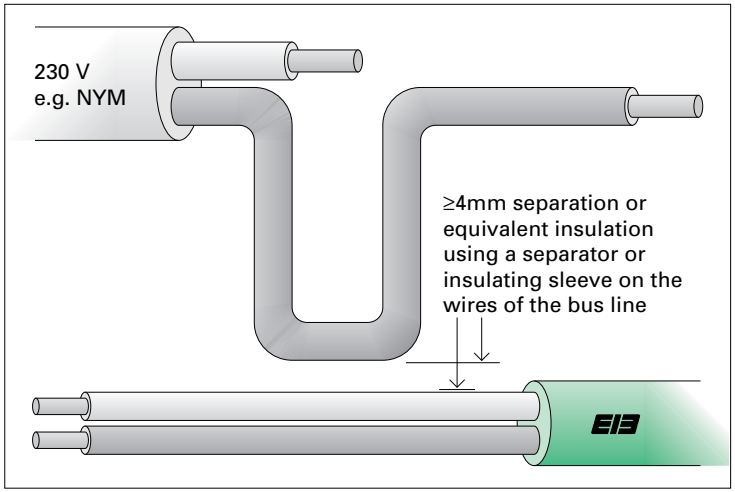


Fig. 2.6-2 *Adjacency of individual wires (schematic representation)*

– 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).

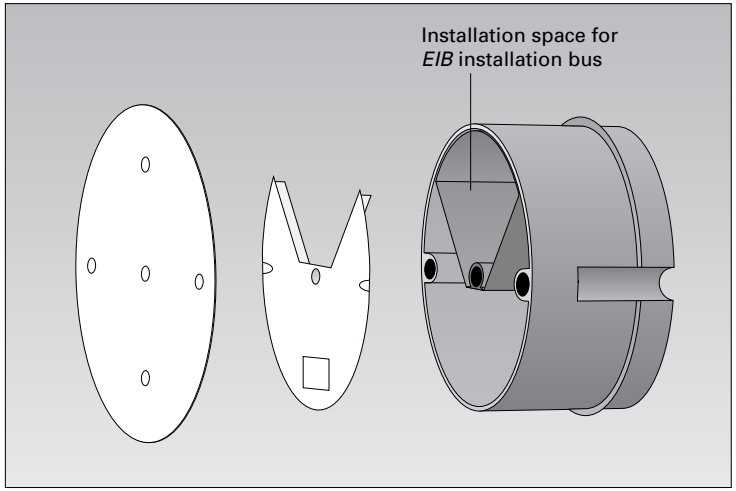


Fig. 2.6-3 Installation socket with separator/separating wall

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).

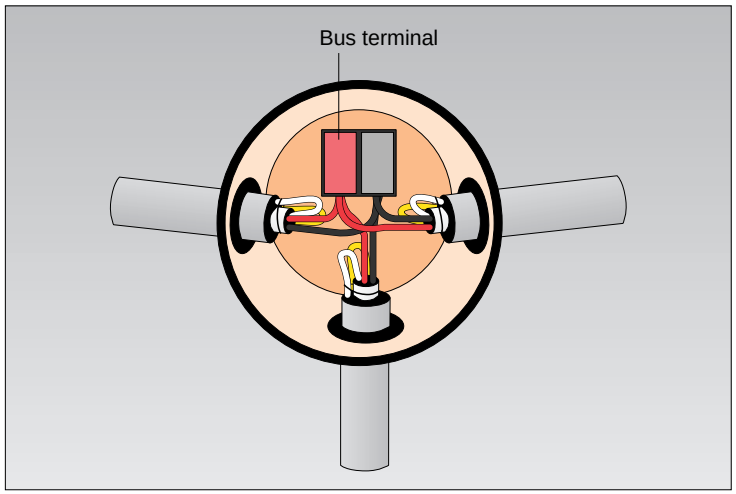


Fig. 2.6-4 Installation socket

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).

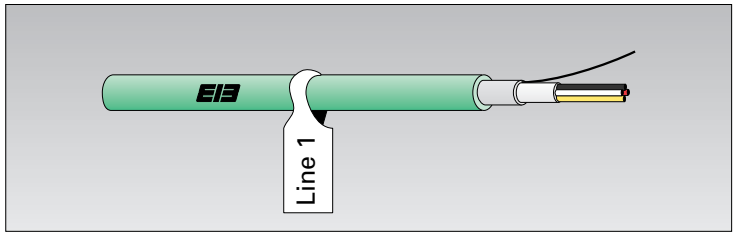


Fig. 2.6-5 Example of a line identification

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.

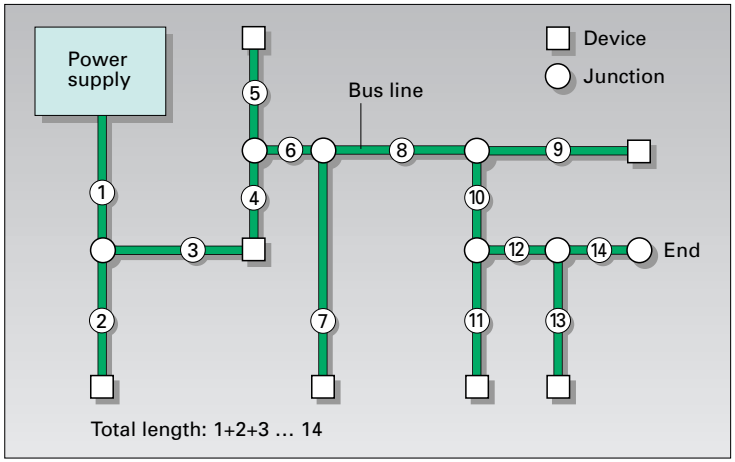


Fig. 2.6-6 Establishing the line lengths in the EIB-TP bus network

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.

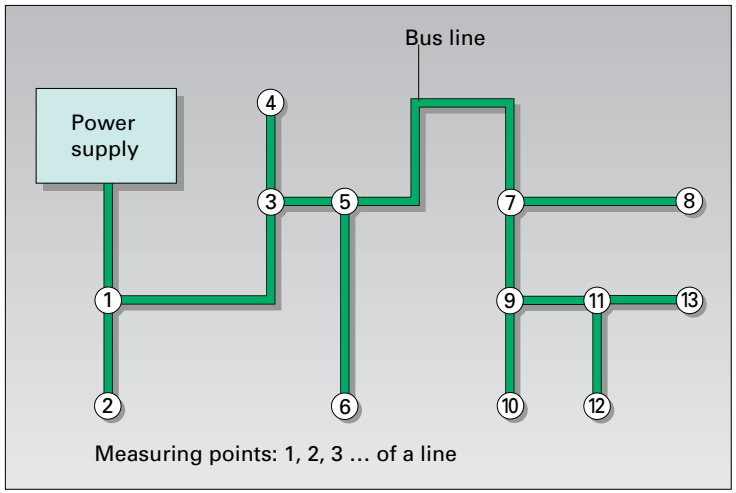


Fig. 2.6-7 Measuring points

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

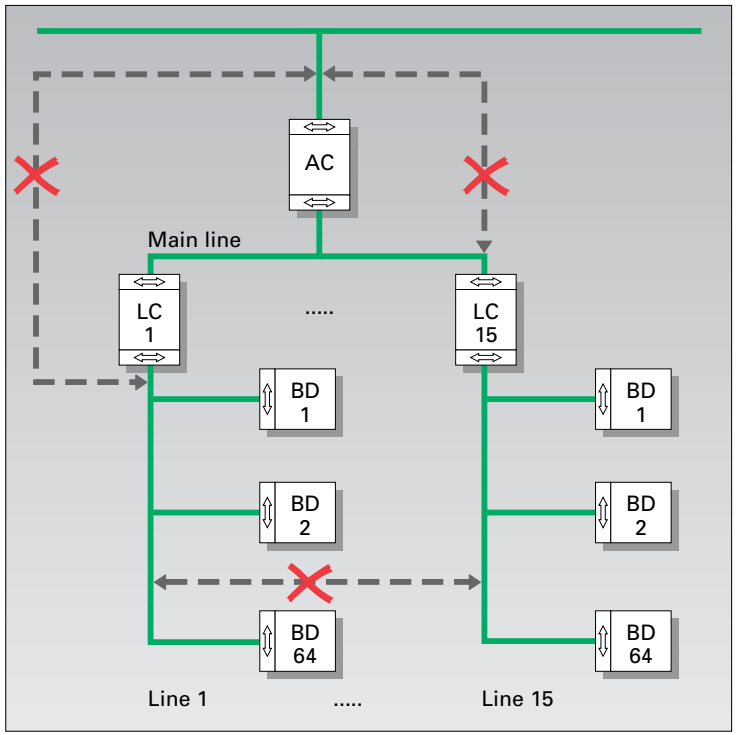


Fig. 2.6-8 Prohibited connections

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.

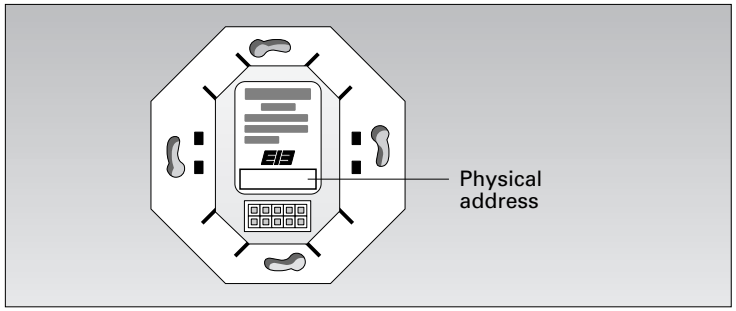


Fig. 2.6-9 Identifying the bus devicess

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.

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.

3 Transmission via the 230/400V power supply

3.1 Introduction

The *EIB* can also be implemented on the 230 V supply network (power line, PL).
This extension to power line transmission opens up further fields of application. Components and tools already introduced and established on the market can, to a large extent, also be used by *EIB powerline*.

EIB powerline

It is no longer necessary to lay separate bus lines. *EIB powerline* devices simply require the connection of active and neutral conductors.
Applications of *EIB powerline* exist for updates, but also for new installations. Device dimensions and operating methods are similar to those already seen for previous, familiar *EIB* components.
Despite the often indefinite transmission properties of the low-voltage network for high-frequency signals, *EIB powerline* facilitates a fast and secure means of data transmission. The system is bi-directional and works in half-duplex mode; i.e. every device can transmit and receive messages. It also supports the functions of the HomeAssistant.
EIB powerline is conformant with current European standards, in particular those of the DIN EN 50065 series (dealing with signalling on low-voltage electrical installations in the frequency range of 3 kHz to 148.5 kHz) and the DIN 50090 series (dealing with electrical system technology for homes and buildings, HBES).

3.1.1 Applications

In situations where, for whatever reason, the installation of a separate, additional bus line to an existent system is not desired or not possible, the use of the available 230/400 V supply network opens up new perspectives. Economy, flexibility and transmission reliability stand at the forefront of this development.
Intelligent components for almost all aspects of the conceivable applications are used to implement the desired functions.
Typical applications for the use of *EIB powerline* are:

- Switching and controlling lights, heating systems, ventilation and air conditioning.
- Blind, gate and awning control.
- Signalling functions.
- Transmission of analogue values.
- Time controls and the simulation of occupancy.

The above named applications are only the tip of the iceberg. It is true to say that the applications of *EIB powerline* cover almost all of those associated with *EIB* systems based on twisted pair lines (see Fig. 3.1-1).

3.1.2 The 230/400 V supply network as the transmission medium

The primary function of the 230/400 V network is the supply of electrical energy. *EIB powerline* uses the available lines for a dual purpose: for energy and information. As the signals for the transmission of information are applied and received between the active and neutral conductors, both these wires must exist in every connected device.

Open network
Impedance

As the 230/400 V network is not available in its original form for the transmission of information, the *EIB powerline* system must be adjusted to the possibilities offered by the network. In a signalling sense, the 230/400 V network is an

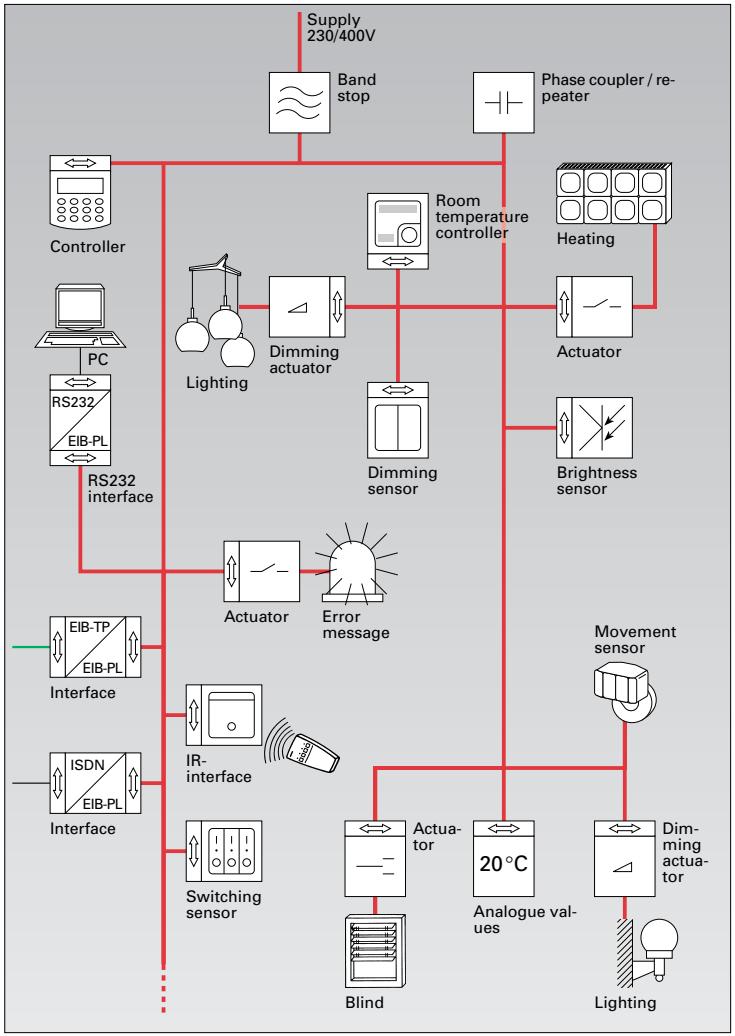


Fig. 3.1-1 EIB powerline system overview

open network, whose transmission behaviour, impedance and induced interference are largely unknown. When planning, the basic rules of the transmission technology must be taken into account (see chapter 3.2.3.1).

3.1.2.1 Mains power supply

Transmission across a transformer is not possible.
The network must have an undistorted, sinusoidal voltage curve with a rated voltage of 230 V. The permitted tolerance for this voltage is equal to ± 10%. Different network structures and parameters (e.g. inverter networks) are not permitted.

3.1.2.2 Mains frequency

The *EIB powerline* system is designed for a mains frequency of 50 Hz. A deviation of ± 0.5 Hz is tolerated by the system. The electric power company provides an accurate enough network. With larger deviations, as sometimes seen with emergency power units for example, transmission may be distorted. It is therefore necessary to check whether the mains frequency and network structure of the emergency power unit are sufficiently accurate.

3.1.2.3 Radio interference

Almost every electrical device that is operated on a 230 V network generates radio interference which is fed to the network. Every device manufacturer must ensure that the threshold values for radio interference as specified by the electric power company are not exceeded.
Compared with the permitted transmitting level of the *EIB powerline* devices, this radio interference is very small. Individual devices do not have any effect on the transmission. However, if several devices are connected in parallel, this may lead to overlapping and with that to increases in the radio interference. In such cases it is necessary to take into account the interference load during the pre-planning stage, by considering the load characteristics of each device (see chapter 3.2.3.3).

3.1.2.4 Mains impedance

EIB powerline is capable of detecting and analysing even the smallest of signal voltages.
A reduction of the signal voltage is usually seen in 230 V networks as a result of the capacitors that are provided in almost all electrical devices. Although this reduces the mains impedance the transmission and receiving circuits of *EIB powerline* adapt themselves to these changes.

Mains impedance

3.1.3 The transmission method

In order to be able to guarantee secure data transmission on the mains network, a new transmission method has been developed.
This new method is denoted SFSK, which stands for Spread Frequency Shift Keying. This guarantees high system reliability for all typical network conditions (see Fig. 3.1-2).
With this method, the signals are transmitted with two separate frequencies. Thanks to the so-called “correlative pattern comparison technology” and the complex correction

SFSK – Spread Frequency Shift Keying

Correlative pattern comparison technology

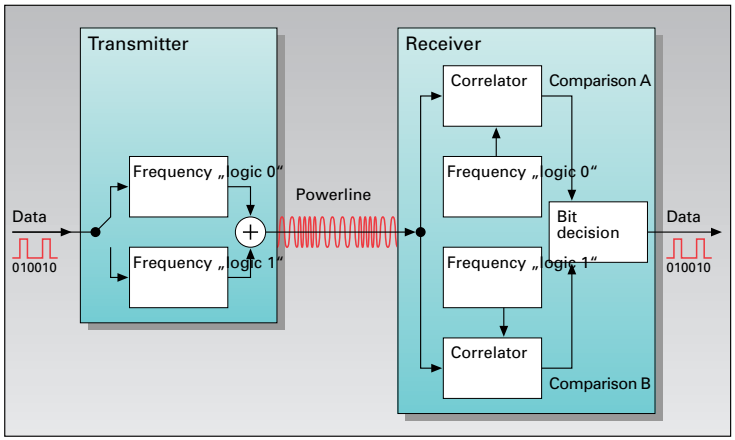


Fig. 3.1-2 EIB powerline transmission procedure

procedures, signals can be 'repaired' upon reception, even if there has been interference during transmission. After the successful understanding of a telegram, an acknowledgement is sent from the receiver to the transmitter. Only then is the transmission process complete. If a transmitter fails to receive a reply, it repeats the transmission process. Such a transmission process takes about 130 ms. The transmission rate of the system is 1,200 bit/s.

Frequency band

For transmission, *EIB powerline* uses a frequency band in accordance with EN50065. In the frequency band of 95kHz to 125kHz, the used frequencies are 105.6kHz and 115.2kHz.

Transmitting level

According to EN50065 such devices are designated as "class 116" devices. This means that the maximum transmitting level is equal to 116 dB (mV) on a standardised artificial mains network.

3.1.4 Topology

To guarantee reliable communication within an *EIB powerline* project, certain basic requirements must be fulfilled. The maximum number of devices within such a project should be limited to several thousand. This is necessary all the more considering that there is no possibility of a physical division into areas and lines using corresponding couplers. On the one hand, this significantly eases the installation of *EIB powerline*, but it also leads to greater telegram loads on the bus. To ensure that a clear overview is maintained in more extensive systems, a structured layout proves useful. Similar to *EIB-TP*, the system is logically divided into areas and lines. With *EIB powerline* there are a total of 8 areas each with 16 lines of 256 devices (see Fig. 3.1-3).

Overshooting
Inductive disturbance
Band stops

To avoid any overshooting into adjacent areas or inductive disturbance between neighbouring *EIB powerline* projects, band stops must be used.

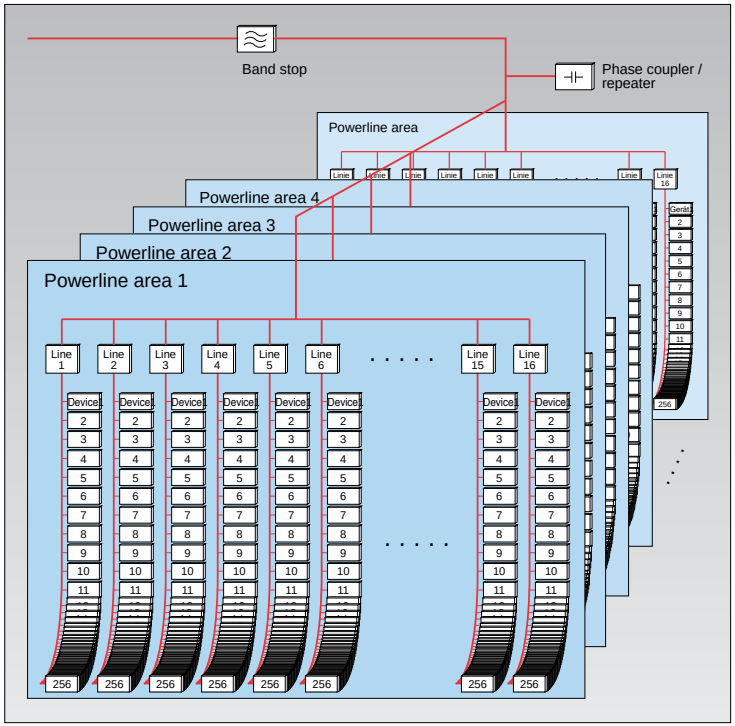


Fig. 3.1-3 EIB powerline topology

3.2 Planning

In the planning phase the exact requirements of the customer are established and then translated into the form of a specifications document or checklist.
The *EIB powerline* devices can communicate with one another from any 230/400 V network connection. All *EIB powerline* devices need a connection to the active and neutral conductors. A certain degree of reserve should be allowed in the distribution panels for subsequent extensions.

Technical connection requirements

The *EIB powerline* system must be planned in accordance with the general, established rules of the technology whilst adhering to the various regional connection requirements laid down by the respective electric power company.

3.2.1 Establishing the customer requirements

The customer requirements can be determined by asking the following questions:

- In which areas of the building should *EIB powerline* be installed immediately and where at a possible later date?
- How is the room divided up and where might this change at a later date? The answer to this question determines the division of lights, blinds and radiators etc. into individual switching groups.
- Will there be any later extensions to the system? If so, sufficient space must be left in the distribution panels.
- Within a building should a universal *EIB powerline* system be installed and/or should there be independent areas per building unit? With the help of band stops it is possible to isolate the areas from one another, thereby preventing unauthorised access. These independent areas can then be reconnected with one another via couplers so that they can exchange information.
- Which functions should the *EIB powerline* system carry out? Possible functions include controlling lights, blinds, heating systems, etc.
- Should these functions be linked together? It is possible for example, to link the window monitoring with the heating control.
- How should the consumers be controlled? With respect to time, wind strength, brightness etc.
- Are priorities needed for certain functions? With the lighting for example, manual operation can be given a higher priority than brightness-dependent control.
- Should the operating statuses of the system be displayed in a central location and should it be possible to change the statuses from there? There are suitable controllers, display and operating panels or PCs available for this.
- Are energy saving measures required?
- Are preventative measures to be included to discourage break-ins? Using time controls with random generators for the lights or blinds, it is possible to simulate occupancy. Movement detectors can be used to trigger various functions, e.g. the exterior lighting. If an *EIB powerline* system is to be used in conjunction with an *EIB-TP* installation, the media couplers described in chapter 3.3.2.7 must be installed.

3.2.2 Writing the specifications

The specifications should provide the answers to the questions posed in Appendix A.

3.2.3 Planning and installation guidelines

As with every other transmission medium in building systems engineering, there are specific guidelines for planning and installing *EIB powerline*, which must be followed to guarantee the trouble-free functioning of the system. These guidelines make it easier to assess whether the modernisation is possible in view of the local conditions and with that

simplify the detailed planning.

3.2.3.1 Application areas / basic rules

Independent of the functions to be executed, *EIB powerline* systems must involve "isolated signal areas".
This includes:

- Network areas that are disconnected from one another by band stops, e.g. in single family houses or apartment blocks.
- Island networks in object areas, e.g. lighting or blind controls in industrial and administration buildings.

The following are excluded:

- Signal transmission between houses or buildings within a street, city area etc. due to the regulations.
- Use in industrial networks involving machines and equipment without sufficient shielding from interference (such as for example, erosion machines, automatic welding machines etc.) if these cannot be separated from the network used for transmission by employing suitable interference suppressing and filter measures (e.g. band stops) or separate wiring.
- Local networks whose parameters differ from the normal network (required characteristics: 230 V ±10%, 50 Hz ±0.5%).
- Transmissions across a transformer.
- Areas in which other carrier-frequency systems are possibly used for the transmission of network data.

In general it is true to say that *EIB powerline* cannot be used for safety-relevant applications (e.g. monitoring life-support or life-saving machines in hospitals, P.A. systems, alarm systems and signalling systems, etc.), because mains-based transmission media are not permitted for these applications!

3.2.3.2 Basic requirements

Characteristic criteria

The number of available *EIB powerline* addresses is equal to 32,768.
These can be divided up into 8 logical areas of 16 lines each, where each line can hold up to 256 devices, to provide a more structured layout. The actual maximum number of *EIB powerline* devices that can be used within a system is determined by the characteristic criteria described in chapter 3.2.3.3.
The system must involve self-contained installation areas, as described in chapter 3.2.3.1.
A pre-requisite for the trouble-free operation of *EIB powerline* is perfect radio interference suppression for all electrical consumers used in the system. This can today be assumed as a consequence of the legal legal requirements and standards for these devices.
When using a great number of electric motor driven devices and frequency controlled devices, they should if necessary be checked (see chapter 3.1.2.3). If there is any doubt, a test measurement should be made in the installation area to be used for the transmission.

3.2.3.3 Pre-planning

The planning of an *EIB powerline* system follows the general, established rules of the technology whilst adhering to the various regional connection conditions laid down by the respective electric power company. As transmission occurs via the 230 V network, the current regulations according to VDE 0100 apply.

As the 230 V installation network in its original form is not intended for the transmission of information, the *EIB powerline* system must be adapted to match the available possibilities. In a signalling sense, it is an open network, whose transmission behaviour, impedance and induced interference

Load characteristic

are largely unknown. For the installation, this means that basic rules must be stipulated, in order to be able to detect and record obvious sources of radio noise during the planning stage. For this we use a characteristic number (see Appendix H) to plan the rough outlines of an *EIB powerline* system. This procedure is based on the approximation that every typical consumer in the network can be assigned a load characteristic number that identifies the degree of noise load. The sum of the load characteristic numbers for all the devices within a system in relation to the maximum transmission path between two powerline devices, yields a total load characteristic number, Z. This Z number can be used to evaluate which, if any, further planning steps are necessary.

Example:
In a one-family house with approx. 200m2 of living area, the lights and blinds are to be controlled with *EIB powerline* devices. The planning has yielded a total of 130 necessary *EIB powerline* devices. From a customer survey, the number of devices in the network and with that the associated load numbers are established as follows (see Table 3.2-1).

Total load characteristic number, Z

Device	Quantity		Char. num.		Sum
PC	1	x	50	=	50
Monitor	1	x	50	=	50
Television	1	x	50	=	50
HiFi / video	5	x	10	=	50
Electronic transformers	4	x	50	=	200
Small electric devices	4	x	10	=	40
Filament lamps	50	x	1	=	50
EIB powerline devices	130	x	1	=	130
Total load characteristic number					**620**

Table 3.2-1 Establishing the total load characteristic number for EIBpowerline

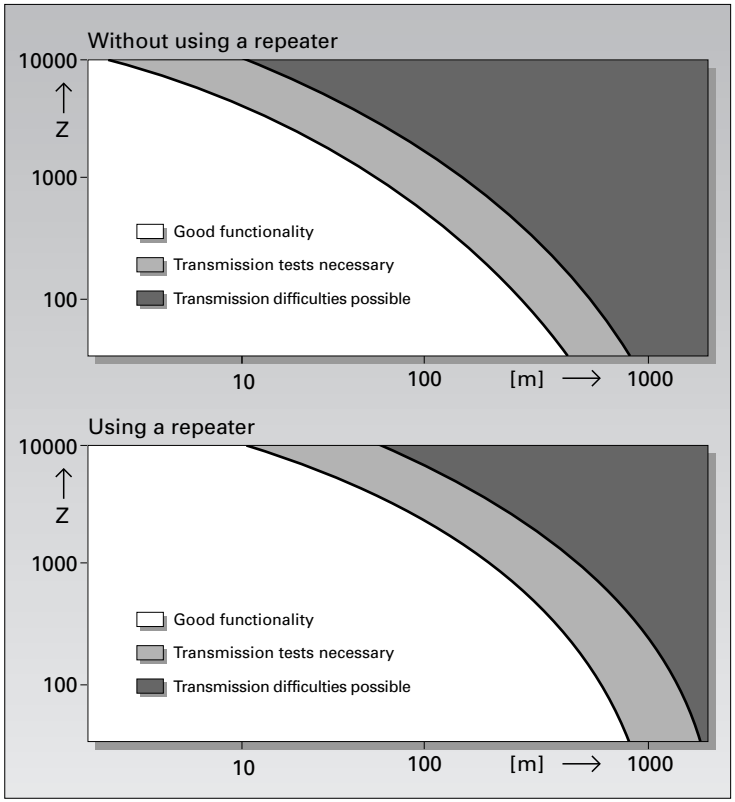


Fig. 3.2-2 The relationship between the total load characteristic number and the maximum line length between two EIB powerline devices

Repeater

From the diagrams (see Fig. 3.2-2) the maximum line length between two *EIB powerline* devices can be read for various values of the total load characteristic number, Z (200 m with and 100 m without the use of a repeater).

3.2.3.4 Planning steps for *EIB powerline* signal transmission

The following planning rules must be followed for every *EIB powerline* system, to achieve a defined basis for trouble-free signal transmission.

3.2.3.4.1 Achieving isolated signal areas

Band stop

Every *EIB powerline* system must be filtered out from the normal network with band stops (see Fig. 3.2-3). The maximum terminal capacity of the band stop is equal to 63 A per active conductor. Filtering must be provided for all three active conductors.
The band stops should be installed in front of the circuits necessary for signal transmission or directly behind the main fuses or the earth leakage circuit breaker.
The structure of the band stop is single-phase, which facilitates division when installing in the distribution panel, enabling better use of the available space.
The maximum wire cross section is equal to 25 mm^2.

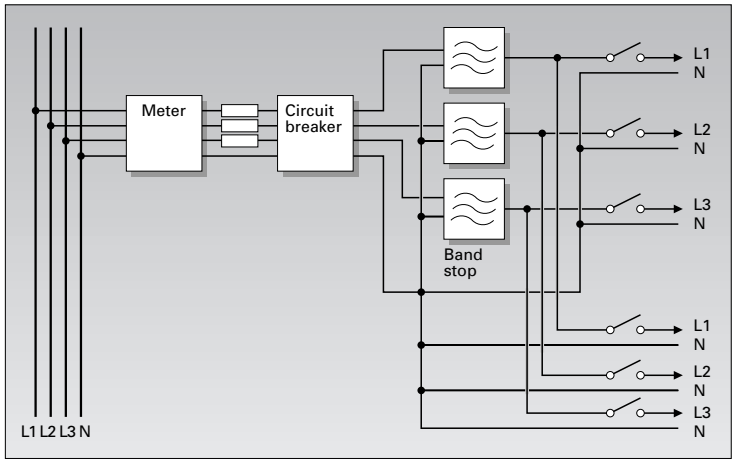


Fig. 3.2-3 Dividing circuits between band stops

3.2.3.4.2 Checking a defined phase coupling

Phase coupling

To achieve defined phase coupling, a phase coupler is installed for every system or in the case of extended networks, a repeater is used (see Fig. 3.2-4).
Phase couplers and repeaters require a three-phase connection.

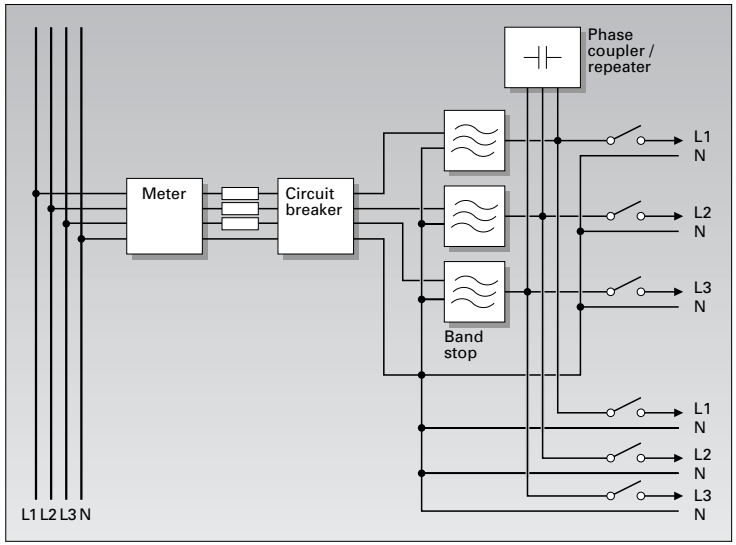


Fig. 3.2-4 Installation of an EIB powerline phase coupler/repeater

3.2.3.4.3 Planning when using a repeater

Only one repeater is permitted per *EIB powerline* system. The repeater is suitable for three-phase connection. It should be installed in a "central point" of the *EIB powerline* system, in order to be able to attain the largest possible signal range.

3.2.3.4.4 Installation wires and material

– The use of shielded wires (with earthed shielding) and cross-sections larger than 25 mm^2 are not permitted for the transmission paths.
– Automatic cutouts or earth leakage circuit breakers with nominal currents less than 10 A are not permitted within the *EIB powerline* signal circuits. In these situations, it is necessary to fall back on the use of safety fuses.

3.2.3.4.5 Telegram load

Transmission duration

The transmission duration of a telegram is approximately equal to 130 ms. This means that up to 6 telegrams/s can be transmitted via the 230 V network.

Transmission rate

Despite this high transmission rate, in practice a high simultaneity of transmission signals needs to be avoided. (Example: Cyclic transmission and polling functions in a time period less than 300 ms or the simultaneous control of more than 4 binary inputs.)

3.2.3.4.6 Device connection

All devices require the connection of active and neutral conductors.
The connection of load and signal lines must be done separately for all *EIB powerline* devices. When working with *EIB powerline* systems with known sources of radio noise (e.g. inverters, UPS supplies) separation of the load and signal circuits can be taken into account right from the planning stage.

3.2.3.4.7 Wiring arrangement

Overcoupling

Any configuration can be used – tree, star or ring.
When there are several *EIB powerline* systems within one building, the parallel wiring of different systems should be avoided to prevent any overcoupling.

3.2.3.4.8 Overvoltage protection

As regards the planning and installation of components for protection against surge voltage, the usual standards and regulations for 230/400 V installations apply.

3.3 Project design

3.3.1 *EIB powerline* devices

The *EIB powerline* devices can be categorised as one of three structures according to the way they are installed.

Mains coupling unit

Application modules/terminals are fitted onto the flush-mounted mains coupling unit. Contact is achieved with the 10-pin user interface. The active and neutral conductors are connected via two terminal screws (conductor cross section of 1 - 2.5 mm^2).
EIB powerline devices in the form of DIN rail mounted units are snapped onto the DIN rail. Connection to an *EIB powerline* line is achieved via terminal screws (conductor cross section of 1 - 2.5 mm^2). To simplify wiring through to other devices, there are two terminals each for the connection of active and neutral conductors that are bridged internally.
EIB powerline devices in the form of surface-mounted or built-in units are attached and connected according to the manufacturer specifications. Connection to an *EIB powerline* line is also achieved here using terminal screws (conductor cross section of 1 - 2.5 mm^2).

3.3.2 Installation material for *EIB powerline*

3.3.2.1 General requirements

EIB conformity is guaranteed with the use of EIBA certified products. This is also indicated on *EIB powerline* devices with the *EIB* trademark. For the assurance of electrical safety, the manufacturer must follow the national (DIN VDE 0632 section 1 and section 501) and international regulations (EN 60669-1 as well as EN 60669-21 and IEC 669-1, 669-2-1).

3.3.2.2 Bus lines

Separate bus lines are not required as the conventional mains lines are used here. There are no known restrictions for current cable and wire types. The use of shielded 230 V lines, for which the shielding is earthed, can in practice cause strong signal attenuation for *EIB powerline* signals. This is caused by the capacity of the individual conductor, which builds up against the shielding or shielding earth. If the use of shielding is essential, a trial measurement must be made to decide upon the suitability of *EIB powerline* transmission. The same goes for mains lines with a cross section greater than 25 mm^2.

3.3.2.3 Automatic cutouts and earth leakage circuit breakers

In general, all types of fuses and earth leakage circuit breakers can be used. They do not represent obstacles for the transmission of signals. For the protection of circuits or devices with nominal currents less than 10 A, it is necessary to fall back on the use of safety fuse elements due to the high insertion loss.

3.3.2.4 Band stops

Band stop

The band stop is provided as a DIN rail mounted device. It is used to protect the *EIB powerline* system from any overshooting of the signals into adjacent areas, as well as to separate neighbouring *EIB powerline* systems from one another. The use of band stops is essential to guarantee the perfect functioning of the system and to fulfil the applicable regulations. The band stop is installed in front of the circuits for signal transmission or directly behind the main fuses or the main earth leakage circuit breaker (see Fig. 3.3-1). Because we are dealing with a series filter, it is necessary to ensure correct installation. It is basically necessary to use three band stops for three-phase operation. The band stops are single-phase units. These can be installed in the sub-distribution panel thereby making better use of the available space.

Series filter

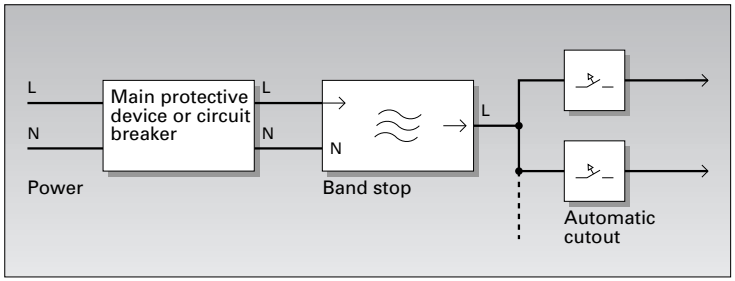


Fig. 3.3-1 Installation of an EIB powerline band stop

Load reduction must be taken into consideration for these devices due to the fact that they warm up in operation depending on the load and the ambient temperature.
The maximum load of the band stop is equal to 63 A. Connection occurs via terminal screws for a wire cross section up to a maximum of 25 mm^2 for the respective active conductor and a terminal screw with a wire cross section up

to a maximum of 2.5 mm^2 for the neutral conductor. If in special cases the current load of 63 A proves insufficient, the fuse circuits used for transmission must be divided among several band stops (see Fig. 3.2-3). Only when there is a separate transformer area can the use of band stops be avoided.

3.3.2.5 *EIB powerline* controller

3.3.2.5.1 Device layout

Powerline controller

The *EIB powerline* controller is a "desktop device" that can be connected to an *EIB powerline* system via a 230 V plug. The user interface is a 7-line LCD display and it is operated via 14 keys. All inputs are made using 4 cursor keys, an OK key and an ESC key (see Fig. 3.3-2).

Scroll bar
Cursor keys

There is an optional help line in the display, which gives information about the key functions available for the current menu item. A scroll bar indicates current position as soon

Fig. 3.3-2 The EIB powerline controller

as a display contains more information than can be shown on the screen. Necessary text inputs are also made using the cursor keys. More extensive text inputs can also be made directly via a standard PC keyboard, which is connected to the rear of the controller via a DIN plug. The rear of the controller also contains an RS 232 interface for data exchange with a PC. A zero modem cable is used for data transmission.
In total it is possible to program and operate up to 400 *EIBpowerline* system devices with the controller.

3.3.2.5.2 Modes of operation

As the central programming and operating unit, the *EIBpowerline* controller has the following three modes of operation:

- System settings
- Installation
- Control centre operation.

3.3.2.5.2.1 System settings

In this mode of operation, the controller is configured for use in an *EIB powerline* system. This involves setting the actual time and date, determining the display options (lighting, help line etc.) as well as establishing the user level (see Fig. 3.3-3).
The last point allows switching between a "simple" mode with basic functions and an "extended" mode with specialised functions and display possibilities for experienced users. By setting a controller number the use of up to 9 controllers within a single system is possible. The "operating system update" menu item facilitates the extension of or changes to the function range, e.g. to implement new functions from the manufacturer. In this situation, the new operating system is loaded into the controller from a PC.

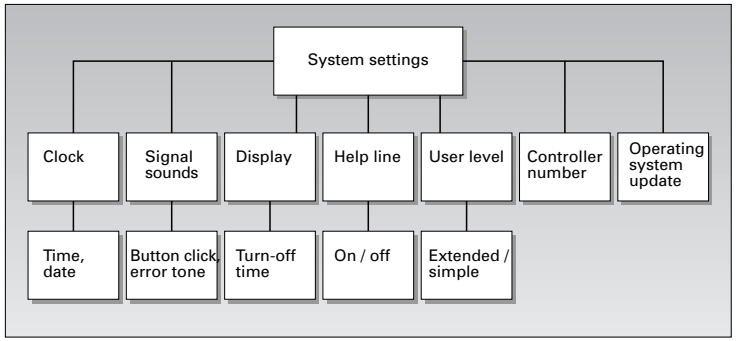


Fig. 3.3-3 System settings of the controller

3.3.2.5.2.2 Installation operation

Installation operation

In the installation mode of operation an entire *EIB powerline* project is designed and programmed into the respective devices. The sequence is based on the actual spatial and functional possibilities/requirements that exist in the project. The first step is to define the rooms (e.g. living room, bedroom, etc.) in which the functions (e.g. switching the lights on and off, adjusting/raising the blinds, etc.) are to be executed. To improve the overall clarity, these functions should then be divided into separate function groups (e.g. lights, blinds, heating, etc.).

The actions of the required/desired devices are now assigned with their input and output channels and options. The parameters of these devices can, if necessary, be adapted accordingly. During the entire planning process neither physical addresses nor group addresses appear on the screen. These are specified in the background and are "invisible" to the user. After programming is complete, installation operation can be blocked with the corresponding password. This prevents the end user making any "accidental" changes to the established functions (see Fig. 3.3-4).

New installation

This involves establishing the project data (project code, customer data, etc.). Because the controller can only be used on one project at a time, any other project already edited with the same device must first be saved. The project planner is guided through the menu accordingly.

Adding/editing actions

These two menu points allow the necessary actions to be changed or extended. It is possible to assign new devices or to adjust room or function allocations.

Edit devices/rooms

The parameters of devices already assigned to certain actions can be modified. It is also possible with this menu item to delete devices or their assigned functions or to change room codes.

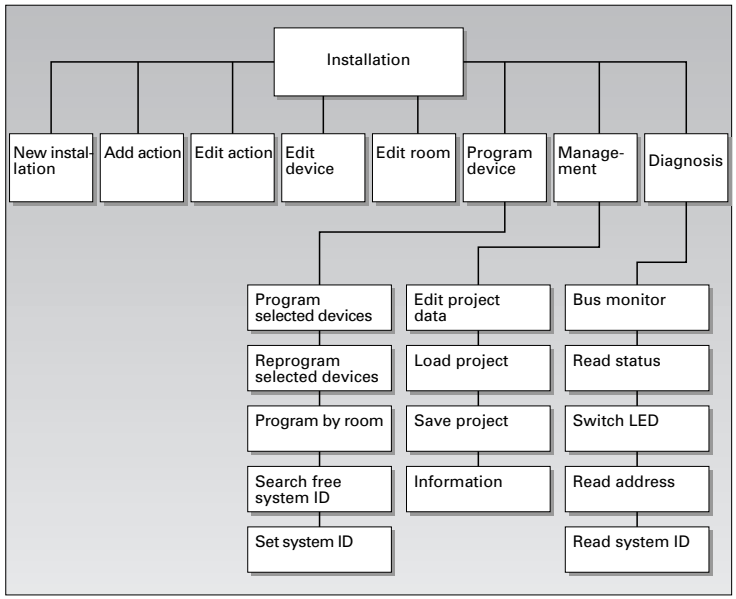


Fig. 3.3-4 Installation operation of the controller

Programming the devices
This menu item is used to program the devices. There are various useful options.

Management
This involves the management of several projects that have been set up with the *EIB powerline* controller. For security, this data can be saved on a PC and then reloaded into the controller when needed.

Diagnosis
This menu point contains various help options for servicing. Simple bus monitoring functions are also provided at this point, e.g. for reading addresses from an *EIB powerline* device.

3.3.2.5.2.3 Control centre operation

After completing the programming, this mode of operation provides the end user with a flexible, manual and time-dependent means of control for all devices and functions of an *EIB powerline* system. The user also works with the rooms, functions and actions already established in the programming. It is possible to define and call up different scenarios, in which for example a variety of single actions are combined together depending on the situation. When there are any changes to the usage of the rooms, the user can alter the terms set down in the planning stage without requiring knowledge of the programming. It is not possible for the end user to simply change the actions, this can only be done be the project planner.
In addition to manual control, all actions and scenarios can be controlled in a time-dependent manner. Aside from the "classic" time control functions such as weekly and holiday programs, it is also possible to select automatic time-shifting to account for special situations in the time-control (e.g. Christmas etc.). This mode of operation also offers the

possibility of an acoustic wake-up function (see Fig. 3.3-5).

3.3.2.6 *EIB powerline* phase couplers/repeaters

Repeater
Phase coupling

The repeater provides active phase coupling with the simultaneous repetition of all received *EIB powerline* signals. The device can be used in all situations where it is no longer possible to guarantee perfect signal transmission between *EIB powerline* terminals as a result of the paths being too long (see chapter 3.2.3.3).
The device is intended for a three-phase connection. When beginning with the design and programming of a system using ETS 2 or an *EIB powerline* controller, the necessity

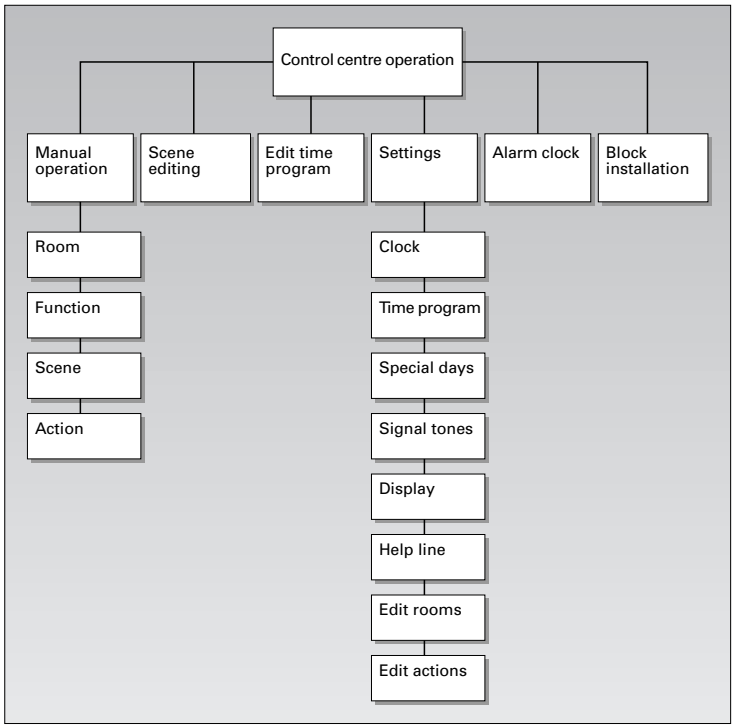


Fig. 3.3-5 Control centre operation of the controller

of using a repeater must be known right from the beginning. After the bus devices have been programmed, any subsequent incorporation of a repeater would only be possible by reprogramming all the devices! Only one repeater is generally permitted within a single *EIB powerline* system! The repeater should be installed in a central point of the system, as this achieves the greatest signal range.

3.3.2.7 Media couplers

Media coupler
Mixed installation

The media couplers are used to couple several *EIB powerline* systems together, or for the construction of mixed installations involving *EIB powerline* and *EIB-TP* areas. Coupling is achieved via an *EIB-TP* line, which connects the areas to be coupled. This line must comply with all regulations and guidelines of the *EIB-TP*.

3.3.2.8 Installation sockets and distributors

Commercial installation sockets and distribution panels can be used for the installation of *EIB powerline* components. The installation sockets for flush mounting must be suitable for screwed fixings (in accordance with DIN VDE 0606-1 or DIN 49 073-1). We recommend the use of installation boxes for light switches.

3.3.3 Project design of the *EIB powerline* devices

3.3.3.1 General advice

The project design of an *EIB powerline* system involves the same prerequisites as that of an *EIB-TP* system. Alternatively, for simple applications it is possible to use an *EIB powerline* controller.

3.3.3.2 Project design with ETS 2

In connection with the respective product data of the manufacturer, ETS 2 can be used for the planning of all *EIB* devices. The common design of *EIB powerline* and *EIB-TP* systems is also possible. It should be established right from the beginning whether a repeater is needed for the planned system, to avoid a great deal of subsequent work.
In all cases it is essential to ensure that mains coupling units, application modules as well as the application programs extracted from the database, which together form a device unit, are all from the same manufacturer.

3.3.3.3 Dividing the *EIB powerline* devices among the lines

During the project design stage, a meaningful line structure should be established to maintain the overall clarity of the planning and programming. The limits on the line lengths are given by the characteristic numbers (see Appendix H).

3.3.3.4 Wiring arrangement

Wiring arrangement

EIB powerline uses the conventional power installation. Any wiring structure can be used. When there are several *EIB powerline* systems within one building, the parallel wiring of two lines from different systems should be avoided to prevent any overcoupling.

3.4 Electrical installation with *EIB powerline*

The DIN VDE 0100 regulations should be used as a basis for *EIB powerline*. When updating *EIB powerline* it may be necessary to make changes to the power installation. These changes are examined in more detail in the following chapters. For wires and bus devices the usual requirements apply, e.g. with regard to the laying of cables in particular rooms or locations and the necessary protection levels.

Programming key

In the same way as every *EIB-TP* device, all *EIB powerline* devices have the familiar programming button to load the application program with all associated parameters. This must be pressed at the initial programming stage. The correct programming sequence is confirmed by the programming LED. In the case of subsequent function changes, it is not necessary to directly access a once programmed *EIB powerline* device. The change can be made directly via the mains line.

3.4.1 Topology

The physical topology of *EIB powerline* corresponds to the typical installation structure of a 230/400 V electrical supply network.

Star structure

Seen from the distribution panel, there is generally a star formation. With branching this can be extended into a full tree structure.
The distribution of electrical energy is achieved from one or more central supply points. From the structure of the installation it is clear that these central points are suitable for the supply of the *EIB powerline* signals via repeaters.

3.4.2 Installation of the *EIB powerline* band stop

The *EIB powerline* band stop is used to suppress the undesired transmission of signals from a system. The band stop is installed between the output of the main protective device or the main earth leakage circuit breaker and the individual automatic cutouts (see Fig. 3.2-3).

Band stop blocking effect

The blocking effect of the band stop depends on direction. It is therefore particularly important to ensure the correct connection of the device. The wires radiating from the band stop should be laid at as great a distance as possible from the supply lines, in order to avoid any unwanted inductive disturbance.
In certain cases the current load of the band stop may not be sufficient, i.e. the sum of the output currents is greater than the nominal current of the stop. In this situation the current circuits must be split between several band stops.

3.4.3 Installation of the *EIB powerline* phase coupler/repeater

The *EIB powerline* phase coupler/repeater is built into the distribution panel (see Fig. 3.2-4).
Connection is three phase, to active and neutral conductors.

3.5 Commissioning

The commissioning of the *EIB powerline* devices requires a PC with the ETS 2 software (see chapter 5). The PC is connected to the *EIB powerline* device via an RS 232 interface. Depending on the local possibilities the *EIB powerline* devices can be commissioned after installation or not . For devices that are difficult to access, it has proven better to commission them before they are installed. This also saves time. The final site of installation for these devices must be noted exactly to avoid any malfunctioning. For commissioning purposes, the devices and the serial RS 232 interface must be connected to one another via Athenians line. The first step is to assign a physical address to every device The second step is to load the application programs into the devices including group addresses and parameters.

3.5.1 Loading the physical address

The process for loading the physical address is basically the same for all *EIB* devices and is described in chapter 6.7.

3.5.2 Loading the application programs with group addresses and parameters

The process for loading the application programs is basically the same for all *EIB* devices and is described in chapter 6.8.

3.5.3 Function tests, official acceptance and documentation

After commissioning, the system functions should be checked and compared with the functions given in the specifications document. The *EIB powerline* system should be documented in written form and on disk. This is the only way to guarantee that subsequent changes and extensions

can be made without incurring problems unnecessarily.
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.).

3.5.4 Troubleshooting and diagnosis in an *EIB powerline* system

In general it is necessary to follow the same procedures described in chapter 8.1.2.2 during diagnosis and troubleshooting in *EIB powerline* systems. The following additional steps and procedures are specific to this medium:

- Is the mains supply available at all devices?
- Are the band stops connected properly (input and output interchanged)?
- Is a defined phase coupling guaranteed (via phase couplers or a repeater)?
- Are all devices programmed with the exact same system ID? *System ID*

If transmission is not possible between two or more points in the system, the procedure is as follows:

- All fuse circuits not directly involved in the transmission should be disconnected from the power supply.
- The transmission should be checked.
- If no connection has been achieved, the electrical consumers in the remaining circuits must be checked for their influence on the transmission and if necessary filtered out with band stops.
- Otherwise the circuits that have been switched off should be switched back on again one after the other, and each one checked as to how it affects the transmission.

To check the transmission reliability, ETS 2 can be used to lower the sensitivity of the *EIB powerline* devices within the system. If after this, the transmission remains perfect, we can assume secure transmission with normal sensitivity.

3.6 Extending an existent *EIB powerline* system

Existent *EIB powerline* systems can be extended at any time. This may be necessary after a change in usage or the extension of the building itself. The planning of the products to be extended must be carried out with the same means used to carry out the initial planning or project design (EIB *powerline* controller or ETS).
During installation it is necessary to ensure that the planning and installation guidelines specified in chapter 3.2.3 are observed for the extended system.

4 Transmission via radio

4.1 Introduction

EIB radio

In addition to the familiar twisted pair line and the *EIB powerline* technology, in the future it will also be possible to use *EIB radio* (***EIB-RF*** = radio frequency) as transmission medium.

Sensors and actuators with battery supply

This does not require the laying of a separate bus line. Sensors and actuators and so on can work off a battery supply and do not therefore require any wiring. This high degree of mobility has advantages not only for the familiar technology, it also opens up many new fields of possibility for mobile operating devices.

Radio transmission is especially suitable for modernisation and the extension of existent systems but equally for all types of new installations. Difficult installation situations, such as glass walls or large distances in the open air present no problems for radio transmission. The mobile operation of all points within a system becomes easily possible.

The *EIB radio* system is compliant with the valid European standards and regulations. Radio transmission is fully compatible with existent *EIB* systems and there are no restrictions even with regard to transmission speeds. This means that the planning and commissioning of such a system are no different from that of the already familiar *EIB-TP* systems. The functions of the HomeAssistant are fully supported.

4.2 Applications

The *EIB radio* system extends the application possibilities to those that are not possible with the bus line or those that would only be possible with extensive wiring. Even the existence of a 230 V power supply is not absolutely essential

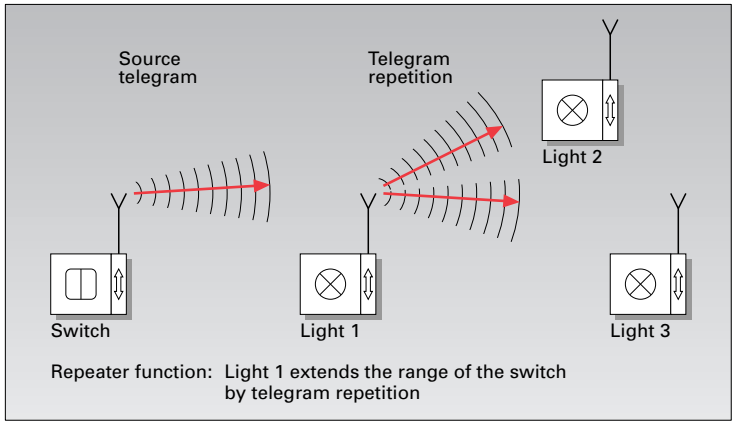


Fig. 4.2-1 Repeater function with EIB radio

for this transmission technology. The mobility really distinguishes the radio method and facilitates particularly flexible handling and operation. As with the *EIB-TP* network, only the actuators are connected to the 230/400 V supply.

Free field

The transmission path in a free field lies at approx. 300 m. There are no functional restrictions for applications in

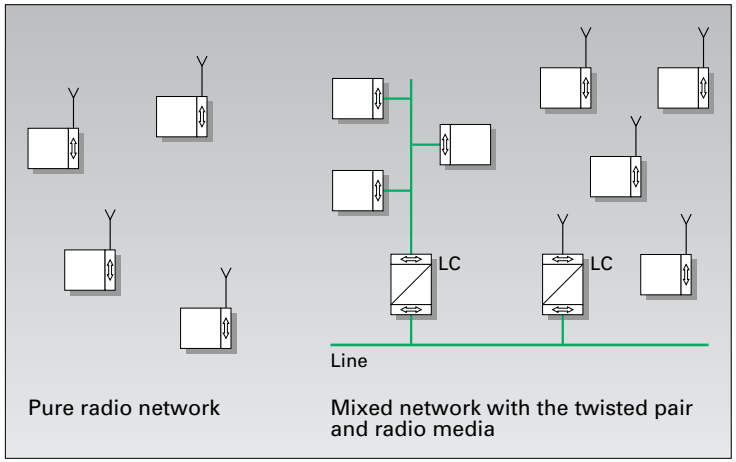


Fig. 4.2-2 Topology of EIB radio

buildings. The range in buildings depends on the structural conditions, but can be extended using repeaters so that the size of the building does not in effect impose any restrictions either. Repeaters automatically repeat telegrams (see Fig. 4.2-1).

Repeater

As the limits of the radio system cannot be exactly defined, a system code is used in the same way as for *EIB powerline* systems to provide a logical separation. This code is automatically assigned by the ETS 2 software and transmitted with every telegram.

System code

Typical applications are all types of switching, controlling, indicating and transmission of measurements as well as mobile operation.

An *EIB system* can consist of a pure radio network, or of a mixture of radio and another medium, such as for example *EIB-TP* (see Fig. 4.2-2).

4.3 The transmission method

With radio, the information to be transmitted is modulated by a carrier. This can either be achieved via the amplitude

Carrier

Amplitude keying

Modulation method

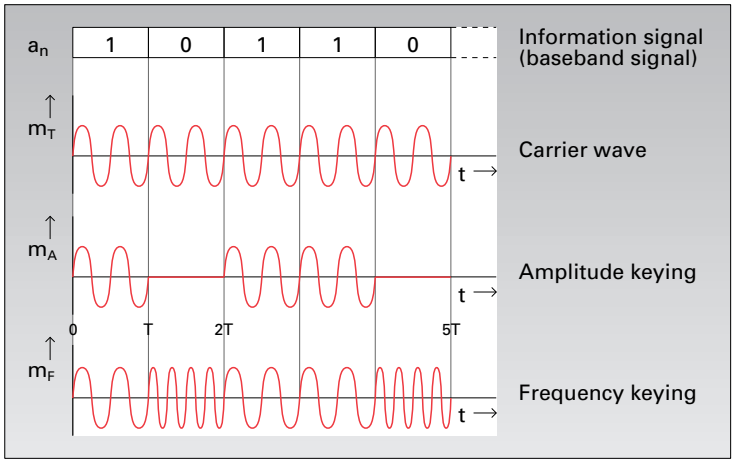


Fig. 4.3-1 Modulation method

Transmitter and receiver parts

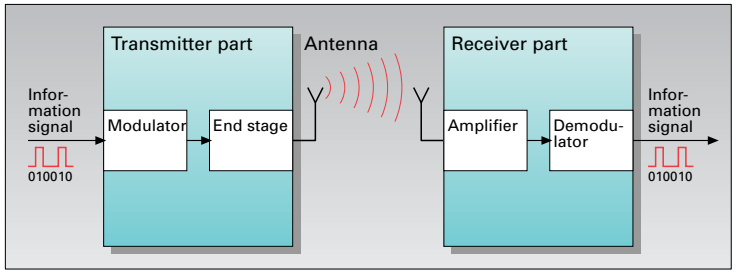


Fig. 4.3-2 Logic diagram representing radio transmission

Frequency keying
Phase keying

(amplitude keying), the frequency (frequency keying) or the phase (phase keying). This modulated carrier is transmitted to the receiver. Here, the received signal is demodulated; i.e. the information is retrieved from the signal. To ensure that different *EIB radio* systems do not influence one another, the information being transmitted is assigned with a unique system code (see Fig. 4.3-1).
The principal layout of transmitter and receiver parts is represented in Fig. 4.3-2.

4.4 Project design and commissioning

The design and commissioning processes do not deviate from the familiar procedures and are supported by the ETS 2 software.

4.5 Product launch

The *EIB radio* products will probably be launched on the market in 1998. The first of these components will be battery operated sensors and switches in flush-mounted and surface-mounted designs as well as switching actuators in the form of DIN rail mounted units.
With this, the radio transmission medium will significantly increase the application possibilities of *EIB* and in particular it will revitalise the extension and renovation market.

5 The HomeAssistant®

HomeAssistant

Used in conjunction with *EIB*, the HomeAssistant is an effective building management system for private homes. It allows the functions in the home to be operated, managed and controlled easily and reliably. It will also be possible in the future to use it for redefining parameterisations (see Fig. 5-1).

Pre-para-meterisation

It is an open “software platform” which can be constantly extended with new applications from various manufacturers. The applications listed here represent the current status.

Any device that is compatible with and can be controlled by the HomeAssistant can carry the registered trademark.

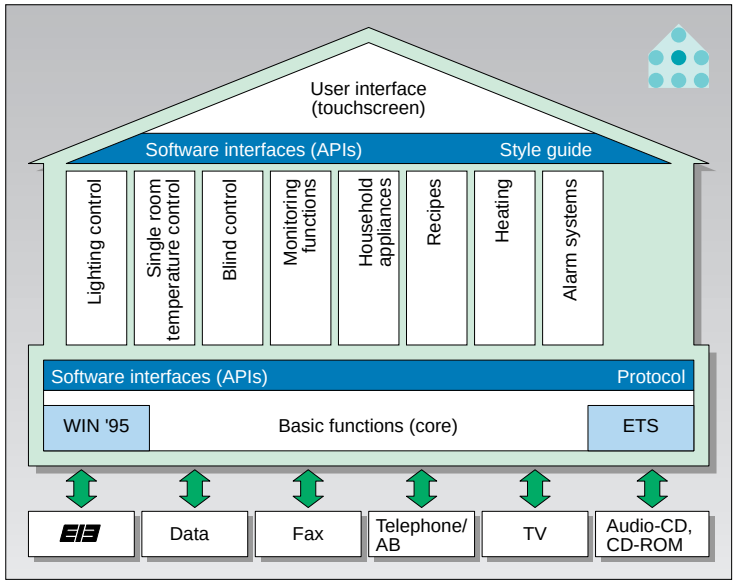


Fig. 5-1 Management functions of the HomeAssistant

Touchscreen
Multimedia services
Communication services

The HomeAssistant represents the central operating element of the system and is a software package for a multimedia PC with a touch-sensitive screen and mouse operation. It can be situated in any desired location within the house (e.g. kitchen or hallway, etc.). It also represents the connection to multimedia and communication services.

Standard operating system

This software, which is capable of controlling a wide variety of applications, is based on a standard operating system and has a user-friendly interface, which is both easy to understand and operate even for inexperienced users. By simply touching the buttons represented on the screen (see

Mouse click

Fig. 5-2) or activating them with a mouse click, the HomeAssistant makes it possible to interactively control all functions within the home, in addition to the normal manual activation of the devices.

The decentralised structure of the *EIB* is not affected by the

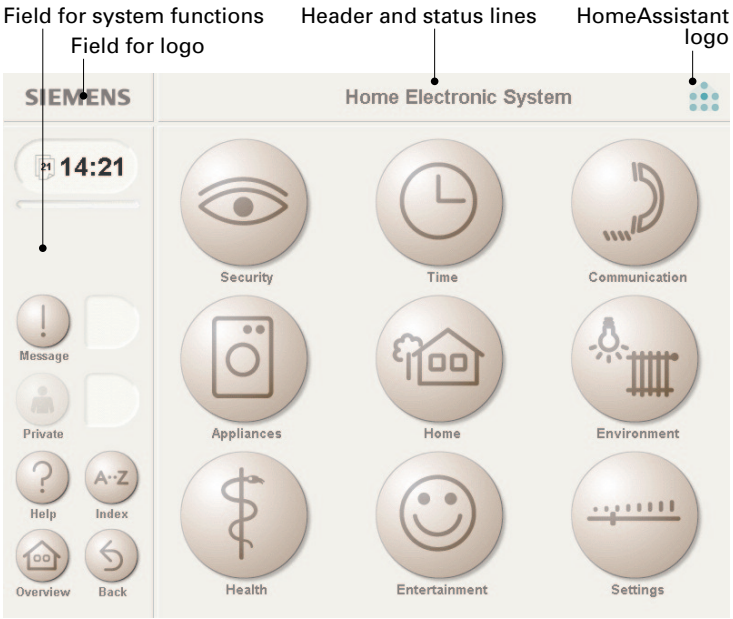


Fig. 5-2 *HomeAssistant screen showing the touch-sensitive keys*

use of a HomeAssistant. Using a HomeAssistant increases the possibilities of using the *EIB* devices. It can work with the transmission media described in chapters 2, 3 and 4. The following chapters describe the basic principles of the HomeAssistant and the requirements on the hardware.

5.1 The structure of the HomeAssistant

The HomeAssistant (see Fig. 5-3) consists of

- operating and base systems
- software for the user interface and
- application software.

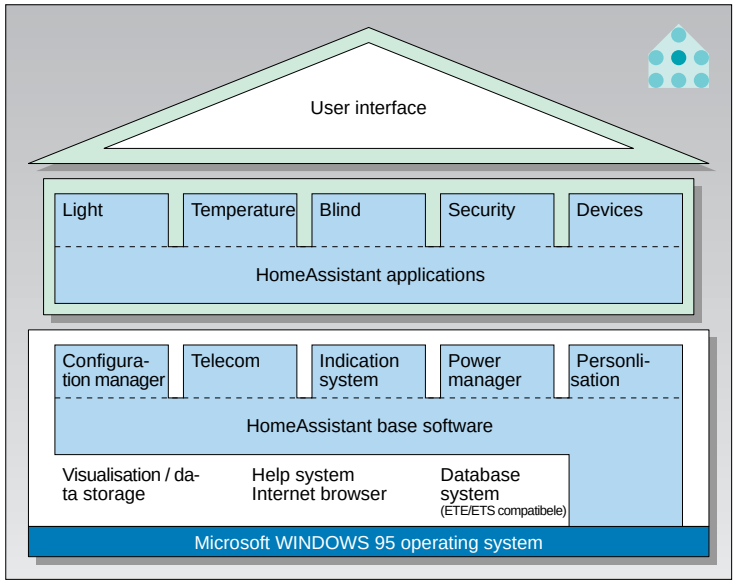


Fig. 5-3 *Structure of the HomeAssistant*

5.1.1 Operating system and base system

Microsoft WINDOWS 95

The software can be run on standard PCs with the Microsoft WINDOWS 95 operating system. The base system contains all functions that are necessary for connecting the HomeAssistant to the *EIB* and the operating system and offers interfaces and functions which facilitate the simple integration of applications. Communication with the *EIB* occurs via the known RS 232 interface. The modules of the operating and base systems are described below.

RS 232 interface

5.1.1.1 Visualisation and data management module

Style guide

All outputs on the screen are made possible via the visualisation components. Interface elements are offered which correspond to the HomeAssistant style guide (see chapter 5.1.2.2) and which execute control via the masks.
For the applications, the modules for the data management form the interface to the process values in *EIB*. The current status is stored in the data manager for each individual *EIB* device.
The applications can also use the data management for the storage of their own data.

5.1.1.2 HomeAssistant database

Information that is supplementary to the data contained in the ETS 2 database is needed to configure the HomeAssistant, set up the operating pages and list the controllable devices. In order to record this data with a dialogue program compatible with WINDOWS 95 and to ensure that it is consistent with ETS, the HomeAssistant Tool Software (HTS) is supplied with the HomeAssistant base system.
Because a deep knowledge of both *EIB* and the HomeAssistant is required by anyone wishing to use this software, specialised training is offered to both installers and planners.

HomeAssistant Tool Software

5.1.1.3 Help system

Help system
Context-sensitive help

The help system can be activated via the specified "Help" field. The user is shown context-sensitive information which helps him better understand the system and thereby eliminates the need for a separate instruction manual.
Help texts are stored in the usual Internet format (HTML). They can be supplemented with multimedia elements, such as video and voice. Thanks to the chosen format, all essential requirements for updating via the Internet are met.

Internet

5.1.1.4 Configuration manager

Conventional visualisation systems are configured by experts to be user specific. One of the greatest advantages of the HomeAssistant is the largely automatic configuration. This saves time and money and for the first time allows the use of "visualisation" in the residential sector.
The configuration manager automatically creates masks and variables based on the database, which is stored in the HomeAssistant.

Mask
Variable

5.1.1.5 Telecommunication

Communication with external bus devices is managed in the HomeAssistant by a standard communication layer. With this interface users are able to use telecommunication services and also to remotely control them from outside.

Remote control

5.1.1.6 Indication system

Indication system

The indication system provides functions for displaying and indicating certain system events.
These system events include alarm messages, emergency calls, operating and fault messages for devices.

System event

5.1.1.7 Power manager and time/logic module

Power manager
System start-up

The power manager controls the proper start-up and shut-down processes for the system. A special module of the power manager, the time/logic module, provides functions for controlling time programs and event reactions.

System shutdown

In order to guarantee that these applications are independent of the running PC operation, external event elements can be used.

5.1.1.8 Personalising the HomeAssistant

In general, the various members of a family will use the HomeAssistant for different things. A personalisation module is provided to cater for this.

5.1.2 User interface software

5.1.2.1 Organisation of the screen

The user interface is geared for use with a touch-sensitive screen. It is divided into four areas (see Fig. 5-2).
The following functions are assigned to these four screen areas:

Logo field

Logo field

The logo field is intended for the display of the company logo and offers *EIB* partners the opportunity of displaying their own logos.

Header line with integrated status line

Header line

The header line contains the name of the currently displayed screen page.

Status line

The status line is a part of the header line and can be used for short explanations or advice.

System function column

System function column

The system function column has an operating and display area and comprises all functions that the HomeAssistant makes available to all applications.

Working area

Working area

The working area is used to place the operating and display elements required by each of the applications.
In addition, this area is also used by systems that are independent of the actual application such as the help system, the indication system or the keyword index system.
The application-specific function bar is situated in the lower part of the working area.
The task of this group of elements is to provide a standardised set of functions that defines the user functions common to all applications.

5.1.2.2 Operating and display elements

Various operating and display elements are arranged in the individual screen areas, and together they are termed the screen mask or “mask” for short.
The operating and display elements of the individual masks should follow a style guide that is the same for all applications.
The “style guide” is a set of rules for representing the symbols and writing on the screen. By touching the symbols on the touch-sensitive screen further steps are offered according to ergonomically based rules and intuition.

5.1.2.2.1 System function column

The operating and display elements of the system function column have the following meaning and function:

Time and date display

The current time and date that are displayed here are sup-

plied by the system and are valid for all devices and device groups attached to the HomeAssistant.

Progress display
This display gives the user an overview of the duration of lengthy processes. During these times, the HomeAssistant is generally inoperative.

The advice and message system
The "Advice" function consists of a display field and an operating element. If there are any messages, the corresponding category is indicated in the display field. After pressing the "Advice" button the user is shown further helpful information (What must I do now? What is the correct procedure?). The messages are ordered according to priority – high (red), middle (yellow) and low (blue) and cause different reactions in the system when they occur.

Message priority

The display field always indicates the category of the message with the highest priority.

The "Private" button (personal operating mask)
This button is planned for the future expansion of the HomeAssistant. After pressing this button the user is transferred to a menu in which he can enter or find his favourite functions.
Functions for access control are also provided on the mask that appears. These functions allow the user to limit access to "private" data.

Pictograph Bitmap

In the display field attached it is possible to incorporate pictographs or other graphics (e.g. bitmaps) which act as 'pictorial' identification of the user.

The "Help" button

Hyperlinks

The help system offers context-sensitive information on using the current mask and where appropriate offers background information by means of hyperlinks.

The "Search" button (keyword index)

Keyword index

The keyword index that is integrated into the HomeAssistant provides alternative access to the system. After finding the desired term in the keyword index it is possible to jump directly to the corresponding mask with the desired application function.

The "Overview" button
It is necessary to differentiate between the following representations and functions:

Fig. 5A *Overview button in the introductory mask*

Representation 1:
The HomeAssistant is in the "Overview" introductory mask.
After pressing this single button, the user is switched to a mask, which displays the status of the house or flat (windows, lighting, etc.). This display is an essential part of the monitoring function. From this mask, it is possible to jump to other more detailed display masks.

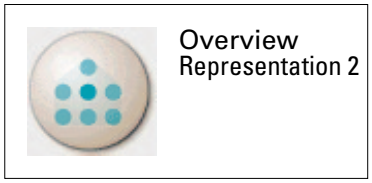


Fig. 5B *Overview button in all other masks*

Representation 2:
The HomeAssistant is not in the "Overview" introductory mask.
If you press this button you are always returned to the "Overview" introductory mask.

The "Return" button

Navigational element

"Return" is a navigational element. After pressing this key the user is always returned to the mask that precedes the

mask currently displayed. This process is independent of whether the last mask was a normal application mask, a mask from the help system or message system.

5.1.2.2.2 Working area

Operating and display elements

The operating and display elements of the working area have the following function and meaning:
The "Overview" introductory mask and with that access to the system has a permanent arrangement and representation, i.e. the look of the mask remains unchanged even if further applications are added to the HomeAssistant by an installation process.
These operating elements are also based on the "style guide". The captions are selected so that the user can always find or retrieve them in the HomeAssistant despite different associations and methods of approach to a device or subfunction of a device.
The terms of the introductory mask and associated applications are explained in the following sections.

The "Security" operating element
Pressing this button displays the "Security" operating mask, which offers functions generally associated with the term "security".
Possible applications include:

- The external protection of a house and garden.
- The simulation of an occupied house when the occupants are absent.
- Emergency equipment, such as for example the reporting of events to selectable addresses, the activation of alarm systems and checks.
- Etc.

The "Dates" operating element
Pressing this button transfers the user to the "Dates" operating mask. This mask offers applications whose functions are associated with the term "dates".
Examples include:

- Summer/winter changeover for all devices connected to the system.
- Displaying a world clock.
- Etc.

The "Communication" operating element
After pressing this button the user is transferred to the "Communication" mask. This mask contains applications that are concerned with the use of communication devices. This could for example, include:

- Emergency calls (direct dialling of important telephone numbers).
- Internet access.
- Addressing and text inputs for pagers.

The "Devices" operating element
After pressing this button, the "Devices" mask displays the devices and appliances that are connected to the system.
This could include for example:

- Lighting.
- Shutters.
- Heating/air conditioning systems.
- Communication devices.
- Switchable sockets.
- Household appliances.
- Meters.

Remarks:
At this point the sockets must be offered as a device class, as various consumers can be connected to them.

The "House/Flat" operating element
After pressing this button, a representation is displayed showing where in the house or on the ground plan a certain operating element of the system is located.
If the number of rooms (sites) exceeds nine, a mask with extra operating elements is created automatically.

The "Light/Heat" operating element
After pressing this button all applications associated with either the lighting or temperature are displayed.
Examples include:

- Setting the room temperature for the different rooms.
- Switching the lights in the individual rooms.
- Operating and adjusting the shutters.

The "Health" operating element
Pressing this button displays all applications loosely associated with the health and well being of the occupants. It also includes however, other applications or functions, which facilitate the rapid discovery of help in emergency situations.
Possible applications include:

- Emergency calling.
- Health advice.
- Home diagnosis equipment.

The "Entertainment/CD" operating element
This displays all applications that are broadly associated with entertainment.
This button also allows for example, optional access to the TV functions (requires a TV card).

The "System Settings" operating element
Scenario
Behind this button there is a mask with system functions such as for example, the "Scenario Manager" which can execute global switching processes.

Examples:
Measures for system extension, switching off the HomeAssistant, configuring a scenario.

5.1.2.3 Operating logic / menu structure

Operating logic
Touching an operating element in a mask logically switches to the next mask and with that takes you a further step towards your goal. This type of operation is termed logical. It facilitates simple usage of the system. Basically, the desired target can be reached by the user in a number of logical steps. By following the offered operating functions, the user will achieve the desired effect without having to learn or note anything in particular.
Menu structure
The menus of the HomeAssistant are arranged in a tree structure and can be divided into two main areas:

- the **system area** and
- the **application area.**

System area
System area
The system area of the HomeAssistant menu tree is composed exclusively of distribution masks. Within the system area, the path along which an application can be reached and the mask into which the application branches are established.

Application area
Rules are established to achieve standardised accesses to the individual applications.
The menu tree of the application area is composed of both distribution masks and operating masks.

Functions and function groups
- The distribution masks serve to divide the application into function groups or individual functions that can be selected from here.
- The actual functions of the application are then listed in the operating masks.

In order to illustrate the step-wise sequence of the operational logic, the following representation shows a few operational masks and a typical process (see Fig. 5-5).
From the “Overview” starting point, the first step is pressing the “House/Flat” button after which the user is transferred to the “House/Flat” mask. This shows all rooms in the house. If the user now presses the “Kitchen” button within this mask, all devices in this room that are connected to the *EIB* are displayed.

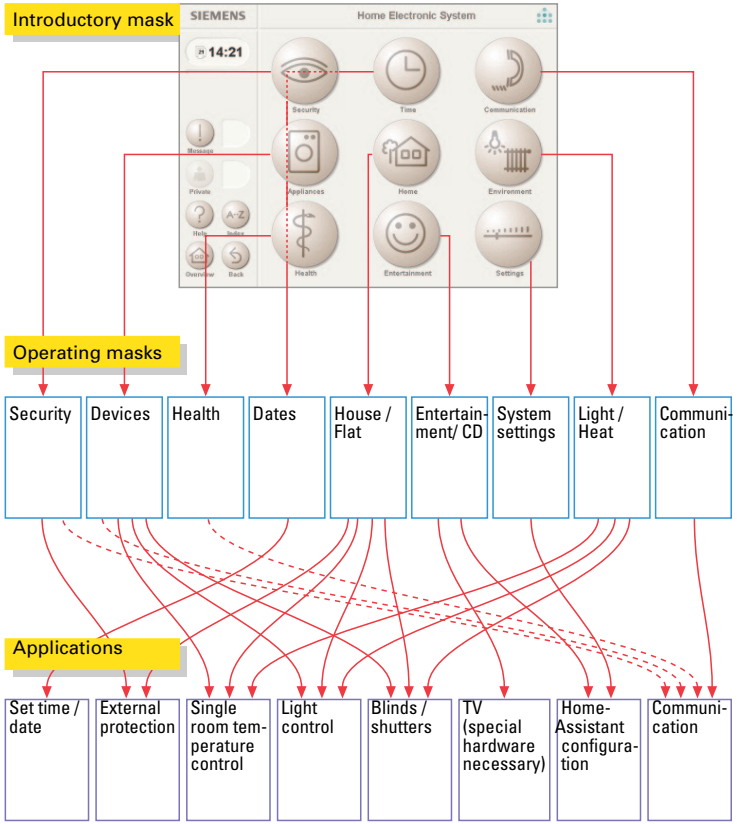


Fig. 5-4 *The menu structure of the HomeAssistant*

If the user selects “Dishwasher” in the next step, the dishwasher mask is displayed and the user can now set this machine.
The same goal could have been reached by selecting the “Devices” field in the “Overview” mask, which displays all

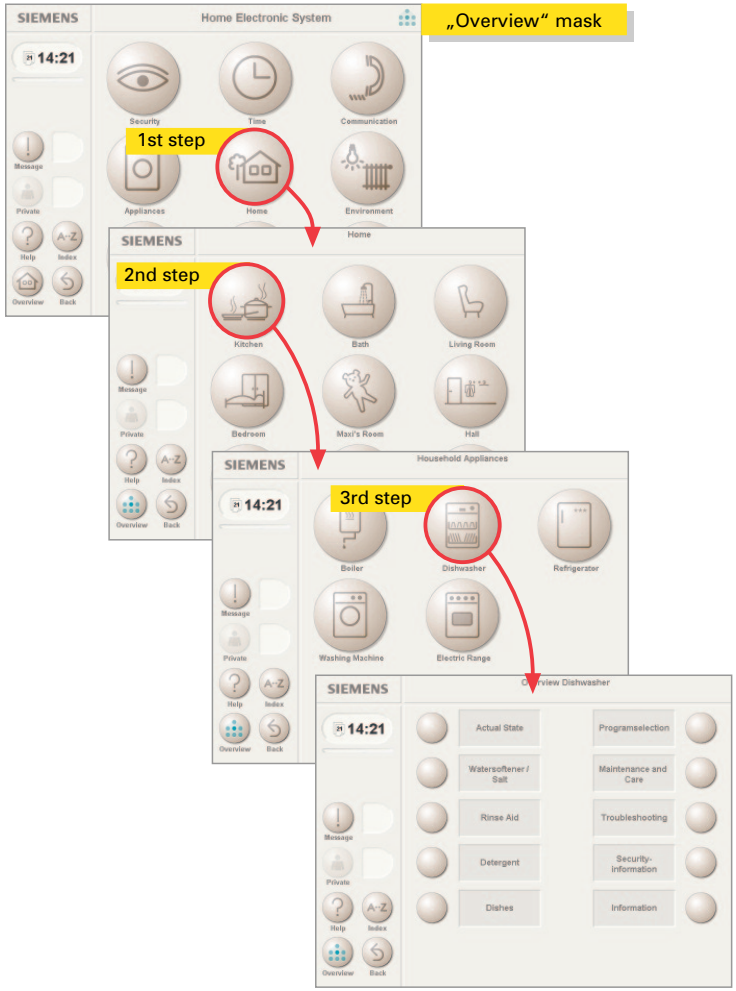


Fig. 5-5 *Sequence from “Overview” to “Dishwasher” via “Kitchen”*

devices connected to the *EIB*, and then selecting the dishwasher (see Fig. 5-6). This ambiguity in the selection process has been chosen intentionally to allow intuitive, barrier-free access to the system.

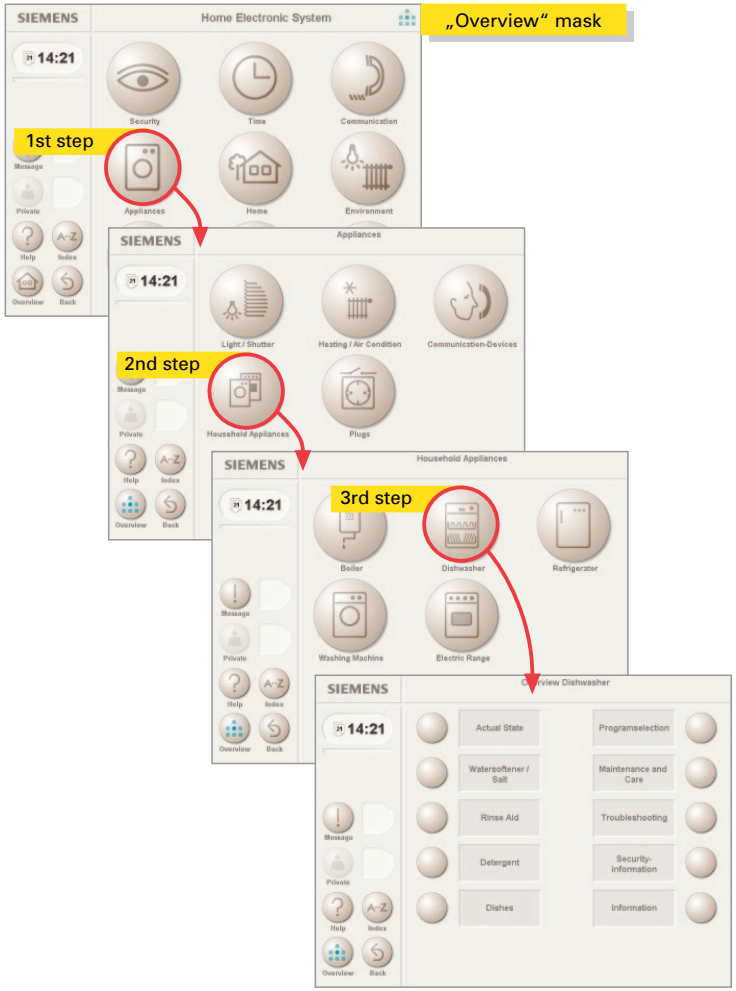


Fig. 5-6 *Sequence from “Overview” to “Dishwasher via “Devices”*

5.2 Planning

The operational and base system on the one hand (see chapter 5.1.1) and the style guide on the other hand (see chapter 5.1.2.2) make up the foundation for the inclusion of the various applications in residential buildings. The operating and base system is designed as an open software platform.
The numerous different functions are grouped together in packages called applications and can be integrated into the HomeAssistant in any sequence and number. It goes without saying that the *EIB* components and devices necessary for the individual applications must be installed.
These applications are supplied by various EIBA manufacturers. The necessary documentation and software tools are available to create the corresponding application software.
As an example, we have included short descriptions of some of the application packages available today.

5.2.1 Lighting / scenario manager

The lighting application with built-in scenario manager can visualise and operate all lights connected to the *EIB* according to their statuses. Ordering according to room simplifies the process of finding individual lights.
With the scenario manager it is possible to put together sequences for various actions and with that to organise different scenes.
In the dialogue, the user selects the devices that are to be included in a particular scene. These are accepted into the scene with their current status. After this, the call-up criteria are established. The scenes can be invoked in a time or event controlled way.

5.2.2 Heating / temperature

The single room temperature control offers a comfortable means of entering the various time-temperature profiles. Every room can be polled for its current temperature. The settings can be made according to the various "day types" which allows the simple adaptation to weekdays, weekends, flexible working times, holidays as well as personal living routines. These day types can also be used for the control of other devices and device groups, such as for example, blinds.

5.2.3 Blinds / shutters

This application offers functions for blinds and shutters that are analogous to those described for lighting applications. If the lighting application is installed, the blinds and shutters can also be operated with the scenario manager.

5.2.4 Security / monitoring function

The "monitoring function" application contributes to the overall concept of security. This application facilitates a display of security-relevant status information, such as for example:

- Window sensors
- Movement detectors
- Switchable sockets.

5.2.5 Television functions

This comprises the complete functional range of a stereo television with additional functions such as full screen / split screen representations, video channel, transmitter selection in single stages, etc. A pre-requisite is a TV card in the PC.

5.2.6 Extensions via a communication socket

Communication socket

Beyond the standard connection of devices to the *EIB*, connection via a communication socket offers the following additional advantages:

- The communication socket can be commissioned with the ETS 2 without any knowledge of the device to be connected.
- The HomeAssistant automatically adds the device connected to the communication socket to the existent *EIB* system by means of the device specific CD-ROM. This is a possible way of separating different building disciplines and areas of responsibility.
- In the future, devices once registered via a communication socket will be instantly recognisable if connected to a different communication socket within the same *EIB* system ("connection of portable devices").

One communication socket should be provided for every bus compatible household appliance.

5.2.7 Other applications

As the HomeAssistant represents an open software platform, applications from different manufacturers can be incorporated into the system.
These manufacturers provide both the development tools and the corresponding documentation for developing applications.

5.3 Project design

When designing an *EIB* project with an integrated HomeAssistant, the following points must be observed in addition to the measures already listed in chapters 2.5 and 3.3:

5.3.1 Hardware for the HomeAssistant

The scope and complexity of the HomeAssistant software demands the hardware components listed in Table 5-1 below.

Personal computer (PC):	
Type	IBM AT compatible
Processor type	Pentium ≥ 100 MHz
Memory	≥ 32 MB
Hard disk, free memory	≥ 500 MB
Disk drive	1.44 MB; 3.5”
CD-ROM drive	≥ 4-way speed
Graphic card	800 x 600 pixels, 64 k colours, ≥ 70 Hz
Sound card	Sound blaster MPC2 compatible, Windows Sound System compatible, 2 mixer inputs (for modem and TV sound)
Loudspeaker	Corresponding to the sound card
Modem	28.8 voice/fax modem (TAPI driver)
Monitor	15” VGA colour monitor
Touchscreen (optional)	Elotouch systems, accotouch with serial interface
TV card (optional)	Fast Movie Machine II
Mouse	Microsoft PS/2 compatible
Interfaces	2 serial interfaces (RS 232) and one parallel interface COM 1 reserved for connection to the *EIB*
Operating system	Microsoft WINDOWS 95

Table 5-1 Hardware requirements for the HomeAssistant

5.3.2 Connection conditions

In each case it is necessary to provide one serial *EIB* interface (RS 232) and a corresponding mains connection for every PC. If several installation points are required, this can be achieved by implementing the actions described below as many times as required.
Fig. 5-7 is a schematic representation of the various connections to the different networks and the connections to the PC and monitor.

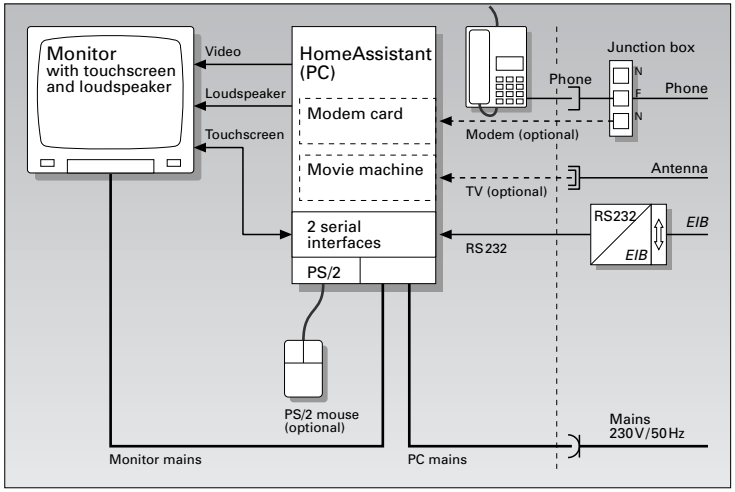


Fig. 5-7 Connections from the HomeAssistant to the various networks and monitor

Mains connection (230 V)
At least one SCHUKO socket is required at the planned installation site; the monitor is usually supplied and switched on/off via the PC. If not, a second mains connection will be necessary.

***EIB* connection**
Connection to the *EIB* occurs via a serial interface (RS 232).

Telecommunication connection (option)

Junction box

Connection to the telecommunications network is achieved via a junction box (analogue).

TV connection (option)

Antenna socket

In order to be able to use the HomeAssistant as a regular TV, a TV card must be installed and a suitable antenna socket provided.

Connections between PC and monitor

In order to guarantee the functioning of the HomeAssistant, the standard cables specified by the manufacturer must be used. With relatively high standard cables, lengths of up to 10 m are permitted.

5.3.3 Design specifications

Setting up an *EIB* project with a HomeAssistant requires the use of two software tools:

- ETS 2 for creating the *EIB* project
- HomeAssistant Tool Software (HTS) for entering additional information for the HomeAssistant.

The sequence of steps is displayed in Fig. 5-8.

Product database

The first step towards visualisation is the creation of a project with ETS 2. The product database must also exist in ETS 2 format. It may be necessary to convert an old ETS 1.x project. The HomeAssistant necessary to the project must strictly adhere to the rules of ETS 2.

a) Building structure

Especially important are the entry of room structure, allocation of devices to rooms, completion of the “key” fields and the addition of extra groups.

Adhering to these guidelines is important because the names for rooms and devices are derived from this information. These names are then displayed in the HomeAssistant menus and indicate to the end user the unique system.

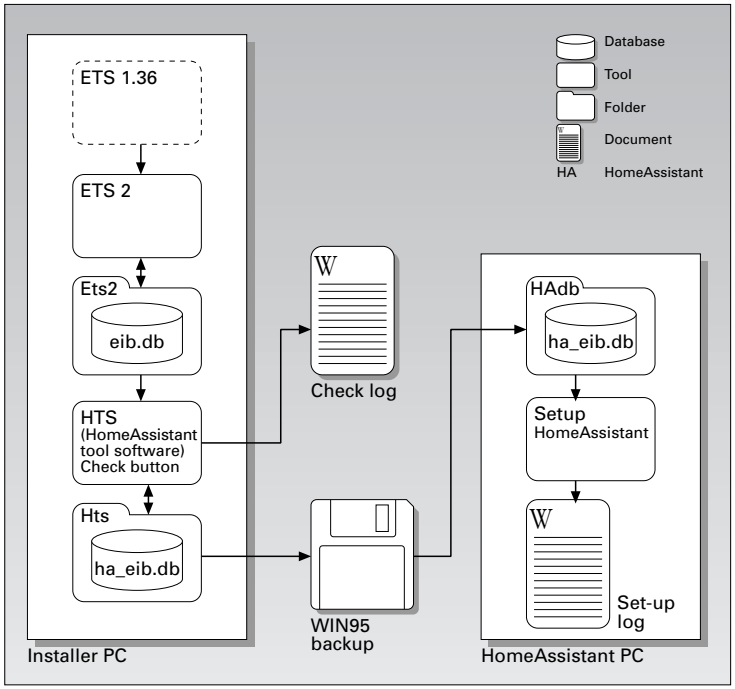


Fig. 5-8 Setting up databases with ETS and HTS

b) Single actuator groups

Single actuator group

For every used channel of every actuator, a separate group address must be specified in the ETS 2 project, so that all actuator functions can be controlled separately from the HomeAssistant. In addition, the so-called single actuator group must be set to “transmitting” for the actuator communication object.

c) Status communication object groups

Status communication object

A separate group address must be assigned to every status communication object. The HomeAssistant needs these

groups in order to be able to read the status of the *EIB* devices.
Actuator application programs, which do not contain status communication objects, should not be used as this may lead to functional restrictions at the HomeAssistant.

d) Flags for communication objects

Flag

The first step is to select the standard settings for the flags of all communication objects. This is achieved by selecting the "Standard" button in the "Edit object" window of the ETS 2 software.
The following points should also be noted:
The "read" flag must be set for every communication object whose value is to be read by the HomeAssistant via the *EIB*. This is especially valid for:

- All status communication objects.
- Sensor communication objects whose status is of interest to the HomeAssistant (e.g. movement detectors).

It is also necessary to ensure that relevant telegrams can reach the HomeAssistant. The corresponding parameterisation of the line couplers is achieved by deactivating the filter tables.

5.4 Installation

Before installation can begin, the database of the *EIB* system must be adapted to the requirements of the HomeAssistant and stored in the PC. If a touchscreen is used, the touchscreen driver must also be installed.
If the PC is configured according to the specifications, the HomeAssistant base package complete with CD-ROM is loaded into the PC via the CD drive.
This is followed by the installation of the actual HomeAssistant, taking into account the specific conditions of the house or flat. The PC internally stores the rooms and devices involved in the *EIB* system (lights, windows, doors, blinds etc.).

5.5 Commissioning

After installing the base package, there are already a number of functions available. The individual applications are installed in the HomeAssistant under "System extension".
Other functions are obtained from extra packages, which are also loaded into the PC from the associated CD-ROM.
If communication sockets are installed, bus compatible devices can be connected to them and integrated into the system using the product-specific CD-ROMs supplied with them.

6 EIB Tool Software (ETS)

6.1 The basics of ETS 2

Software tool

For planners and electricians the ETS 2 represents a powerful software tool which, by virtue of a clear structure, is easy to use.
The ETS 2 is based on the ETE (*EIB* Tool Environment), which contains all basic functions and interfaces to other software systems. The ETE is an extensive software library, which enables access to the project and product data of the ETS database and which contains *EIB* network functions.
The new ETE and the ETS also offer manufacturers entirely new possibilities of product design and presentation.
The ETE provides the basis for the development of ETS 2 add-on modules, interfaces to other software systems and product-specific ETS 2 supplements and extensions.

Context-sensitive on-line help

The ETS 2 is user friendly. It provides extensive on-line help, which in turn supplies concise, context-sensitive information. There is also an assistant function, which makes targeted suggestions for proceeding, thereby supporting the user.
The ETS 2 represents a modern and powerful software tool used to fully exploit the extensive range of *EIB* technology.

6.2 Content of the ETS 2

ETE

The ETS 2 is an open system. It consists of a basic development environment, termed ETE (*EIB* Tool Environment), with the following functions (see Fig. 6.2-1):

- User guidance
- Printer control
- Language management
- Database access
- Access to *EIB* installations via RS 232

- Import/export of products and projects
- Interface for add-on modules and data exchange with other software.

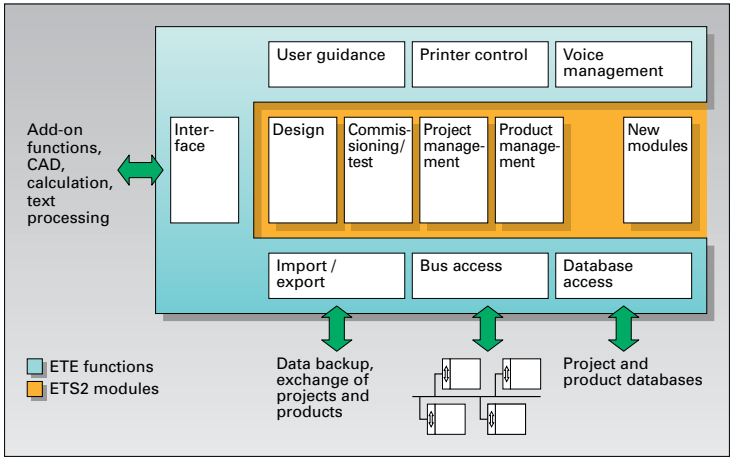


Fig. 6.2-1 System architecture and interfaces of the ETS 2 and ETE

These functions can be used by all software modules, including those added at a later date.
The ETS 2 currently contains the following modules, which can be used for the various tasks necessary for the design and commissioning of *EIB* installations:

- Settings
- Project design
- Commissioning / testing
- Project management
- Product management
- Conversions.

Drawing, simulation and calculation programs

By virtue of the ETE functions it is possible to integrate other, specialised software modules into the ETS 2 such as drawing, calculation and simulation programs.

The ETS 2 software offers the following important advantages when compared with ETS 1.x:

Database system
Drag and drop
Team-oriented project design

- Common user interface and operational philosophy
- New and more powerful database system
- Consistent “drag & drop” functionality
- Flexible structuring of projects
- Assistant functions for supporting the project design and commissioning stages
- Shortening of the design times by the use of ready-made solutions
- Supports team-oriented project design
- Extensive functions for troubleshooting in installed *EIB* systems
- Supports *EIB powerline* and *EIB radio*
- Supports various languages.

6.4 ETS 2 modules

The ETS 2 consists of the following modules, which can be used for the various tasks during the project design and commissioning stages:

Settings
This module offers functions to define general ETS 2 settings, e.g. printer, passwords, address formats and languages.

Project design
With this central module it is possible to define the structure of the *EIB* project, the necessary *EIB* devices can be added and connected to implement the desired functions. Powerful functions are provided for fast and simple project design. Documentation is largely automated.

Commissioning / testing
This module is used for commissioning and then testing *EIB* systems.

Project management
This module supports the management of projects. Special functions are provided for the management of the product database, such as for example, the import and export of projects.

Product management
This module provides functions for the management of product data, such as for example, the import of new, manufacturer-specific product data on disk.

Conversions
This module allows the user to maintain and edit projects that have been created with ETS 1.x. Product and project data can be converted for use with ETS 2.

6.5 Project-specific keys

A significant and in its function very important extension of the ETS 2 is the possibility of additionally defining “keys” in the various detail dialogues. These keys are project-specific codes, names or keywords for buildings, building areas, rooms, building disciplines, group addresses, areas, lines, devices and communication objects. They are used for communication with other software programs, e.g. visualisations and the HomeAssistant and for these are a basic requirement when designing the project.

6.6 System requirements

The following system configuration is recommended for the use of ETS 2:

- Pentium PC
- 16 MB RAM
- DOS version 5.0 or higher
- Microsoft WINDOWS, version 3.1/3.11, WINDOWS 95
- Microsoft WINDOWS compatible mouse
- VGA or other graphics card, which supports Microsoft WINDOWS with a monitor resolution of 1024x768 or 800x600 pixels and can represent at least 16 colours or shades of grey
- Monitor compatible with the installed graphics card.

6.7 Loading the physical address

Physical address

The physical address (see chapter 2.1.5) allows individual devices to be contacted directly. The programming of the physical address is a prerequisite enabling the relevant application program and assigned group addresses to be loaded into the devices. The physical address is also required for reprogramming, diagnosis and troubleshooting functions. The physical address therefore must be loaded into every device, at the very latest during commissioning. It is loaded via the *EIB* data interface connected to the bus. All devices connected to the bus can be programmed via this interface. At the PC, the desired physical address is first selected and then the programming button on the device is pressed. After this button is pressed the red LED on the device lights up and is extinguished again once programming is completed successfully. If several physical addresses have been selected at the PC, the next is now sent and the programming button must be pressed on the corresponding device.

Programming buttons for various bus coupling units shall not be pressed at the same time, as this would lead to undefined physical addresses.
The physical address can be overwritten as often as desired.
If it proves impossible to load the physical address, reasons include:

- The device is not properly connected to the bus line
- Power supply is not switched on
- The reset switch on the choke or *EIB* power supply is set to reset
- Short circuit on the bus line
- PC not correctly connected to the *EIB* data interface (RS 232)
- PC configured incorrectly
- Line or area coupler programmed wrongly or not at all
- Wrong or defective PC/*EIB* data interface connection line
- Bus device is defective.

With *EIB powerline*, additional causes include:

- Bus device is not connected to the network.
- Bus device is connected to a different active conductor. Use repeater/phase coupler.
- No possibility of communication due to network conditions (interference, impedances, see chapter 3.1).

6.8 Loading the application programs with group addresses and parameters

Application program

A bus device consists of the hardware (bus coupling unit and application module) and the application program, which determines the functionality of the device. Before the device can function, the application program must be loaded into its memory. The application programs can be obtained from the device manufacturers as product databases on diskette. There may be more than one application program for a particular device, containing/offering different functions.
To guarantee the proper functioning of a device, only the application programs designed particularly for that device should be loaded into it.
Bus coupling unit, application module and application program must originate from the same manufacturer and must never be mixed.

Group address

The application program can be loaded into the device at any time after the physical address has been assigned. The devices that work together are determined by the group addresses. These are specified during the project design stage (see chapter 3.5.1). In accordance with the physical address, the application program with group addresses and parameters is loaded into the desired device with the ETS commissioning program and can be changed as often as is necessary thereafter.
The functionality of the device is determined by the application program, which can be obtained from the manufacturer on disk. The application program together with the group addresses and parameters is then loaded into the *EIB* device after the physical address has been established (see chapter 5.2.6). Application program, group addresses and parameters can be changed as often as desired. This means that partial commissioning is also possible.

6.9 Loading the filter tables

Line coupler
Area coupler

Line and area couplers can be used to pass on telegrams to specific lines or areas only. If this function is activated, the corresponding settings must be made in the project design or commissioning stage.
The telegrams to be passed on or blocked are recognised by the group address. For this purpose, the commissioning program of the ETS creates a table for every coupler called filter table, in which the group addresses to be passed on are noted.

Filter table

The filter table should be loaded into the coupler after the physical address and application program.
If new group addresses are specified for specific lines or areas or the existing ones are changed after commissioning, the relevant couplers must be loaded with the updated filter tables.

6.10 Programming the line and area couplers

When programming the planned data into the bus devices, the first step is to program any line or area couplers with the physical address, the application program and where applicable the filter table. To achieve this the line or area couplers must be supplied with power from both the superordinate and subordinate lines. The line or area couplers via which the telegrams are to be transmitted must first be programmed.
After this and within a suitable area, e.g. one room, all other bus devices are selected in turn in the ETS commissioning program and loaded with the corresponding physical address and application program.
After the bus device has been programmed the physical address should be indicated somewhere on the device.
The following example illustrates the programming of an *EIB* installation:
The *EIB* data interface is arranged in the first line of the first area.

We recommend the following procedure:
The first step is to individually load line coupler 1.1.0, then line couplers 1.2.0 to 1.15.0 and finally area coupler 1.0.0 with the appropriate physical address, application program and if applicable, filter table. The next step is to load area couplers 2.0.0 and 3.0.0. After this it is possible to program the line couplers in the second and third areas. The last step is to program the remaining bus devices in the lines with physical address and application program, in any sequence.

6.11 Advice on the procedure

The project design phase must be complete before loading the physical address, application program and if applicable the filter tables. This loading process can be carried out either before or after the devices are installed.

The sequence of events depends on various criteria, such as for example, the number of trained employees available to carry out the work, the number of PCs in operation, and the duration of installation and commissioning or the storage area at the site.
In practice, it has proved most effective to program devices that are difficult to access before they are installed and those with easy access after they are installed.
The programming of devices before installation can either be carried out on site or in the workshop. In order to be able to program the devices, they must be connected on the bus side to an *EIB* power supply with choke and to an *EIB* data interface. One serial interface of the PC must be connected to the *EIB* data interface via a V24/RS 232 line (1:1 connection line, the so-called “nine-pin monitor extension lead”).

7 An example of project design

7.1 Establishing the customer requirements

It is basically possible to design a residential building according to criteria similar to those of a functional building (see chapter 2.4.1.2) and with that to plan the same functionality.
The building installations usually seen up to now have for years been based on the distribution and switching of electrical energy. This method is long outdated.
Private clients still tend to derive their requirements and expectations regarding electrical installations from their experiences with familiar installation technology. But in terms of

- comfort,
- possibilities for flexible room usage,
- centralised and decentralised controls,
- security,
- the intelligent linking of systems across different building disciplines,
- communication possibilities,
- environmental considerations as well as
- a reduction in the energy and operating costs,

modern installations have changed dramatically.

During a consultation, the private client is largely unaware of the range of possibilities and opportunities for future extension that are offered by an *EIB* installation. This information must be passed onto him as clearly as possible without overloading him with unnecessary details. He must be told that it is easily possible to expand or complete his *EIB* installation at a later date. Good and comprehensive

consultation is the best foundation for follow-on contracts for the completion and extension of carefully planned *EIB* systems. Incomplete or inadequate consultation can quickly turn an initially satisfied customer into a very unsatisfied customer, if he later learns that his investment in a bus installation cannot be fully exploited.

The questions put together in the example questionnaire, included in Appendix A, can be answered easily without requiring knowledge of *EIB* technology. It must be made clear however, that the answers themselves do not define the installation. They only serve to analyse the customer's requirements as a basis for determining the feasibility. Some of the questions hint at technical solutions that will only be available on the market in the months or years to come. They do however play a role in the suggested solutions, as it is possible to take them into consideration for implementation at a later date (preparatory cabling). Completion of this questionnaire essentially represents the specifications. An offer can then be made on the basis of this document, using the "ZVEH calculation aid". Project design begins once the contract is awarded.

7.2 Writing the specifications based on a given example

The answers marked in the questionnaire yield the following basic requirements on the *EIB* project:

- The private customer is building a one-family house with garden and garage on a remote site.
- There are distinct demands on security.
- Value is placed on ways to save energy and costs.
- Particular demands have been made regarding comfort.
- Some of the wishes cannot yet be technically realised, which means that a system planned with foresight is extremely important for follow-on contracts.

- Subsequent extensions to the system and functionality must be taken into consideration.
- A few of the possibilities mentioned in the questionnaire are viewed as critical; further information and more detailed explanations could extend the project and offer approaches to a service contract.

The system requirements essentially comprise the following:

Lighting
- Within the house, switching points should be located near the doors as well as in the sleeping and seating areas.
- Lighting control with movement detectors should also be planned for the garden and access paths.
- Security lighting should be incorporated.
- The simulation of an "occupied house" by adjustable sequences is required.
- The lighting control should be integrated into the HomeAssistant.

Sockets
- Switchable sockets should be provided for the exterior areas, kitchen, workroom and bedrooms.
- Sockets must have child-protection.
- For the simulation of an "occupied house", switchable sockets should be planned for lights.
- The switching status of the sockets should be represented in the HomeAssistant.

Room heating
- Single room temperature control should be included, which in addition to manual intervention also allows monitoring and control via a HomeAssistant.
- The radiators should be switched off when the windows are open.

– Remote control and remote signalling should be possible for the heating system.
– Reporting to a customer services department should be planned for a later date.

Heating system
– The heating system should be adapted to the requirements in a way that saves energy and costs. It should also be possible to monitor it from a central position; i.e. it should be connected to the *EIB* and integrated into the HomeAssistant.

Hot water supply
– The hot water supply should be investigated separately, as a combination of gas, electricity and perhaps at a later date solar energy must be taken into account.

Blinds and shutters
– The blinds should be motorised and must react accordingly in adverse weather conditions.
– In addition to manual operating possibilities located near to the windows, it should also be possible to control and monitor them from a central position.
– In rooms subject to dazzling sunlight, it should also be possible to adjust the angle of the slats.
– The open or closed status should be centrally displayed.
– They should be incorporated into a security system.

Awnings
– In addition to manual operating possibilities, awnings installed on the patio should be automatically retracted in strong wind or rain. It should also be possible to use them to influence the temperature of the shaded room.
– They should also be used to simulate an "occupied house" and allow the possibility of control from a central position.

Window monitoring
– The closed status of the windows should be monitored and displayed centrally.
– Any tampering should be detected and incorporated into a security system.
– Motor-driven operation should be included as a possibility for use at a later date.

Door and gate monitoring
– The closed status of the house doors and garden gates is to be incorporated into a security system. Additional visual monitoring is also desired.

Monitoring the supply lines
– For extra safety, the water and gas supplies should be monitored and integrated into a security system. As this is not yet on the market, a provisional installation must be planned.

Meter monitoring
– As a prerequisite for measures to save energy and costs, the meter readings and running costs should be displayed. The installation should be designed for the future implementation of remote meter reading.

House appliances
– Regarding new purchases, interest lies in the use of devices with a bus connection. It is therefore necessary to plan, at least provisionally, the corresponding number of communication sockets.

Garden system
– In the garden and along the path to the house there should be lighting and movement detectors and these should be integrated into a general security system.
– It should be possible to operate a sprinkler system depending on the dampness of the ground.

Security equipment
- Measures should be included to increase security. This must include interior and exterior lighting, the windows, blinds and the entrance doors.
- Monitoring at the HomeAssistant with remote signalling possibilities should be planned.
- It should be possible to trigger emergency and help calls, quickly and easily.

Central operating and control unit
- A device, which is capable of receiving television signals in addition to allowing the simple operation and control of the household installations, should be fitted in the kitchen (HomeAssistant).

Extras

There is also interest in the following extensions, planned for the future:
- Cultivation of a winter garden with shadowing and utilisation of the heat energy that is produced in the transitional period.
- Lighting in the living area.
- Isolation of the bedrooms to avoid electromagnetic fields.
- Connection to service stations for the various devices.
- Construction of a garden pond with the ability to monitor the circulating pump and maintain a constant level.
- Installation of a solar panel and integration into the existing hot water supply.

7.3 An example of designing a project

Although in comparison with a large functional building, we are dealing with a much clearer installation here, a *** installation should be planned. This has as much to do with the variety of functions desired as well as with the high probability of later expansion.
A separate line should be provided for each floor to ensure

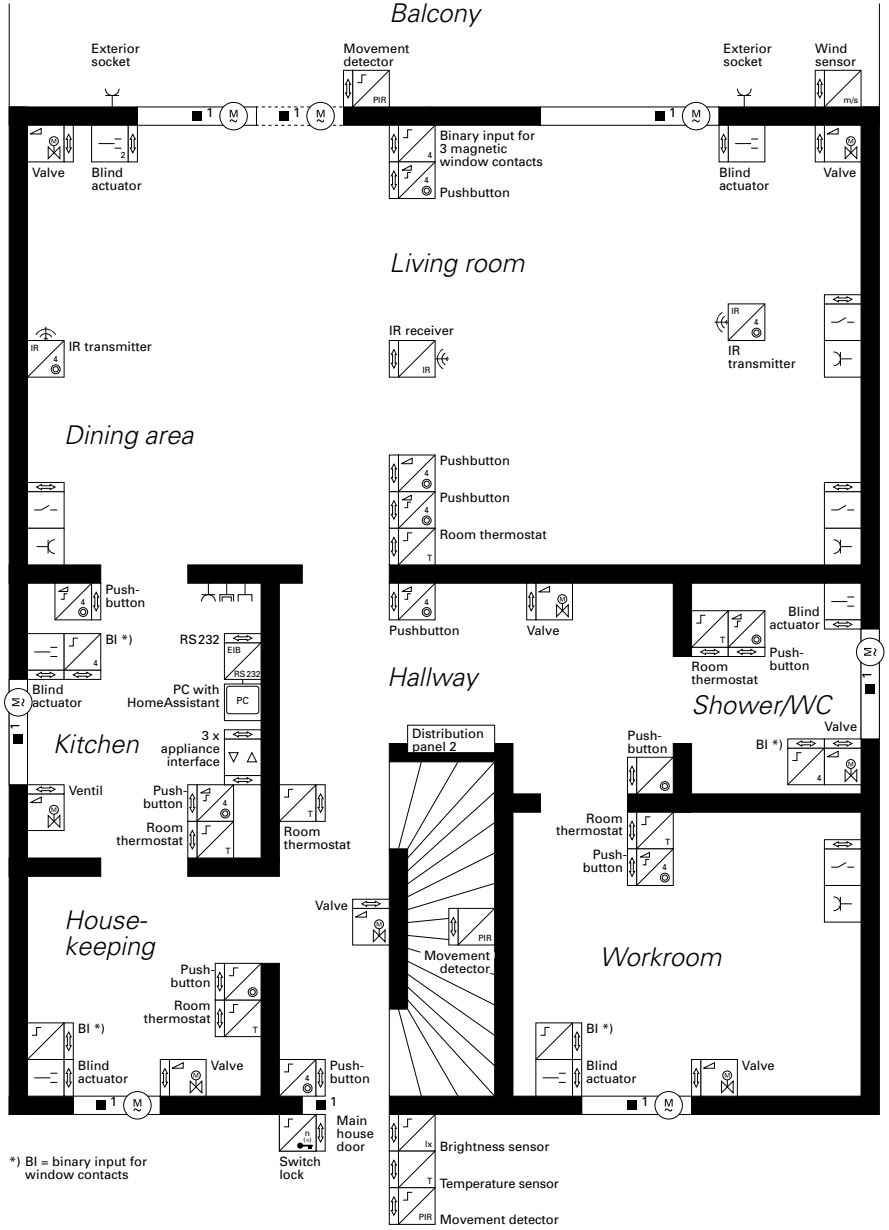


Fig. 7-1 Ground plan with EIB devices

simple and clear structuring.
Because this example deals with a new project, the project design is carried out with ETS 2. The result is an extensive set of detailed lists. For projects where there is a high probability of expansion or modification within subsequent years, other documents should be provided in addition to the lists. In chapter 2.5.6 on “Documentation” we stress that the results of the project design stage form the foundation for all subsequent steps of the installation, commissioning and maintenance, and with that of course for all future expansion. Reference is made to the documents or wiring diagrams in accordance with the standards of the EN 61082 or DIN 40719 series, in particular to the bus devices and bus lines with physical and group addresses that are marked on the ground plan (see Fig. 7-1).
The logic diagram indicates the bus devices and their physical addresses as well as allocation to the lines. If the complexity of the project demands, it may also be necessary to draw up a functional diagram. This saves a considerable amount of time during subsequent expansions or modifications. If you also draw the parameter block for each of the bus devices, you are left with an excellent and very clear set of documents (see chapter 2.5.2.5).
The HomeAssistant necessary to implement this example system demands exact adherence to the rules of ETS 2 and to the design guidelines specified in chapter 2.5.2.2.3. Of particular importance is the entry of room structure, completion of the key fields and the addition of extra groups (so-called single actuator groups).
Adherence to these guidelines is important because the terms and names for the rooms and devices are derived from this data and appear in the operating menus of the HomeAssistant, allowing the end user to recognise his own individual system.
The database created with ETS 2 is transferred into the HomeAssistant using the HomeAssistant Tool Software (HTS), which is included in the scope of supply.

8 Operation and maintenance

The operation of a system comprises all activities from delivery to the customer to the commissioning of the system (DIN 32541). This includes servicing and maintenance.
This demands the existence of a person responsible for the system, the system manager. Both the system manager and the operator must be in possession of the entire system documentation (see chapter 5.7).
If the system manager is replaced, the documentation must be handed over to the new system manager. The same goes for a change in operators.
The documentation also includes a maintenance plan, if such a plan is required for the system. If there is a maintenance plan there is usually an accompanying contract. This is recommended for larger systems. Even without a maintenance contract however, the necessary service is available through the system manager or a suitably *EIB* trained electrician.
All changes made within the framework of maintenance and servicing must be incorporated into the documentation.

8.1 System upkeep

8.1.1 Maintenance

Maintenance contract

The work carried out in accordance with the maintenance contract increases the reliability of the system by means of prevention.
Usually, the operator signs the maintenance contract with the system manager. The system manager is familiar with the handling and functionality of all installed bus devices. In addition, he also has the necessary commissioning and diagnostic tools as well as a team of suitably trained staff.

8.1.2 How to proceed when errors arise

8.1.2.1 Advice for operators

If there is a maintenance contract, the operator will usually inform the service department when an error occurs.
Warning! The behaviour of the system under certain operational conditions may sometimes be wrongly perceived as an error.
For example:
For safety reasons, certain actuators must take on a defined (safe) state following a mains interruption. It may be necessary therefore, to press certain touch sensors to return these actuators to the state they were in before the interruption.
If there is definitely a fault, the following points should be noted:

– Work should only be carried out on electrical systems by skilled electricians.
– The operator should contact the relevant system manager.
– In his own interests the operator should try to describe the fault in as much detail as possible to the system manager or service department. Get the documentation ready.
– Determine the area of the building in which the error occurred and find out what the consequences were.
– Check for a power failure or the triggering of a protective device.
– Any operating voltage LEDs that may be provided on the bus devices can help the operator to detect the failure of the bus voltage.

8.1.2.2 Advice for electricians

Systematic trouble-shooting

During diagnosis and error removal the DIN VDE 0105-1 regulations must be upheld (mainly the five safety rules).

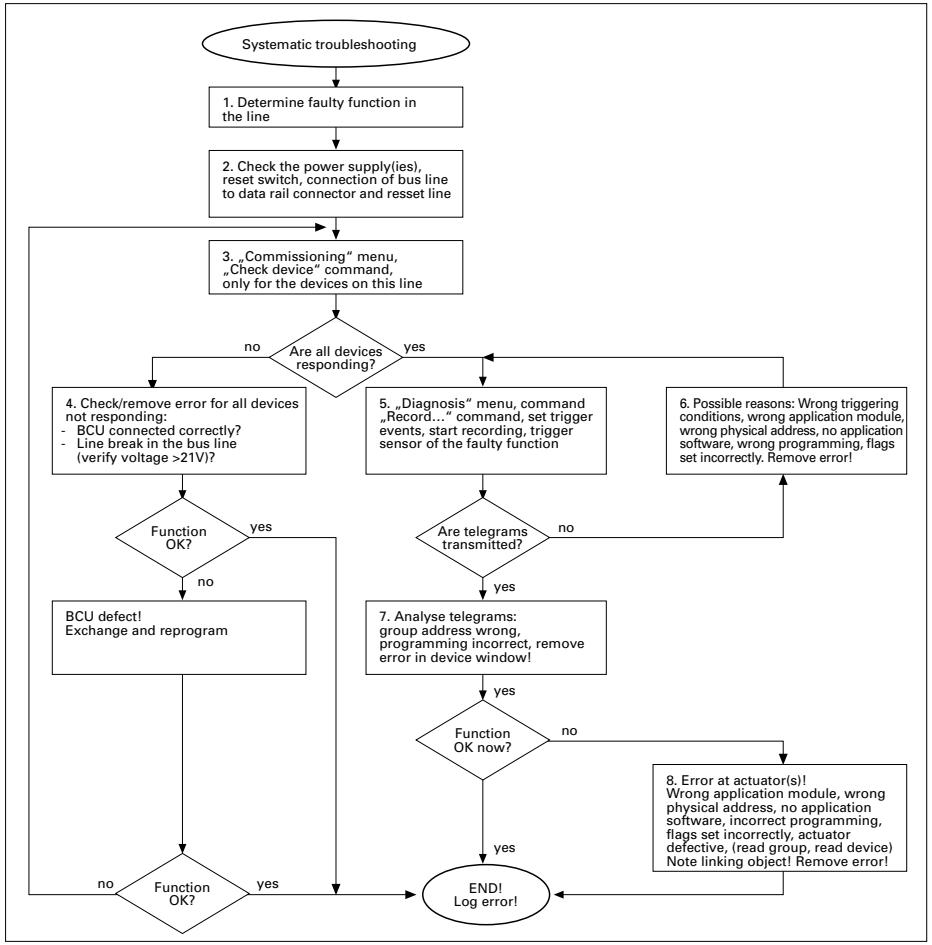


Fig. 8.1-1 Systematic troubleshooting

1. Localise the error by a visual check and/or based on the information given by the operator. Identify the bus line(s) used for that particular section/application/function. Does it involve an actuator? Are there any associated sensors involved? Does it involve a single bus device or several devices within the line(s)?

2. Check the bus voltage(s) on the *EIB* power supply(ies) of the relevant line(s).
Only for *EIB-TP*!:

- If the green LED is lit up on the *EIB* power supply, then this is working correctly.
- If the yellow LED is lit up, indicating "overvoltage" (not provided for all EIB power supply devices), the bus voltage needs to be checked and the device changed.
- If the red LED is lit up indicating "excess current", then a short circuit has occurred in the bus line.
- If only the green LED on the *EIB* power supply is lit up then you can try to remove the error by activating reset.
- The switch on the choke should be moved to reset (red LED on the choke illuminates) and then moved back after about 2-3 seconds.
- Afterwards check whether the error has been removed. Check the connection of the bus lines on the data rail connector.

3. With the commissioning software check that all bus devices on the relevant lines are responding. Check any that are not:

- Does the physical address established with the software match the label on the device and the documentation?
- Press the programming button on the bus coupling unit. Does the red LED light up?
- If yes, press the programming button again. The light will extinguish.
- If no, check the connection of the bus coupling unit and operating voltage and check the operating voltage on the bus device.
- Establish whether the sensor(s) associated with the relevant function(s) is (are) working properly. Set the corresponding triggering conditions with the diagnosis software and press the sensor(s).

4. If no telegrams are recorded by the diagnosis software, the causes must be clarified and any errors removed. Possible causes are:

- The triggering conditions have been wrongly specified.
- The application module does not match the application software of the bus coupling unit.
- The physical address of the sensor does not match the physical address of the triggering conditions.
- No application software has been loaded into the bus coupling unit.
- The application software has been incorrectly programmed.
- The flag settings are wrong.

5. If telegrams have been recorded by the diagnosis software these must be analysed and if applicable, the programming of the relevant bus devices modified.

6. Do the transmitted group addresses correspond to the planned group addresses?

7. Is the programming correct?

8. If no errors were established for the sensors, or the established errors have been removed and the overall functioning is still faulty, the relevant actuators must be checked. Possible causes of error are:

- Wrong application module.
- Wrong physical address.
- No application software in the bus coupling unit.
- Conditions for any possible links are not met.
- Actuator is defective or there is no operating voltage.

9 Training

EIB technology places new demands on the planners, electricians and service staff.
This document, "Project Engineering for *EIB* Installations, Basic Principles" provides the basic information necessary for the planning, project design, installation and commissioning of *EIB* systems. It does not contain detailed information on the planning and commissioning software.
The EIBA approved training centres teach the use of this software and improve the system knowledge of those attending. The participants learn about designing, commissioning and diagnosing *EIB* systems.

System training

Information on certified *EIB* training centres can be obtained from:

European Installation Bus Association sc (EIBA)
Avenue de la Tanche 5
B-1160 Brussels
Belgium
Tel. + 32 2 675 50 20
Fax + 32 2 675 50 28

Product training

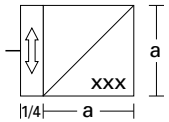
In addition to a sound knowledge of the system, detailed knowledge of the products is also essential. The manufacturers of *EIB* components also offer suitable training. These courses convey information on the electrical and mechanical properties of the devices as well as the range of functions determined by the application programs. A list of EIBA members is given in Appendix F.

Appendix C Symbols

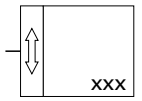
General information

The overall symbol consists of a square of side length “a” into which the individual symbols are entered. The transmission electronics are represented by a rectangle with dimensions a x a/4, which depending on the function of the device, is attached to one or two sides.
The “bus arrow” is inserted into the a x a/4 rectangle representing the transmission electronics. Individual symbols are inserted into the square, side length a, to represent the function. These symbols are identical to those of the DIN 40 900 standard.
The direction of information flow can, if desired, be represented by arrows on the bus line.
The following symbols should be used for bus devices that cannot be represented by the specified symbols:

Sensor

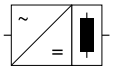
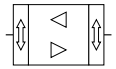
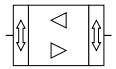
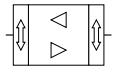
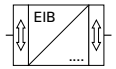
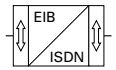
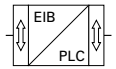
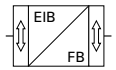


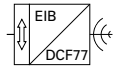
Actuator



xxx = alphanumeric term

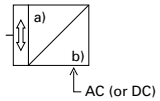
Basic components and system components

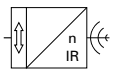
Product name	Abbrev.	Symbol
Bus coupling unit	**BCU**	
Choke	**CH**	
Power supply	**PSU**	
Power supply with integrated choke Power supply unit	**PSUTCH**	
Line coupler	**LC**	
Area coupler	**AC**	
Repeater	**RE**	
Data interface RS 232 interface	**RS232** **(V 24)**	
External interface Gateway	**GAT**	
E.g. to ISDN		
PLC interface		
Field bus interface		

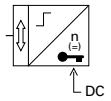
Product name	Abbrev.	Symbol
DCF77 interface		
Application controller Application control Control element Scene element Logic element Linking element Time profile control		
Connector		
Band stop		
Phase coupler / repeater		

Sensors

n = number of inputs [1, 2, 3,...]

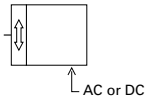
Product name	Abbrev.	Symbol
Sensor, general a) Field to identify the application software b) Field for physical input quantities to identify the input channels		
Sensor, general – With auxiliary supply		
Binary sensor Binary input Binary device Input terminal Pushbutton interface b) Field for physical input quantities to identify the input channels		
e.g. for DC		
e.g. for AC		
e.g. 2 inputs, AC		
Binary / analogue sensor Binary / analogue input Binary / analogue device		

Product name	Abbrev.	Symbol
Analogue sensor Analogue input Analogue device		
Touch sensor Pushbutton		
Dimming sensor Dimming push button		
Control touch sensor Control push button		
Blind sensor Blind push button		
IR transmitter		
IR receiver		
IR receiver with n-way pushbutton		
IR decoder		
IR receiver / decoder		
Brightness sensor		
Brightness detector Brightness value switch Twilight push button		

Product name	Abbrev.	Symbol
Temperature sensor		
Temperature detector Temperature value switch Room thermostat		
Movement sensor PIR = Passive Infrared US = Ultrasound		
Movement detector		
Clock Time sensor		
Timer Time value push button		
Wind speed sensor		
Switch lock		
Automatic cutout monitoring		

Actuators

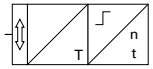
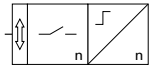
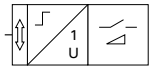
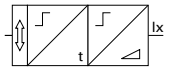
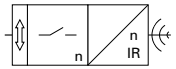
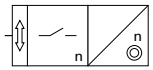
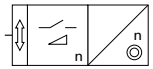
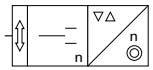
n = number of outputs [1, 2, 3,...]

Product name	Abbrev.	Symbol
Actuator, general		
Actuator with auxiliary supply		
Actuator, general with time delay		
Switching actuator Switching device Binary output Binary device Output terminal		
Blind actuator Blind switch		
Dimming actuator Switching / dimming actuator		
Display panel Display unit Display terminal Info display, e.g. 8-way		
Analogue actuator Analogue output Analogue device Regulator Control unit		

Product name	Abbrev.	Symbol
Pulsed switch e.g. for electrical heating/heating valve *) Function: Switching output ON/OFF (0-100%); i.e. if 60% is entered as an analogue value, the output is at ON for 60% of the time and at OFF for 40% of the time. (Time units of approx. 64 seconds are used.)		
Valve Proportional valve positioner		
Binary display		

Combination devices

n = number of inputs/outputs [1, 2, 3,...]

Product name	Abbrev.	Symbol
Combination of sensor functions in one device E.g. Temperature sensor and time value switch		
Switching device E.g. binary input and binary output		
Switching device E.g. dimmer and binary input		
Bus coupling unit module with timer and light intensity switch (with brightness sensor)		
Switching actuator with n-way infrared receiver		
Switching actuator with n-way pushbutton		
Dimming actuator with n-way pushbutton		
Blind actuator with n-way pushbutton		

Appendix D Regulations, standards and requirements

DIN VDE 1000-10	Safety requirements for persons working in the field of electrical engineering
DIN VDE 0100	Erection of power installations with rated voltages below 1000 V
-200	– Definitions
-410	– Protective measures; protection against electric shock
-420	– Protective measures; protection against thermal effects
-430	– Protective measures; protection of cables and cords against overcurrent
-510	– Selection and erection of equipment; common rules
-520	– Selection and erection of equipment; wiring systems
-610	– Verification; initial verification
-725	– Auxiliary circuit
DIN EN 501 10-1	Operation of power installations
DIN VDE 0105	(operation of electrical installations)
-1	– General requirements
DIN VDE 0106	Protection against electric shock
-1	– Classification of electrical and electronic equipment
-100	– Actuating members positioned close to parts liable to shock
-101	– Basic requirements for protective separation in electrical equipment

DIN VDE 0110	Insulation co-ordination for equipment within low-voltage systems
-1	– Fundamental requirements
DIN VDE 0160	Electronic equipment for use in electrical power installations and their assembly into electrical power installations
DIN VDE 0185	Lightning protection system
-1	– General data with regard to installation
V-100	– Protection of structures against lightning (tentative standard)
E-102	– General principles; guide; planning, set-up, maintenance, testing
E-103	– Protection against electromagnetic lightning pulses (LEMP)
V-110	– Manual for testing lightning protection systems (tentative standard)
DIN VDE 0207	Insulating and sheathing compounds for cables and flexible cords
DIN VDE 0470-1 EN 60529 DIN EN 50102	Degrees of protection provided by enclosures (IP code)
VDE 0470-100	Degrees of protection provided by enclosures for electrical equipment against external mechanical loads (IK code)
DIN VDE 0472-508	Dielectric test on cables, wires and flexible cords for power installations.
DIN VDE 0603	Consumer units and meter panels, 400VAC
-1	– Consumer units and meter panels

DIN VDE 0604	Ducts mounted on walls and ceilings for electrical installations
-1	– General requirements
DIN EN 50086-1 VDE 0605-1	Conduits and fittings for electrical installations
DIN VDE 0606	Connecting material up to 600 V
-1	– Installation boxes for accommodation of equipment and/or connecting terminals
DIN EN 60999 DIN VDE 0609-1	Connection material; safety requirements for terminal screw points and screwless terminal points for electrical copper wire
DIN VDE 0641-11	Circuit breakers for overcurrent protection for household and similar applications
DIN EN 60099 DIN VDE 0675	Guiding principles for overvoltage protective devices
-1	– Non-linear resistor-type lightning arresters for alternating voltage networks
E-6	– Surge arresters for use in a.c. supply systems with rated voltages ranging from 100 V to 1000 V
DIN VDE 0800	Telecommunications
-1	– Requirements and tests for the safety of facilities and apparatus
-2	– Earthing and equipotential bonding
-4	– Erection of telecommunication lines
DIN VDE 0815	Installation cables and lines for telecommunications and information processing systems

DIN EN 50090	Home and Building Electronic Systems (HBES)
-2-1	– System overview; System architecture
-2-2	– System overview; General technical requirements
DIN V VDE 0829	
-100	– Standardization structure; Definitions
-230	– System overview; General technical requirements for installation devices
-240	– Technical report – Guidelines for the specialised laying of cables with twisted pairs, class 1
-521	– Twisted pair class 1; Safety layer
-522	– Bus line with twisted pair class 1
DIN EN 50081 / VDE 0839-81	Electromagnetic compatibility (EMC); Generic emission standard
-1	– Residential, commercial and light industry
-2	– Industrial environment
DIN EN 50082 / VDE 0839-82	Electromagnetic compatibility (EMC); Generic noise immunity standard
-1	– Residential, commercial and light industry
-2	– Industrial environment
DIN VDE 0845	Protection of telecommunications systems against lightning, electrostatic discharges and overvoltages from electric power installations
-1	– Provisions against overvoltages
E-2	– Requirements and tests of overvoltage protection devices and telecommunication apparatus

DIN 18015	Electrical installations in residential buildings
-1	– Fundamentals of planning and design
-2	– Type and scale of minimum equipment
-3	– Layout of cabling and electrical equipment
DIN 19226	Automatic control engineering
-1	– Definitions, fundamentals
supplement 1	– Keyword index
DIN 19246	Measurement, logic and sequence control, closed-loop control; project handling; terminology
DIN 31051	Maintenance; terms and measures
DIN 32541	Operation of machines and comparable technical equipment; terms used for operator activities and functions
DIN V 32734	Digital automation for technical installations in buildings; General requirements for design, planning and execution (digital building services automation)
DIN 40719	Connection diagrams
-2	– Identification of electrical equipment
DIN 40900	Graphical symbols for wiring documents (symbols for contact units and switching devices)
DIN 43871	Small distribution boards for built-in devices up to 63A

DIN 43880	Built-in devices for electrical installation; Enclosure and mounting dimensions
DIN 49073	Apparatus sockets made of metal or insulating materials for the connection of installation equipment of up to 16A, 250V
-1	– Main dimensions
DIN EN 50022	Industrial low-voltage switchgear; Mounting rails, DIN rails, 35 mm width for snap-on mounting of devices
DIN EN 61082	Documents in electrical engineering
-1	– General rules
FTZ 731 TR1	Distributing pipes and other concealed conduits for telecommunication lines in buildings; Technical description
VBG 4	Rules for prevention of accidents, "Electrical Installations and Equipment"

Please note:

Draft standard (e.g. DIN E VDE)
Recommendation for a standard. It is generally used as a basis to raise objections to, to vote on or to approve a standard.
Because the intended standard may differ from the existing draft, such drafts are used at one's own responsibility and must be specially arranged.

Tentative draft (e.g. DIN V VDE)
A tentative draft is the result of a standards session, which because of certain reservations concerning the content or DIN having taken up a position opposed to it, has not been issued as a standard. Tentative standards deal with subjects that are in need of being standardised. Linked to this is the expectation that tentative standards will at some point be converted into accepted standards after the necessary changes according to the usual procedures, or alternatively withdrawn.

International standard (e.g. DIN EN)
Standard that has been accepted by an international standardisation committee and is available to the public.

Appendix E Selection of relevant literature on the subject of electrical installations

Title	ISBN	Publishing house
EIB manual Project Engineering for *EIB* Installations, Basic principles		WFE, Frankfurt, Germany
EIB manual Project Engineering for *EIB* Installations, Applications		WFE, Frankfurt, Germany
Mathematical and Electrotechnical Fundamentals*	3-8023-1571-5	Vogel
Electrical Installation Technology*	3-8023-1525-1	Vogel
Household Appliances, Lighting and Air Conditioning Technology*	3-8023-1580-4	Vogel
Electrical Measurement and Closed-Loop Control*	3-8023-1463-8	Vogel
Digital Technology*	3-8023-1440-9	Vogel

Title	ISBN	Publishing house
Microprocessor Technology*	3-8023-1453-0	Vogel
Electrical Control and Drive Technology*	3-8023-1556-1	Vogel
Taking Measurements, Protective Measures DIN VDE 0100*	3-7905-0702-4	Pflaum
Electrical Installation in Practice*	3-7905-0519-6	Pflaum
EIB Building Systems Engineering*	3-7905-0712-1	Pflaum
Modern Electrical Installations*	3-7785-2410-0	Hüthig
Compliant Electrical Installations in Residential, Commercial and Industrial Buildings*	3-7785-2410-0	Hüthig
Building Systems Engineering in Residential and Functional Buildings with *EIB**	3-7785-2391-0	Hüthig
Electrical Installations in Residential Buildings, VDE Regulations*	3-8007-2108-2	VDE

Title	ISBN	Publishing house
Safety Tests in Electrical Installations with Voltages below 1000 V*	3-8007-2027-2	VDE
Security in Telecommunications and Information Engineering*	3-8007-1716-6	VDE
The Electricians Selection* (with subscription)		VDE
The Electricians Trade, DIN Standards*	3-410-13548-0	Beuth
The ABC of Electrical Installations*	3-87200-309-7	Energie
The Low Energy Manual*	3-87200-685-1	Energie
The ABC of Electric Hot Water Supplies*	3-87200-684-3	Energie
Electrical Installation Handbook	3-8009-4138-4	Siemens

**) Currently only available in German and only valid in countries regulated by VDE. Similar English documentation is planned for English-speaking countries.*

Appendix F EIBA members and licensees

as at March 1998

Members

ABB Elettrocondutture SpA, Milan/Italy
ABB STOTZ-KONTAKT GmbH, Heidelberg/Germany
Albert Ackermann GmbH & Co., KG, Gummersbach/Germany
A. Ahlström Corporation, Strömfors/Finland
Altenburger Electronic GmbH, Seelbach/Germany
AMP Deutschland GmbH, Langen/Germany
ASTRO Strobel GmbH & Co., Bergisch Gladbach/Germany

Gebr. Berker GmbH & Co., Schalksmühle/Germany
OBO Bettermann OHG, Menden/Germany
Bosch-Siemens Hausgeräte GmbH, Munich/Germany
Buderus Heiztechnik GmbH, Lollar/Germany
Busch-Jaeger Elektro GmbH, Lüdenscheid/Germany
BTicino spa, Milan/Italy

Caradon Electrical Holdings Ltd. (ex Pillar), Leicester/United Kingdom
CERBERUS-GUINARD S.A., BUC CEDEX/France
CMC Carl Maier + Cie AG, Schaffhausen/Switzerland
Crabtree Electrical Industries Ltd., Walsall/United Kingdom

DEHN + SÖHNE GMBH + CO. KG, Neumarkt/Germany
DIEHL GmbH & Co. Controls Division, Nuremberg/Germany
DIEM Electronics S.A., Geneva/Switzerland

Eberle Controls GmbH, Nuremberg/Germany
Electrium (ex Hanson Plc), Willenhall/United Kingdom
Eltako GmbH, Fellbach/Germany

ELVOX Costruzzioni Elettriche Spa, Padova/Italy

Feller AG, Horgen/Switzerland
FELTEN & GUILLEAUME AG, Cologne/Germany
Framatome Connectors Deutschland GmbH, Erkrath/Germany

GEYER AG, Nuremberg/Germany
GEWISS SPA, Bergamo/Italy
GIRA Giersiepen GmbH & Co. KG, Radevormwald/Germany
Grässlin GmbH & Co. KG, St. Georgen/Germany
GRUNDIG E.M.V., Fürth/Germany

Hager GmbH / Hager Electro SA., Ensheim/Germany – Obernai/France
Theodor HEIMEIER Metallwerk KG, Erwitte/Germany
Paul Hochköpper GmbH & Co. KG, Lüdenscheid/Germany

INSTA ELEKTRO GmbH & Co. KG, Lüdenscheid/Germany

Albrecht Jung GmbH & Co. KG, Schalksmühle/Germany

Hermann Kleinhuis GmbH & Co. KG, Lüdenscheid/Germany
Heinrich Kopp AG, Kahl am Main/Germany

LEGRAND SA, Limoges/France
Levy Fils AG, Basle/Switzerland
Lindner GmbH, Bamberg/Germany
LK A.S., Ballerup/Denmark

MENNEKES Elektrotechnik GMBH & CO. KG, Lennestadt/Germany
Gebr. Merten GmbH & Co. KG, Wiehl-Bomig/Germany

N.V. NIKO, Sint Niklaas/Belgium
NIESSEN S.A., San Sebastian/Spain

Philips Licht GmbH, Cologne/Germany
Phoenix GmbH & Co. KG, Blomberg/Germany
POPP + Co. GmbH, Bad Berneck/Germany
Power Controls B.V. (Vynckier), Gent/Belgium

Ritto-Werk Loh GmbH & Co. KG, Haiger/Germany
RITZENTHALER S.A., Baldenheim/France
Robert Bosch GmbH, Stuttgart/Germany
Wilhelm Rutenbeck GmbH & Co., Schalksmühle/Germany

Scharnebecker Electronic Fertigung GmbH, Scharnebeck/Germany
SCHUPA-ELEKTRO-GMBH + CO. KG, Schalksmühle/Germany
Siedle & Söhne Telefon- und Telegrafenwerke Stiftung & Co., Furtwangen/Germany
Siemens AG, Munich/Germany
Simon s.a., Barcelona/Spain
Somfy S.A. / Somfy GmbH, Cluses/France – Rottenburg/Germany
Stiebel Eltron GmbH & Co. KG, Holzminden/Germany
Striebel & John KG Elektroverteilersysteme, Sasbach-Obersasbach/Germany

TEGUI Electronica S.A., Pamplona/Spain
TEHALIT GmbH, Heltersberg/Germany
THEBEN-Werk Zeitautomatik GmbH, Haigerloch/Germany

Joh. Vaillant GmbH u. Co., Remscheid/Germany
Gebr. Vedder GmbH, Schalksmühle/Germany
Viessmann Werke GmbH & Co., Allendorf/Germany
VIMAR S.R.L., Marostica (Vicenza)/Italy

Wago Kontakttechnik GmbH, Minden/Germany
Wieland Electric GmbH, Bamberg/Germany
Winkhaus GmbH, Münster/Germany
Woertz AG, Muttenz/Switzerland

Zumtobel AG, Dornbirn/Austria

Licensees

Amann GmbH, Oberhaching/Germany
APT GmbH, Scharnebeck/Germany
Ardan Production and Industrial Controls Ltd., Holon/Isreal
ATICON Home Automation GmbH, Braunschweig/Germany

BERG-Energiekontrollsysteme GmbH, Gröbenzell/Germany
BÜRK ZEITSYSTEME GmbH, VS-Schwenningen/Germany

Elero GmbH, Beuren/Germany
ELJO AB, Bastad/Sweden
ELKA-Elektronik GmbH, Lüdenscheid/Germany

Hüppe Form Sonnenschutzsysteme GmbH,
Oldenburg/Germany

Intertel, Nova Milanese/Italy
IPAS GmbH, Duisburg/Germany

Landis & Gyr Building Control Corp., Zug/Switzerland

Metec GmbH, Hamburg/Germany
Multronic AG, Dietlikon/Switzerland
Hugo Müller GmbH, Schwenningen/Germany

Elektroanlagen Dieter NAGEL, Kandel/Germany
Netcon GmbH Gebäudeautomation, Radolfszell/Germany

F.W. Oventrop KG, Olsberg/Germany

RCS Realtime Control Systems AG, Rotkreuz/Switzerland

Schaeper Automation GmbH, Hannover/Germany

Sika Systemtechnik GmbH, Kaufungen/Germany
Stengler Gesellschaft mbH, Gütersloh/Germany

TechnoTrend GmbH, Erfurt/Germany
Tridonic Bauelemente Gesellschaft mbH, Dornbirn/Austria

Appendix G Requirements for the EIB bus line

1	Regulation	The bus line must meet the conditions of IEC 189-2 or the equivalent national regulation, if not otherwise stipulated in the following list of requirements.
2	Conductor diameter 1)	Minimum: 0.8 mm, maximum: 1.0 mm
3	Conductor material	Copper, single and multi-wired
4	Line layout	
4.1	External covering	Casing is required
4.2	Wires	2 = One twisted pair 4 = Two twisted pairs Type 1: 2 twisted pairs, paired Type 2: 4 twisted wires, spiral quad All wires should have different colours
4.3	Electric shock	Minimum 5/m
4.4	Shielding	Necessary Shielding should cover the entire circumference Tracer: min. diameter 0.4 mm

5	Capacity conductor / conductor	Max. 100 nF/km (800 Hz, 20°C)
6	Crosstalk attenuation	1 kHz: greater than 80 dB 10 kHz: greater than 70 dB 100 kHz: greater than 60 dB
7	Tension	2-wire line: min. 50 N 4-wire line: min. 100 N
8	Insulating resistance	100 MOhm x km (20°C) or 0.011 MOhm x km (70°C)
9	Testing voltage wire / wire	800 V
10	Additional high-voltage test	Test according to DIN VDE 0472-508, test type A or HD 21.1 S2 and HD 21.2 S2 However: – Testing voltage: 2.5 kV 4 kV 50 Hz – Testing duration: 5 minutes 1 minute – Test set-up: All wires and shielding connected to the external surface of the covering; in a water bath
11	Quality control system of the manufacturer	At least DIN ISO 9002, corresponds to EN 29002, corresponds to ISO 9002

1) A bus connection terminal should be used; see chapter 2.5.1.2.4

Remarks:
The DIN V VDE 0829 standard specifies the value of the testing voltage for the additional high-voltage test at 2.5kV .

The following lines are recommended for the *EIB* application (see chapters 2.5.1.2.2 and 2.5.3):

YCYM 2x2x0.8 Testing voltage 4 kV	*EIB* specification, for laying arrangements see Table 2.5-2
J-Y(St)Y 2x2x0.8 Testing voltage 2.5 kV	*EIB* specification, for laying arrangements see Table 2.5-2
JH(St)H 2x2x0.8	Halogen-free line, lay with separation
A-2Y(L)2Y or A-2YF(L)2Y	Underground telecommunications cable, lay outside

Appendix H Load characteristics for EIB powerline

Characteristic K = 1 (devices with low noise load)	– Conventional plugable power supplies – Conventional low-voltage halogen transformers – Filament lamps – Blind and awning drives – *EIB powerline* devices
Characteristic K = 10 (devices with mid-level noise load)	– Small electrical devices such as for example, fan heaters, irons and other household devices – Electric ovens – Refrigerators and freezers – Power tools and other small machines – Garden tools (e.g. lawnmower) – Vacuum cleaners – Fans and ventilators – HiFi and video equipment – Fax machines – Energy-saving lamps
Characteristic K = 50 (device with high noise load)	– Heating controls – Personal computers (PCs) – Monitors – Televisions – Copiers – Electronic transformers – Fluorescent lamps with electronic ballast – Air conditioning units – Solariums

Characteristic K = 1000 (critical consumers)	– Inverters – Carrier frequency transmission systems, such as for example, mains-based baby intercoms – UPS systems

This table only lists a small number of the appliances that could be used in practice. In all situations where critical consumers are included in the system, a field trial will provide information on the quality of transmission.

Index

The index contains all sub-chapter headings that are not included in the list of the contents.

Appendix A Questionnaire

The following questionnaire can be used as a means of establishing the customer's requirements for new buildings, renovations or redevelopments.
No technical knowledge is needed to answer any of the questions. The questionnaire is divided into general question areas according to the scope of the project, equipment in the rooms, requirements on the lighting, etc.
Some of the questions are redundant or mutually exclusive. Analysis of the questionnaire ultimately leads to the creation of the specifications document as described in chapter 7.2. An offer can be drawn up on the basis of this document, using the "ZVEH calculation aid". Project design starts as soon as the contract has been awarded.

1. Scope of the project

1.1 Are we dealing with an owner-occupied flat, a single-family house or an apartment block?
1.2 In the case of a new building, does it involve a solid building or a prefab?
1.3 Is an old building to be redeveloped, modernised or renovated?
1.4 Is the house/flat situated in the inner city, suburbs or countryside?
1.5 How many main rooms?
1.6 How many side rooms?
1.7 Is there any change in usage planned for the future, e.g. the addition of a granny flat?
1.8 Is a winter garden planned?
1.9 How is the winter garden to be used?
1.10 Is there any shading planned for the winter garden?
1.11 Is the warm air generated in the winter garden to

be used to heat the house in the transitional periods?
1.12 Is there a balcony?
1.13 Is there a garden?
1.14 Is there a garden gate?
1.15 Is there a yard gate to be considered?
1.16 Is there a garage?

2. Equipment in every room

2.1 General data
2.1.1 Name of the room (e.g. kitchen)?
2.1.2 Position of the room (e.g. ground floor)?
2.1.3 Size of the room (e.g. approx. m2)?
2.1.4 Number of doors?
2.1.5 Number of windows?

2.2 Lighting data
2.2.1 How many ceiling lights are provided in total?
2.2.2 How many of these are low-voltage halogen lamps?
2.2.3 How many of the lamps are to be switched?
2.2.4 How many ceiling lights should allow dimming?
2.2.5 Are there to be any other switches in the room in addition to those near the door?
2.2.6 Should remote control be provided for the lights?
2.2.7 Is the lighting to be switched on automatically as somebody enters the room and switched off again once they have left?

2.3 Socket data
2.3.1 How many sockets should be installed in the room?
2.3.2 Do you want to be able to switch off the sockets, e.g. in the children's rooms?
2.3.3 Should it be possible to switch a standing lamp connected to a socket on and off according to a

certain program allowing the simulation of an occupied house?
2.3.4 Do you want to pre-program the breakfast equipment in the kitchen, e.g. toaster, coffee percolator, etc. so that it operates according to a rhythm defined by you?

2.4 Heating data
2.4.1 How many radiators in this room?
2.4.2 Should it be possible to adjust the temperature in this room according to the usage?

2.5 Blind/shutter data
2.5.1 Are blinds and shutters planned for this room?
2.5.2 Should motorised operation be planned in addition to manual operation?
2.5.3 Are you only using blinds and shutters to protect against dazzle effects?
2.5.4 Are you also using the shutters for security reasons?
2.5.5 Are you also using the shutters for protection against light and heat?

2.6 TV and radio antenna data
2.6.1 Is there an antenna socket planned for this room?

2.7 Telephone system data
2.7.1 Is the main telephone connection located in this room?
2.7.2 Is there a secondary telephone socket in this room?
2.7.3 Are you using a telephone with a cordless handset?
2.7.4 How many cordless stations will you be using?

3 Planning and using the lighting

3.1 How certain are you of the switching functions for the lights? Would you prefer to establish the definitive functions once you have lived in the room for a while?

3.2 Do you want to be able to switch off the lights in the house from one or several switching points, in order to avoid checking the entire house before going to bed?

3.3 So that you feel safer in the house, do you want to be able to switch on all the lights including those in the garden from one or more locations in the house?

3.4 Depending on the occasion or situation, do you want to create different "atmospheres" by varying the lighting of the ceiling and floor lamps, and then be able to recall this setting at the touch of a button?

3.5 Do you always want to have an even, optimum brightness in the rooms, without having to push any buttons? (If the sun is too bright for example the shutters will close slightly, or the lights will come on automatically when it clouds over.)

3.6 In your absence do you want to simulate the appearance of occupancy by switching the lights in the various rooms on and off in a suitable rhythm?

3.7 Do you want this switching program to be automatically orientated around and saved according to your living habits?

3.8 If you are away from home do you want to be able to use the telephone to enquire whether all the lights are off, or to be able to switch the simulation program on in case you have forgotten?

3.9 Is the exterior lighting, e.g. at the garden gate and along the access paths etc. to be as flexible as the interior lighting, i.e. should it react to movement, brightness and darkness?

3.10 Do you want to be able to check whether the lights are on or off from a central point?

3.11 From this central location do you also want to be able to switch the lights on and off or to program their sequence according to your requirements?

4 Planning and using the sockets

4.1 Are sockets to be provided on the external walls of the house or other exterior locations?

4.2 Should it only be possible to use the exterior sockets when needed?

4.3 Do you want to be able to switch off any of the sockets, e.g. in any of the children's bedrooms?

4.4 Do you want to be able to switch off the sockets in the bedrooms at night (if you are over-sensitive to electromagnetic fields)?

4.5 Should it be possible to switch standing lamps that are connected to any of the sockets on and off for the simulation of an occupied house?

4.6 Do you want to be able to program the breakfast equipment, e.g. toaster, coffee percolator, in the kitchen to work according to a rhythm defined by you?

4.7 Do you want the possibility of checking from a central location the sockets that are operating and those that are switched off as well as those that need to be used for the breakfast program?

4.8 If you were away from the house would you like to be able to deactivate certain sockets via the telephone in case you think, for example, that you have forgotten to unplug the iron?

5 Planning and using the room heating

5.1 What type of heating have you planned?

5.2 Is the specified thermostat valve to be the only possible way to adjust the temperature in the individual rooms?

5.3 To save energy, do you only want to heat the rooms according to the level of usage?

5.4 How exact do you want the temperature control?

5.5 Should it be possible to reduce the temperature through the night in all of the rooms? If the rooms are then being used in accordance with your living patterns, should the desired temperature be restored?

5.6 To save maximum energy, do you want a very flexible temperature control?

5.7 Do you want to be able to differentiate between weekdays and weekends?

5.8 Should holidays automatically be taken into consideration?

5.9 To save energy, should the radiators be turned off automatically when the windows are opened in a room?

5.10 During your vacation, do you want to maintain an energy-saving temperature level?

5.11 If you were away from home do you want to be able to use the telephone to check that your heating is working properly even on very cold days?

5.12 If you intend returning home earlier than planned, do you want to be able to raise the temperature setting to you optimum level via the telephone?

5.13 On sunny autumn or winter days, do you want to incorporate the solar energy to reduce your heat energy whilst maintaining an even temperature?

5.14 Do you want to be able to change the temperature in every room depending on how you feel?

5.15 Do you want to be able to check the temperatures in all of the rooms from a central location?

5.16 Do you want to be able to simply change or set different temperatures for different time periods from one central location for all rooms?

5.17 From a central location do you want to be able to reduce the temperature in the guestroom as the situation demands (e.g. cancellation of a visit), without having to enter this room?

5.18 In your absence do you want a neighbour to be informed automatically if there are any deviations in the temperature as a result of a fault?

5.19 Do you want the customer services to be informed if there are any major disturbances?

5.20 Do you want to entrust a security service with your heating in your absence?

6 Planning and using hot water

6.1 How do you generate your hot water? From the existent heating system (summer operation?)?

6.2 Have you planned special hot water devices (gas or electric) for your requirements?

6.3 Do you plan using a solar panel for generating hot water as an energy saving measure?

6.4 Do you want to connect the washing machine and the dishwasher to the hot water network in order to save electrical energy?

6.5 Would you like the hot water temperatures in the kitchen to be different from those in the bathroom or other hand basins?

6.6 In your absence, do you want to be able to use the telephone to check that your hot water system is working properly or to make any changes?

6.7 In the case of disruptions, do you want to inform the responsible office, a security service or the customer services department?

7 Planning and using the heating system

7.1 Do you want your heating system to work in the most optimum way, i.e. using as little energy as possible?

7.2 Do you want to be able to monitor the operation of your heating system from a central location, without having to enter the boiler room?

7.3 Should any errors in the system be detected automatically and if necessary reported to your heating engineer?

7.4 Should this heating engineer have the possibility of carrying out remote diagnosis?

8 Planning and using the blinds and shutters

8.1 Should the blinds and shutters close automatically in the wind or rain?

8.2 Should the blinds close automatically if you have left the house and there is nobody else at home?

8.3 Do you want to register any manipulation of the blinds from the outside and then pass this information onto an address that is specified by you?

8.4 Do you want to program the blinds so that they move up and down as normal when the house is empty for extended periods?

8.5 Do you want to be able to check from a central location whether the blinds are fully or partially closed?

8.6 In addition to manual operation, do you also want to be able to check and adjust the blinds from a central location?

8.7 In your absence do you want to be able to check the functioning and control the blinds via the telephone?

8.8 Should any functional faults be reported centrally and if necessary reported to other sources?

9 Planning and using awnings

9.1 Do you want to have an awning over a veranda or balcony?

9.2 In addition to the usual manual operation do you also want the possibility of automatic operation so that the awning is lowered when the sunlight becomes too strong preventing the room behind from becoming overheated?

9.3 Should the awning be retracted automatically once a certain wind strength is reached or once is starts to rain?

9.4 Do you want to be able to check and control the functioning of the awning via the telephone?

9.5 Should any functional faults be reported centrally and if necessary reported to other sources?

9.6 Should it be possible to check and adjust the awnings from a central location, in addition to manual operation?

9.7 During your absence should the awnings be moved as they would during a normal day?

9.8 Do you want to be able to check whether the awning is fully or partially extended from a central location?

10 Planning and using window monitoring

10.1 Do you want to be able to check whether all the windows in the flat, cellar and on the roof are closed, or to be given an indication if any are slightly open?

10.2 Should any unauthorised attempt to open a window be registered?

10.3 Should this fact then be reported to an address specified by you?

10.4 If there is any attempt to force open a window do

you want the lights in that room to go on automatically, and at the same time all the lights in the house (flat) and garden?

10.5 Should damage to the windowpanes be monitored and reported?

10.6 In addition to manual operation, do you want to have electrical operation for the windows?

10.7 Do you want to be able to operate electrically lockable windows both manually and automatically?

10.8 Should the opening and closing of windows be adjusted to meet the weather conditions or climate and temperature conditions within the rooms?

11 Planning and using door and gate monitoring

11.1 Do you want to be able to check whether the
– house door
– garage door
– garden gate or yard gate
is closed from a central location?

11.2 Do you want to be able to see who is standing at the gate or door?

11.3 Do you want to be able to speak to these people?

11.4 Do you want to be able to illuminate the areas in front of the doors or gates whenever necessary?

11.5 Do you want to be able to open the doors and gates via a motorised mechanism?

11.6 Do you want to be able to operate these motorised doors and gates from a central location in the house?

11.7 During your absence do you want to be able to check or change the closed status of the doors and gates?

12 Planning and monitoring the supply lines

12.1 Water valves
Should the main water supply be cut off via a valve if the situation demands?
Should this main water supply be shut off in general if there is nobody at home, to avoid the possibility of water damage?
Should any inexplicable water consumption generate a warning to you or a neighbour?
After such a warning, should the main stopcock be cut off and this status clearly displayed or reported to another source?

12.2 Oil valves
Do you want to be able to shut off the oil supply either manually or automatically should the situation demand, e.g. in dangerous circumstances?
For safety reasons, do you want to be able to cut off the oil supply when absent from the house, e.g. during vacations.

12.3 Do you want to be able to cut off the gas supply at the point where the pipe enters the house, either manually or automatically?

12.4 Do you want the gas supply to be cut off whenever the house is empty?

12.5 Should the gas supply be cut off when any unusual gas consumption is detected?

12.6 Do you want to install a sensor in one of the rooms to detect gas leaks, and do you want to automatically shut off the gas if this sensor is triggered?

13 Planning various meters

13.1 Do you want to be able to check how much energy each of your appliances is using thereby helping you save energy and costs?

13.2 How do you feel about being able to check how much money you are spending on electricity every day, week or month?

13.3 What do you think of the possibility of being provided with advice on saving energy when you are using a device or being told that there is a better tariff available?

13.4 As you know, water is becoming more expensive both for drinking and sewage.
Wouldn't it be useful to be able to check your water consumption at any time on a daily or monthly basis, and to work out the equivalent costs?

13.5 Wouldn't it be useful to be able to check the oil consumption at any time without having to enter the cellar to look at the oil tank?

13.6 Is it important to you to be able to compare oil consumption with that of the previous year for example, in order to be able to assess whether any implemented measures, e.g. heat insulation, have been effective?

13.7 Would it be interesting for you to know how high the gas consumption is, in order to be able to decide upon gas cooking and/or heating?

13.8 If you are on the (long-distance) heating network, would you like to be able to check that everything is in full working order at any time and to see how the costs are increasing? All necessary information can be viewed on the central operating and indication panel.

13.9 How do you feel about the possibility of arranging for the various meter readings to be transmitted via the telephone line at a time appointed by you, thereby eliminating the need for a visit to the house?

13.10 Do you want to be able to detect and read the length of the operating periods of the various devices, how often they have been switched on and off?

13.11 Do you want to be promptly notified once a particular checking interval has been reached?

14 Planning and using connections for household appliances

14.1 What appliances do you intend buying in the future?

14.2 Do you have a large kitchen, which is used not only for cooking but also as a breakfast room/living area?

14.3 Apart from the cooker, extractor fan, fridge and dishwasher, do you also plan to install the washing machine and dryer in the kitchen?

14.4 Or will they be placed in a separate "washroom" or utility room?

14.5 Would you like to be able to use your appliances in special situations without having to always look up the instruction booklet?

14.6 What do you think about tips, tricks and advice that allow you to help yourself instead of having to splash out on costly customer services?

14.7 Would you like to use your appliances at the times you want whilst exploiting the best tariff times?

14.8 Would you like to be informed of the status of your appliances at all times, including that of the washing machine in the cellar, for example, regardless of whether you are in the kitchen or bedroom?

14.9 Would you like to be able to check the status of your appliances, and to switch them on and off via the telephone?

14.10 Would you like to use water that has been warmed via a solar panel in your washing machine or dishwater, which not only saves money but time too?

14.11 What do you feel about always being provided with useful information on the correct storage of food in your fridge?

15 Planning and using exterior systems

15.1 Do you want to have lighting in the garden, which you can adjust according to the atmosphere or occasion?

15.2 Do you want to automatically illuminate the path between the house and garden gate whenever anybody is using it?

15.3 Do you want to switch the garden lights on and off according to a specific program?

15.4 Do you want to install a sprinkler system in the garden?

15.5 Should this sprinkler system be switched on and off according to a specific time program?

15.6 Should the sprinkler system operate in accordance with the level of humidity?

15.7 Should it be possible to operate the sprinkler system depending on the various plants?

15.8 If you were away from the house would you like to be able to switch the sprinkler system on and off via the telephone?

15.9 Do you want to operate the fountain in the garden depending on the time or weather?

15.10 How would you feel about being able to enquire about the weather from a central location in the home? For example, to find out if it is raining and how hard, whether the air pressure has changed and how high it is, which direction the wind is blowing and how strongly?
What is the outside temperature and what's the trend?
Do you want to be able to use these parameters to control the necessary equipment?

15.11 Do you want to be able to operate the circulating pump of your garden pond exactly as you want, including the possibility of remote control?

15.12 Should the status of the pump filter be monitored and reported?

16 Planning and using security equipment

16.1 Would you like to have any unwanted activity in front of your house registered and displayed?

16.2 In addition to this message would you like to switch on an outside light in the area where the disturbance is occurring?

16.3 Would you like to have a display in the entrance area to your flat where you can check that everything is the same as you left it or whether there have been any changes in your absence?

16.4 On this display would you also like to be able to enquire about the status of other entrances (closed status of the windows, garage door, garden gate etc.)?

16.5 Should the reaction of security equipment be transmitted to an address that has been specified by you?

16.6 Do you want to be able to check the status of your security equipment via the telephone?

16.7 Do you want to be informed, via a pager for example, whenever something important changes in your home?

16.8 Do you want to be able to trigger an emergency call if you find yourself in a difficult situation?

16.9 Should this call be forwarded to another family member, a neighbour or an emergency service?

16.10 Should perhaps a doctor be informed?

16.11 Do you want to simulate occupancy? (In your absence the control simulates the illusion of an occupied house).

17 Planning and using a central operating and control unit

17.1 Do you know that with a special centralised operating and control unit you can also watch TV, and with that have a second TV in the kitchen?

17.2 Would you also like to be able to listen to CDs there?

17.3 Would you like to use it to make easy telephone calls by selecting the name and address from a telephone book in plain text and then dialling the number with a single keystroke?

17.4 Would you like all members of your family to be able to use this central operating and control unit?

17.5 Would you like to ensure that certain settings can only be made or changed by certain people?

17.6 Would you like to be able to initiate actions by simply touching the screen?

17.7 Without having to attend a PC course, would you like to be able to operate a system, in which all devices connected to it are controlled in the same way according to the same rules?

17.8 Would you also like to be able to send and receive fax messages on this machine?

17.9 Would you like to be able to read tips and advice on your devices without having to look up the individual instruction manuals?

17.10 Would you like to know with certainty that you do not need to buy everything at once, that you can in fact expand your system bit by bit as and when you want?

17.11 Do you want to install the unit in the hallway, in the kitchen, near the cooker or in the living room, or would you like several units distributed about the house?

Appendix B Terms and definitions

This summary of common and useful terms has been put together to ease understanding of building systems engineering, upon its introduction to the market. The definitions of technical terms and abbreviations refer to *EIB*, but also to more general connections and will be helpful to electricians, manufacturers, planners and the trade in general.
Explanations are not given in a purely scientific manner; we have tried to give descriptions in layman terms. With this objective in mind, we have listed the universal terms that crop up in connection with building systems engineering – the list however should only be used in this context.
In the creation of this list we have drawn on many dictionaries that already exist in the field of data technology. In some cases, the definitions may differ from those generally used in the field of telecommunication.
Any suggestions with regard to changing the wording or the inclusion of terms not already listed will be gratefully accepted.

a.m.	Ante meridiem; before midday
a/b interface	Two-wire connection for the transmission of signals with analogue terminals (telephone, answering machine, modem, etc.).
A/D converter	Converts an analogue signal to a digital signal, see DIN 19226, Appendix D
Absence of electrical interaction/ feedback	– Errors in devices connected to the *EIB* installation bus remain limited for those with absence of electrical feedback. – Errors, e.g. short circuits in an electrical segment, remain limited in these segments.
Absence of interaction/ feedback	Electrical and/or logical decoupling of bus devices and/or electrical segments or lines within a compound system. See absence of electrical interaction / feedback See absence of logical interaction / feedback See absence of physical interaction / feedback
Absence of logical interaction/ feedback	The decoupling of two subsystems (e.g. lines) within a system to ensure that the subsystems cannot influence each other by the exchange of telegrams. Example: One line is used for light control and another for monitoring/reporting. Whenever a danger message occurs, it is possible for example to switch on the light. When the light is switched on however, a danger message should not be wrongly generated.

Absence of physical interaction/ feedback	See absence of electrical interaction / feedback.
AC	Area Coupler
Access	Method of reaching a specific place in a memory medium or type of organisation which establishes the sequence in which network partners can communicate with one another, see CSMA.
Access authorisation	Authorisation to use the system after entering a password or PIN.
Access lighting	Limited lighting for pedestrians
Account	User account that is used to calculate the cost of network services
ACK	Acknowledge
Acknowledgement	Positive confirmation of reception. With the *EIB* installation bus it is included in the acknowledgement field of the telegram.
Acoustic coupler	Device to link a computer to the telephone network via a telephone handset. Allows data transmission to other computers by converting digital signals into acoustic signals and vice versa.
Active conductor	Live wire
Actuators	*EIB* bus devices, which receive information, process it and trigger actions.

	Examples: – Switching actuator, binary output – Dimming actuator, analogue output – Display, display unit
ADC	Analogue Digital Converter
Address	Identification of bus devices, e.g. in the form of a sequential number – Telegram – Target address – Source address – Physical address – Group address
Address field	Part of the *EIB* telegram. Contains the source and target addresses.
Address manager	Hardware or software module for the automatic, dynamic allocation and management of group addresses in an *EIB* system with plug-and-play components.
Address table	See equipment list and function list
Addressing	Procedure with which the bus device is assigned a physical address and/or several group addresses.
Adjacency	See separation
AFL	Application-specific function bar, see function bar
Alarm configuration	The selection of sensors (e.g. closed status sensors and movement detectors) and signal transmitters to be analysed in an alarm situation.
Alarm scenario	Alarm configuration saved on the Home-Assistant.
Alarm, "local"	Visual and audible alarm to warn the occupants and scare any intruders.
Alarm, "silent"	Alarm message transmitted to the outside world via an automatic dialling and announcement device.
Alphanumeric characters	A set of characters containing letters and special characters in addition to numbers.
Alternative mark	Method of bit coding, used with inversion, AMI, see DDB
AM	See amplitude modulation
Amplitude keying	With amplitude keying, the information to be transmitted is superimposed on the frequency of a carrier. For example, if the information to be transmitted is digital, the carrier is switched ON with a logical 1 and switched OFF with a logical 0.
Amplitude modulation	Modulation method in which the carrier is modified in the rhythm of the signals to be transmitted.
Analogue value	Value which can take on an infinite number of intermediate values between a minimum and maximum, e.g. temperature, brightness.
ANSI	American National Standard Institute

Answering machine	Device which outputs saved messages when called and which automatically records incoming messages.
APC	Application Controller
APCI	Application Layer Protocol Control Information
API	Application Programming Interface; Application Interface of software modules (here the HomeAssistant in particular)
Appliance Interface	Interface between the *EIB* and the bus compatible devices (household appliances), consisting of the *EIB* bus coupling unit and the communications interface.
APM	Advanced Power Management; power saving circuitry for computers (Intel and Microsoft)
Application	Solution for a specific set of tasks within the framework of the *EIB* system
Application controller	Control device connected to the bus for application-specific links and processes. Not necessary for simple applications.
Application event	Event that is defined and solvable by the application itself
Application module	Also used to describe the application-specific hardware and/or user interface of a bus device.

Application program	Computer program with fixed tasks
Application software	Program for a set of defined additional functions.
Application-specific function bar	See function bar
Area	Via a main line it is possible to combine several bus lines to form an area using line couplers.
Area coupler	*EIB* system component. Connects a main line with the area line.
Area line	Connects several area couplers allowing data to be exchanged within the specified area.
ARI	Air-conditioning and Refrigeration Institute
ARU	Audio Response Unit
ASCII	A digital 7-bit code, usually referred to as ASCII characters
ASHRAE	American Society of Heating, Refrigeration and Air-conditioning Engineers
Asynchronous transmission	Transmission method in which the transmitter and receiver are only synchronised after the transmission of a special signal. Used with the *EIB* installation bus.

Audio-CD	Compact disk for music and voice reproduction.
Authorisation level	Allocation of the use of functions within a system for specific people.
Auxiliary power supply	Additional power supply for certain bus devices and sensors; additional to the power supply from the *EIB*.
Awning	Retractable sun protection made of firm material for windows, balconies, etc.
Backbone bus	Superordinate bus, which is used for example to connect several sub-buses. Can be constructed in the same way as a sub-bus, or be much more powerful.
BACnet	Communication protocol for building systems automation (ANSI standard, under revision as an ISO standard).
Band stop	Component in *EIB* powerline to physically limit the powerline transmission.
Bandwidth	In communication technology: The frequency band between two threshold frequencies, in which the voltage or current transmission drops by 3 dB. The bigger the bandwidth the more information can be transmitted per time unit.
BAPT	German Federal Office for Postal Services and Telecommunication
Base system	Basic module of a software program

Basic components	Term for the equipment which forms the basic requirements for communication between the bus devices, independent of application, e.g. power supply. See system components.
Basis tables	Data on people, companies, addresses or telephone numbers.
Baud rate	Dimension for the speed of data transmission, e.g. in bits per second.
BC	See broadcast
BCD	Binary Coded Decimal
BCI	Broadcast Interference
BCU	Bus Coupling Unit
BD	Bus Device
Bi-directional	In transmission technology means that signal flow is possible in both directions.
Binary system	System that can only take on two defined states.
BIOS	Basic Input Output System; software routines for the fundamental system operations of a computer.
Bit	Binary digit; binary unit either "1" or "0".
Bit coding	Adapts digital signals for transmission on the line. There are various bit codes (with reference to a given binary signal), where

	"voltage" and "no voltage" or "current " and "no current" represent the two possible states.
Bit error	Falsification of a binary character during transmission (from "0" to "1" or vice versa).
Bit error rate	Ratio of faulty bits to total number of bits during a transmission.
Bit rate	Bit frequency or bit speed. The speed with which information is transmitted, measured in bit/time unit.
Bitmap	Definition of the picture elements of a graphical representation in the computers screen memory.
Blind	Moving shutter composed of overlapping slats for windows, doors etc.
Blind control	Program to control blinds.
Block lock	Electromechanical safety lock with priming device for the alarm system, sabotage-proof.
Blocking effect of the band stop	Created when the band stop is arranged properly within the system.
BNC	Barrel Nut Connector; coaxial connector for high frequency connections of all types, such as for example, data network connections, antenna connections etc.
Boot process	Start-up of a computer system.

Breakthrough message	Display of highest priority messages on the screen, which are superimposed over the current contents.
Bridge	Connection of the same type of network with possibly differing transmission media (e.g. twisted pair and fibre-optic cables). A bridge converts among other things, the level or physical sizes, regulates access to the transmission medium and deals with transmission errors. It has no intelligence; such as for example that which is needed for the conversion of different transmission formats, see gateway.
Brightness sensor	Optoelectronic sensor which, depending on the sensitivity and mechanical design, can be used for internal and external areas.
Broadband transmission	Divides the bandwidth of the transmission medium into frequency bands. Certain tasks can then be assigned to the individual frequency bands, e.g. transmitting or receiving. Greater technical complexity when compared with baseband transmission.
Broadcast	Message from an active bus device sent to all other bus devices.
Browse	Turn the pages.
Browser	Auxiliary program to browse within files and data networks.
BSI	British Standards Institution

BSI	German Federal Office for Security in Information Technology
Btx	See screen text; see DATEX J, T-Online.
Btx decoder	Software to make the data received via modem visible on the screen.
Building disciplines	Represent specific works in the field of construction, i.e. the services provided by different, suitably qualified, contractors such as electrical installation, plumbing etc. Application area or domain.
Building systems automation	Networked equipment for the control and automation of functions within a building.
Building systems control	Previously used term to describe the central display, operation and reporting of operational systems in buildings. Section of the more general building systems automation.
Building systems engineering	Networking of system components and bus devices via the *EIB* installation bus to form a system tuned into the electrical installation, which guarantees the functions and processes as well as system links within a building. The intelligence is distributed among the bus devices, information is exchanged directly between the bus devices. See HBES.
Built-in unit	A bus device integrated into a housing.

BUS	Binary Unit System; a data exchange line to which many devices can be connected allowing them to communicate with one another ("omnibus line").
Bus access method	Method which each individual bus device uses to access the bus for the purpose of exchanging information (not physical, only organisational), see CSMA/CA, CSMA/CD.
Bus connection terminal	Is the same as a bus terminal, connects bus devices with the bus line.
Bus coupling unit, BCU	Forms the mechanical, electrical and data technical coupling between the bus line and the application module/terminal. May also include application software.
Bus device, BD	Any device that is connected to the bus line and contains at least one bus coupling unit.
Bus line	Line for transmitting data with the *EIB* installation bus, twisted pair for connecting the bus devices.
Bus rail	Top hat rail according to DIN EN 50022, 35x7.5 with inlaid data rail.
Bus topology	See topology.
Bus utilisation	A measure for the relative temporal occupancy of the bus line with telegrams. Specified as a %.

Busy	Occupied; acknowledgement signal for data transmissions.
Button	Also as a graphical symbol on the user interface.
Byte	A data word of 8 bits.
BZT	German Federal Office for Telecommunications Certification
Cache memory	– Fast buffer memory as a section of the main memory (RAM), which increases the speed of programs as it avoids having to access the memory drives (hard disk, disk and CD-ROM drives) as often. – Stand-alone hardware module (second level cache) with a particularly fast memory, which optimises microprocessor access on the main memory.
CAPI	– Communication Application Programming Interface, transmission standard for fax polling in Europe. – Common ISDN API; standard software interface for ISDN operation.
Carrier	To transmit information via radio, it must be put into a suitable frequency band. This is achieved by superimposing the information onto a carrier with the desired frequency.
CAS	Communication Application Standard; transmission standard for fax polling (Intel).

CASE	Computer Aided Software Engineering.
CATV	Community Antenna Television
CCIR	International Consultative Committee for Radio, see ITU
CCITT	International Consultative Committee for Telegraph and Telephone, see ITU
CD	Compact Disc
CDI (also CD-IV)	Compact Disc Interactive; interactive digital audio-video CD
CD-ROM	Compact disc as an interchangeable data storage medium in a computer system, read-only.
CE certification	Statement of conformity from the manufacturer. The products adhere to the corresponding EC guidelines, e.g. EMC regulations.
CENELEC	European Committee for Electrotechnical Standardization. European standards passed by CENELEC must be accepted as the national standard by all member countries in their original format.
Centralised system	System with a controlling centre. In this type of system, the control centre controls the exchange of information and device access to the bus.
CEPT	European Conference for the Administration of Postal and Telecommunication

	Services. Committee for suggestions regarding new communication services and standardisation of the implemented methods of data transmission.
Channel	General term describing the transmission path for signals. It firstly indicates the actual purpose, e.g. data channel, television channel, etc. Further information then determines the transmission medium, e.g. wire channels, fibre-optic channels or radio channels. The physical features are also mentioned, e.g. carrier frequency channel or time channel. A transmission channel only ever knows one direction. With devices, this term is also used to describe individual equipment parts in more detail, e.g. 4-way switching actuator,channel 1 = relay contact 1, channel 2 = relay contact 2, etc.
Character	Element of a set, which can exist in the usual graphical form (letter, number, etc.) or in coded form (group of binary characters). Combination of several bits to form a unit understood by the system. With the *EIB* installation bus it consists of 11 bits: start bit, 8 data bits, parity bit, stop bit.
Characteristic method	See load characteristic
Check bit	See parity bit

Checkback signal	Message confirming that an item of information (command) has been understood and/or processed and/or executed and the relevant resource has changed its status. There are different types of checkback signals, which may need to be specified in greater detail. See confirmation of reception, acknowledgement.
Checklist	Aid to systematic questioning.
Checksum	Additional data within a telegram, in order to detect any transmission errors.
Checksum field	Part of the *EIB* installation bus telegram.
Child-proof	Systems that prevent children gaining access to them.
Chip	Semiconductor crystal; integrated electronic circuit on a semiconductor crystal
Choke	Prevents any short-circuiting of the telegrams on the bus line due to the power supply.
City call	Radio calling system, which transmits signals in one or more zones (tones, numbers or texts), see pager.
Closed status sensor	Magnetic contact on windows and doors to monitor the closed status.
Closed-loop control	Process of bringing a true value in line with an adjustable set point and maintaining it, taking into consideration disturbanc-

	es, e.g. regulating the room temperature by thermostat valves on the radiator. Also referred to as feedback control.
CNG	Tone signal for fax code (1000 Hz 500 ms, 0 Hz 3 ms).
CoC	Centre of Competence
Coding	Agreed representation of information to be transmitted, e.g. the representation of a character by voltage or current. See bit coding.
Collision	Occurs when two or more transmitters access the bus simultaneously. With the EIB installation bus there is a mechanism to avoid collisions. See CSMA/CD
Colour depth	Differentiation of the colour difference on the screen; depending on the method up to 16.7 million colours (TrueColor).
Command	Information contained in the telegram that orders the triggering of an actuator, e.g. ON/OFF, UP/DOWN, COLD/WARM.
Common system manager	Contact person for a comprehensive *EIB* system who is common to all building disciplines, e.g. gas, electricity etc.
Communication network	Facilitates the transmission of data, voice, text or pictures between the devices.
Communication system	– System for the transmission of information between two or more devices

	– Representation of the connection of various system components, i.e. the communication between applications as well as subsystems and devices (hardware and virtual devices).
Communications socket	Interface between the *EIB* and the bus compatible devices (household appliances), consisting of the *EIB* bus coupling unit and the communications interface.
Compatibility	The ability of devices from one or several manufacturers to be operated in conjunction with other devices within a bus system, without exerting a negative influence on one another. Example: Within a system, sensors from manufacturer A control actuators from manufacturer A and sensors from manufacturer B control actuators from manufacturer B. Devices from manufacturer A however must not be used directly with devices from manufacturer B. See interoperability.
Components	See basic components, system components.
Computer	An electronic computing machine that is controlled by programs, preferably with digital data processing. In special cases analogue computers are used for measuring purposes.
ComSys	Communication System

Configuration manager	Manages the configuration status as well as the functionality of the equipment available in the HomeAssistant.
Configure	Set the parameters of a computer system, a peripheral device or a program
Confirmation (of reception)	Reply to confirm the reception of faultless or faulty information. See ACK, acknowledgement, checkback signal
Console	– Control panel – Input and output device of computer systems, see terminal (keyboard/screen, keyboard/printer, touchscreen, etc.)
Context-sensitive	Information specific to the situation.
Control centre operation	Method of using the *EIB powerline* controller.
Control field	Part of an *EIB* telegram . Contains system information such as for example, access priority.
CoRes	Concrete Resource; hardware components of the HomeAssistant (modem, loudspeaker, etc.), which are stored as an abstraction of the physical device in the HAL (Hardware Abstraction Layer).
Correlative pattern comparison technology	Correlation is a dimension for statistical similarity. With *EIB powerline*, bit decisions are made on the basis of correlation. This technology is very robust with regard to disturbance.

Coupler	See area coupler, line coupler.
Coupling module	See bus coupling unit.
CPU	Central Processing Unit; central control of a computer with microprocessor
Cross-reference list	See equipment list, function list.
CRT	Cathode Ray Tube
CSMA	Carrier Sense Multiple Access; a multiple access method in local data networks, which by virtue of a special process (e.g. CSMA/CA) prevents any collisions during simultaneous transmissions.
CSMA/CA	Carrier Sense Multiple Access with Collision Avoidance
CSMA/CD	Carrier Sense Multiple Access with Collision Detection; denotes a bus access method, standardised according to ISO 8802-3. Every bus device listens in on the bus and only accesses the bus once it detects that there is no data traffic. When sending a message, it simultaneously listens in to ensure that no other bus device has begun to transmit at the same time. If a collision is detected both devices withdraw. Random generators in the bus devices control the time until the next bus access, so that there is only a very slight possibility that both bus devices will begin their transmissions

	again at the same time. With high bus traffic, the net data throughput is greatly reduced by the associated time delays.
CT 1+	Analogue transmission standard for cordless phones, not protected against bugging.
CT 2	Digital transmission standard for cordless phones, limited protection against bugging
Cursor key	Key for controlling the position of the cursor.
D/A converter	Converts a digital signal into an analogue signal (see DIN 19226, Appendix D).
D1	The German Telecom radio telephone network.
D2	Radio telephone network from the Mannesmann Mobilfunk company.
D2B	Alternative abbreviation for DDB, Domestic Digital Bus
DAC	Digital-to-Analogue Converter
Daily profile	Smallest adjustable unit for time-temperature profiles.
DAL	Data Access Library; with regard to ETS, access functions for reading the database are provided.

Data	All information elements that are exchanged via the transmission paths and processed in communication devices.
Data circuit-terminating equipment, DCE	Converts the signals from the data terminal into a form suitable for transmission, and converts the arriving signals into a form suitable for the terminals. A modem is a typical device for adapting signals in an analogue network such as the telephone network.
Data field	Part of the telegram with *EIB* technology that contains the useful data.
Data interface	Term used in building systems engineering for a bus device with a V24/RS 232 interface. Bus devices can for example be programmed via the data interface.
Data management module	Module for the management of data in the HomeAssistant.
Data rail	Conductive plate for the bus used in building systems engineering, inserted into the DIN rail. See bus rail.
Data rail connector	Facilitates the connection of the bus lines to the data rail.
Data service	Supply and management of data transmission possibilities in large networks (e.g. Btx, Datex J etc. by the German Telecom).
Data sink	Data receiver.

Data source	Data transmitter.
Data terminal equipment, DTE	General term for all devices transmitting and/or receiving data, i.e. data terminals, data concentrators and data processing systems. This also includes telecontrol terminal equipment.
Database	A collection of data by the systematic storage of related data; search method for the fast and secure retrieval of individual data items; access possible via different search mechanisms. See product database.
Datex	Various data transmission services of the German Telecom.
Datex J	Development of Btx.
Datex P	Data transmission via addressed data packages according to the X.25 protocol.
dB	Decibel; logarithmic dimension for the ratio of two voltages, currents or quantities, including optical quantities.
DCF 77	Time transmitter located in Mainflingen (D), carrier frequency 77.5 kHz, approx. range 1500 km.
DCI	Display Control Interface (Intel and Microsoft), real-time video representation without loading the CPU.
DDB	Domestic Digital Bus

Debugging	Troubleshooting and error removal in hardware and software; test.
Decentralised bus access method	All bus devices can access the data bus.
Decentralised system	System that manages without a control centre. In such systems the bus devices themselves regulate the process of exchanging information and bus access.
DECT standard	Digital European Cordless Telephone Standard, protected against bugging.
Device connection box	Installation material
Digital	Representation of information with discrete (staged) values.
Dimmer	Device for the continuous variation of the brightness of lights.
DIN	German Institute for Standardization.
DIN rail	Data rail model.
DIN rail mounted devices	Devices according to DIN 43 880 to clip on to the DIN rail according to DIN EN 50022.
Directory	A listing of documents or files.
Diskette, disk	Disk shaped storage medium, easily interchangeable and suitable for data exchange; currently available in 3.5" format.

Display unit	– Device for the alphanumeric or graphical display of information, – Liquid crystal mini-display as an *EIB* device with the following functions: alphanumeric display, blinking and signal tone as well as an acknowledgement key, see info display
Distortion	Change in the original form of a signal during transport through a circuit or line.
DKE	German electrotechnical commission in DIN and VDE.
DLL	Dynamic Link Library; software library which in the course of a program once called up is loaded into the memory and after execution removed again.
Door camera	Visual extension of the intercom system by a simple TV camera at the entrance door, garden gate.
Door contact	Contact to monitor the closed status of the door, see magnetic contact.
Door intercom	Device allowing the user to enquire about the status of the door via the telephone or to open the door from a distance.
Double word	A 32 bit data word.
Download	The transfer of data from a large computer into a smaller one, e.g. a microcomputer; updating virtual memory resistant programs (firmware in EEPROMs or Flash-ROMs); transferring data from a third party

	computer into your own computer.
DR	Choke
Drag-and-drop	To move a screen element from one position to another with the mouse cursor.
Driver	Sub-program for controlling devices (e.g. printers) or executing other programs.
DSP	Digital Signal Processing; digital processing of analogue signals (after AD conversion at the circuit input and if necessary DA conversion at the circuit output). Used for example in measuring methods, control technology, filters, displays, modulators, demodulators, etc.
DTMF	Dual Tone Multiple Frequency; dialling procedure in which after every keystroke, the additive mixed product is generated from two frequencies of a matrix. See MFV
Dual system	Number system in base 2 represented by the numbers 0 and 1.
Duplex	There are basically three ways of using a transmission path: – One-way traffic (simplex, i.e. information flows in one direction only, e.g. point-to-point radio). – Exchange traffic (half-duplex, i.e. transmission on the same path alternates in direction, e.g. telex network). – Two-way traffic (duplex or full duplex, i.e. simultaneous transmission in both

directions, e.g. telephone network).

Duplex operation	Simultaneous functioning of two data transmission and reception devices in separate locations (bi-directional communication, full duplex).
Dynamic scenario	Program to operate lights and blinds in variable time sequences.
Echo	(Unwanted) signal caused by reflection that travels back to the transmitter.
EDH	Enhanced Device Handling; a logical link for handling routines with separate data libraries.
Editor	Program which supports the entry, output, modification and saving of data (e.g. texts and programs).
EDP	Electronic Data Processing, see computer.
EEPROM	Electrically Erasable Programmable Read Only Memory
EHSA	European Home Systems Association
EIA	Electronics Industries Association, standards committee in the USA.
EIB	European Installation Bus Denoted by the trademark EIB. A decentralised, event-controlled, electrical installation bus for switching, reporting, controlling, monitoring and displaying in functional and residential buildings. Follows DIN EN 50 090 or DIN V VDE 0829.
EIB Tool Software (ETS)	See ETS
EIBA	European Installation Bus Association; organisation for all companies developing and manufacturing *EIB* products.
EIBA certification	Confirmation from EIBA that the product meets the requirements.
EIBA trademark	The EIBA logo EIB
EIS	*EIB* Interworking Standard.
Electrical interference	See electromagnetic compatibility.
Electrical segment	Smallest independent unit within the topology of a bus system/an *EIB* installation. An electrical segment is supplied by at least one power supply with choke.
e-mail	Electronic mail transmitted within a computer network or by remote data transmission.
EMC	Electromagnetic Compatibility; property of electronic and electrical systems, which work perfectly under certain conditions and do not cause mutual interference.
EMC protection management	Measures to comply to the EMC guidelines.

Emergency call	Message with the highest priority in the message system; can be reported to the police, fire brigade etc. See breakthrough message
EMI	Electromagnetic Interference
Energy management	An application for cost management, which takes into account the energy tariffs.
EPIS	*EIB* Product Interworking Standard
EPROM	Erasable Programmable Read Only Memory
Equipment level	Definition of the design of an electrical installation involving up to 3 stars.
Equipment list	List of devices connected to the *EIB* installation bus. Created during the project design stage. The equipment list contains: – Physical address – Device type – Manufacturer – Installation site – Group address(es) – Remarks See function list.
Error detection	Method of detecting transmission errors. See parity bit, check sum
Escalation	See message escalation.
ESD	Electrostatic Discharge

ESPRIT	See European Strategic Programme for Research in Information Technology.
ETE	*EIB* Tool Environment; software library for basic ETS functions.
Ethernet	A LAN (Local Area Network) with a bus structure, access to which is achieved with CSMA/CD. The maximum transmission rate is equal to 10 Mbit/s.
ETS	*EIB* Tool Software; software for the design and commissioning of *EIB* products.
ETSI European Installation Bus Association	European Telecommunication Standard Institute See EIBA
Eurosignal	Radio paging system
Event manager	Analyser of events that can arise in the VALs.
Event-controlled information exchange	Information that is passed on in specific situations.
External camera	Simple TV camera to monitor the outside area or to check visitors at the entrance door (element of the door intercom system, see door camera).
External protection	Involves the checking of all windows and doors etc. for their closed status by suitable sensors, as well as the checking of outside areas by movement detectors.

External security	Positive status check of all sensors and actuators to guarantee external security.
Extra-low voltage	Voltage ≤ 25 V AC or ≤ 60 V DC for protection against direct or indirect contact. See FELV, PELV, SELV.
Fan in	Standardised value of the input current. (Definition of the value however is arbitrary).
Fan out	Specifies how many inputs can be controlled from an output. Example: If fan out = 8, then 8 inputs can be controlled when fan in = 1 or 4 inputs when fan in = 2.
Fax	Transmission of graphical information via the telephone network.
Fax polling	Communication between fax machines via remote polling; reception of prepared messages after selecting the polling function.
Fax-on-demand	Polling of prepared fax messages via the telephone; after agreeing the transmission on the telephone, operation switches over to fax mode.
FELV	See Functional Extra Low Voltage
Fibre-optic cable	Medium for the transmission of optical signals.
FIFO	First In First Out; sequence for data processing, the first accepted into memory is the first thrown out again.
File	Set of data belonging together with an own name.
Filter table	Table that can be created by the design and commissioning program. It is loaded into the coupler. It specifies which telegrams will be passed on or blocked by the coupler. See coupler.
Firmware	System and application programs that are permanently stored in the computer memory (ROM). See download.
Flag	Character indicating status.
Flash memory (Flash-ROM)	Fast, integrated mass storage with read and write properties (similar to EEPROM). Information is retained when the power supply is cut off and can be deleted by short current pulses (flashes) without additional external devices.
Flat square monitor	Computer screen with very slight camber.
Floor channel	Type of channel for laying cables.
Floppy disk	Magnetic disk.
Flow diagram	Graphical representation of the sequence of steps in an operational process.

Flush-mounted device	Bus devices that are installed in the wall, flush to the surface.
FM	Frequency modulation
Font	Letter style, character set
Frame	Within data transmission also used to describe a bit group.
Frame grabber	Device to produce single pictures from a video sequence with the possibility of after-editing.
Free field	Ideal transmission area without interfering or reflective influences, e.g. *EIB* radio.
Freeware	Free software, where the developer retains the copyright.
Frequency band	Section of a frequency spectrum.
Frequency division multiplexing	Simultaneous transmission of different information on a transmission medium with the aid of various frequencies.
Frequency keying	With frequency keying, the information to be transmitted is superimposed with the frequency of a carrier. For example, if the information to be transmitted is digital, the frequency of the carrier is boosted by a certain amount with a logic 1 and reduced by that amount with a logic 0.
Frequency response (amplitudes)	Signal height in relation to the frequency; dimension for the bandwidth of a transmission system.

Frost protection	Minimal heating program with a fixed minimum temperature.
FSK	Frequency Shift Keying; special frequency modulation method involving the keying of two or more frequencies.
FTP	File Transfer Protocol; protocol for the transmission of files between computers.
Full duplex	See duplex.
Function bar, application specific (AFL)	The application-specific function bar is an operating element group in the lower screen border of the HomeAssistant. It makes it easier for the user to find his way around the application and entire system.
Function groups	Combination of several functions to form one unit.
Function list	Describes the interaction between actuators and sensors. The function list contains: – Group address – Allocated sensor – Allocated actuator – Remarks See equipment list.
Functional building	Building for commercial usage.
Functional Extra Low Voltage, FELV	Low voltage without protective separation according to DIN VDE 0100 part 410/11.83 section 4.3.3 Modification draft A2/8.88 Future: Low voltage with earthed electric

	circuit without protective separation; for functional reasons additional measures are needed against direct and indirect contact.
Functions	Functions generally describe the connection between cause and effect, between input value and output value or sensor and actuator. The *EIB* system offers the following functions: – Switching – Controlling – Regulating – Reporting – Measuring – Monitoring
Gateway	Connection element between different bus systems or networks (translation of different protocols).
Glass breakage sensor	Sensor to monitor glass panes in windows and doors, e.g. by interrupting a closed circuit current or by noise detection.
Glossary	Index of words with descriptions.
GMT	Greenwich Mean Time
GND	Earth (Ground US)
GPS	Global Positioning System; global satellite navigation system based on radio.
Green mode	Energy saving function in a PC which involves switching off the monitor, switching off the drives, decreasing the clock rate etc., see APM
Group address	Address which allows several receivers to be contacted with a telegram. These form a group. The group address is a function-related address. In ETS 1 it is represented in two levels with main and sub groups. With ETS 2 it can be represented in either 2 or 3 levels with main, middle and sub groups.
GSM	Global System for Mobile Communications; international transmission standard for mobile radio.
GST	Building systems engineering
HAL	Hardware Abstraction Layer; the abstraction of *EIB* hardware (concrete resources) is determined in this level.
Half-duplex	See duplex.
Halogen-free line	Special bus line.
Handshaking	– Co-operation between two computers via the reciprocal exchange of data, always after acknowledgement – Exchange of data between two interfaces for the purpose of mutual control.
Handy	Colloquial term for mobile phone
Hard disk	Disk shaped, magnetic storage medium in a hard drive or in the form of a removable disk memory.

Hardware	All mechanical components and devices of a computer system.
HBES	Home and Building Electronic Systems
Header line	The header line in the upper screen border of the HomeAssistant (with integrated status line) is a helpful aid to the user. It permanently displays the name of the application or operating mask. See status line.
Heating program	Temporal sequence of daily profiles.
Heating program cycle	Cyclic repetition of daily profiles.
Help system	On-line support system, e.g. for the users of a HomeAssistant.
Help text	Advice and tips in the form of texts that can be called up during running programs.
Home banking	Carrying out bank business from a home PC.
Home office	Screen workplace in your own home, on-line connection with your employer
Home shopping	Carrying out your shopping from a home-based PC.
HomeAssistant	Software package, see chapter 5
HomeAssistant Tool Software (HTS)	Integrates the HomeAssistant into an *EIB* system configured with ETS 2.

Hook detection	Detection of whether the telephone receiver is on the hook or not, see hook switch.
Hook switch	Cradle switch.
Host computer	Main computer to which other lower order computers or controls are connected.
Hotline	Service centre for emergencies, contacted via telephone or fax, currently free, 24-hour operation.
Household systems automation	Range of tasks as for building systems automation but with regard to the home or living areas.
HTML	Hypertext Markup Language; formal language for the creation of text that contains so-called hyperlinks (formatting language for documents). HTML allows the integration of texts, pictures and sounds in hypertext documents.
HTTP	Hypertext Transmission Protocol; transmission protocol in the Internet.
Hyperlink	Connections in a networked, hierarchy-free system which make information from different types of media accessible. Hyperlinks are used for example to guide the user through a help system with text, graphics, sound and video.
Hypertext	A networked text system, in which additional information can be called up as needed via a means of highlighting (or markings and inserted graphics).

Icon	Symbol.
ID	Identification
IEC	International Electrotechnical Commission
Impedance	Amount of electrical resistance of the 230/400 V supply network. With *EIB powerline* systems this is generally dependent on frequency and location. A low impedance dampens *EIB powerline* transmissions.
Increment	Increase by a specific amount
Incremental	Changing in defined steps…
Index	Directory of names or objects, register
Indication system	System module of the HomeAssistant for the generation of messages.
Inductive disturbance	Undesired transmission of a signal from one data transmission path to a neighbouring path (by coupling of an electric, optical sort etc.)
Info display	See display unit, mini display
Information	General term for every type of single or combined message, statements or characteristic values, which are exchanged between bus devices.
Infrared decoder	Element for data transmission based on infrared light.

Infrared hand-held transmitter	Remote control unit for the transmission of digital data telegrams using infrared light.
Infrared light	Invisible radiation in the red area of the light spectrum with wavelengths > 770 nm.
Infrared receiver	Element for data transmission based on infrared light.
Infrared receiver-decoder	Element for data transmission based on infrared light.
Infrared system	System for the transmission of information using infrared light.
Infrared transmission	Wireless means of transmission using light in the infrared range as the transmission medium.
Infrared transmitter	Element for data transmission based on infrared light.
Installation (software)	Installation of operating systems and programs with the set-up command from external storage media or the network server.
Installation bus system, *EIB*	A system which is based on the *EIB* installation bus and contains a transmission path and protocol as well as bus devices/components, product database, system documentation etc.
Installation bus, *EIB*	See *EIB*

Installation socket	Installation material
Installation zone	Established cable paths in the case of concealed wiring arrangements.
Integrated Services Digital Network, ISDN	ISDN denotes the public digital telecommunications network, which on one line under one call number allows the simultaneous transmission of voice, data, text and pictures. Several services with high transmission quality can run via the same line, e.g. fax and phone.
Interaction	Manual intervention by the user, in order to be able to proceed with the program.
Interactive TV	Interaction between screen information (questions, problems) and user input via mouse, keyboard or touchscreen.
Intercom system	Voice link in half-duplex mode between the living area and the entrance door or the garden gate, usually combined with the doorbell (entrance) and the open button (inside the house).
Interface	Electrical, mechanical or data-technical interface for adaptation between different devices and systems. In data processing, an interface between the computer and its peripheral devices and between data networks of differing structures, see gateway. In *EIB* there are defined interfaces, for example between the line and bus coupling unit or between the bus coupling unit and application module.
International Electrotechnical Commission, IEC	This commission has its headquarters in Geneva and develops international standards for the individual areas of electrical engineering.
International Organization for Standardization, ISO	Headquarters in Geneva. Develops international standards for various technical fields excluding electrical engineering.
International Telecommunication Union, ITU	The tasks of this union include the international allocation and registration of transmitting and receiving frequencies, the promotion of new developments and the international co-ordination of activities in the field of telecommunication. The formulation of technical recommendations previously taken up by the CCITT has been carried out by the ITU-TS, the standardisation body of the ITU, since spring 1993. Since 1993, officially sanctioned co-operation with ISO/IEC JTC 1 "Information Technology" in the drafting of telecommunication standards. The radio communication sector, ITU-RS, has been named as the successor to CCIR.
Internet	World-wide computer network
Interoperability	The ability of devices from one or several manufacturers to work with other devices within an application or across applications.

Interrupt	Interruption of a running program
Intersection and adjacency	Intersection and adjacency of *EIB* cables with other systems.
IR decoder	See infrared decoder
IR receiver	See infrared receiver
IR transmitter	See infrared transmitter
IrDA	Infrared Data Association; committee for the purpose of establishing a quasi-standard for infrared data transmission (half-duplex; 9.6-115 kBit/s; range 1-3 m)
ISDN	Integrated Services Digital Network; network that integrates a variety of data transmission methods and services.
ISO	International Organization for Standardization.
ISO 9000	Rules for the layout and design of a quality control system. Standards of the 9000 group deal with all the problems of quality control, from the development through production right up to delivery of products and services.
ISO/OSI seven layer model	OSI = Open Systems Interconnection. Theoretical model for the subdivision of communication processes into different layers. The layer model does not determine requirements, it merely describes which requirements need to be established in the various layers.

- Layer 1: electrical and mechanical quantities
- Layer 2: data protection
- Layer 3: connection layout in the network
- Layer 4: transport of information through the network
- Layer 5: connection set-up by the user
- Layer 6: transparent preparation of data
- Layer 7: user instructions

The communication processes of the *EIB* installation bus correspond to this model.

Isolated signal area	Transmission range isolated by band stops for *EIB* powerline applications.
ISP	Internet Service Provider; company that provides access to the Internet subject to a charge.
ITU	International Telecommunication Union
IWV	Pulse Dialling Method; digital dialling procedure in the telephone network (alternative to MFV).
Java	Programming language in the World Wide Web (company JavaSoft or Sun Microsystems), which aims to help the WWW achieve the functionality of a network computer.
JPEG	Joint Photographic Experts Group; committee that has developed a standard for digital picture compression.

Junction	Point in the bus at which the transmission medium branches
Keyboard	Bank of keys for the entry of alphanumeric and special characters in the computer and for the execution of control functions.
Keyword index	Method of finding terms in a file.
LAN	See Local Area Network
Laser disc	Disc that records sounds digitally, pictures in analogue.
Layer model	See ISO/OSI seven layer model
LC	Line Coupler
LCD	Liquid Crystal Display
Leased line	Telephone or data line which is constantly available to the user.
LED	Light Emitting Diode
Level ratio	The ratio of two electrical voltages, currents or powers. The signal to noise ratio (S/N) on the power network is the decisive factor and is given as the level ratio (in decibels [dB]).
Library	Here: A collection of sub-programs to process frequently occurring tasks.
Light intensity switch	Switching element that reacts to light intensity.

Lighting actuator	Installation bus device, which switches or dims lights according to the bus telegram
Lighting control	Control of the lights in an electrical system.
Lightning arrester	Part of the lightning protection system to divert excess currents.
Lightning protection system	System for the protection against lightning strikes.
Line	Smallest element of the *EIB* installation bus with up to 64 bus devices. The line consists of one or more electrical segments that are connected via repeaters.
Line coupler, LC	Component in the *EIB* installation bus system used to connect lines together. Telegrams are either passed on via the line couplers or blocked by them, see filter table.
Line identification	Measure to identify the lines.
Line segment	See electrical segment
Line termination	See terminating resistor.
Link	– Link; connection element between hardware or software modules – Return command; sub-program function, which creates the connection to the main program

Link layer	Session layer of the OSI layer model.
List box	Representation of tables or lists in a Windows window. The complete list can be read by scrolling.
LL	Link layer
Load centre	Installation site of an *EIB powerline* repeater. A point within the installation at which separation from all *EIB powerline* devices is as equal as possible. This achieves the greatest efficiency of the repeater.
Load characteristic	Criterion for the possibility of using *EIB powerline.*
Load management	Application that monitors the energy consumption of *EIB* bus devices with the aim of using electrical energy more economically or avoiding any overloading of the network.
Load physical address	Assign the bus device with its address.
Local Area Network, LAN	Local network for bit-serial communication between independent devices that are connected together via a communication medium.
Logical operation	Guided operating procedure
Login	Signing on to the network with name and possibly password.

Logo	Company sign.
Logo field	Place for the representation of the logo
Logout	Sign off from the system
LON	Local Operating Network; local network in automation technology, especially for household and building systems automation.
Loop formation	Illegal connection in bus technology.
LV	Repeater
LWL	Fibre-optic cable
Macro (command)	Group of individual commands belonging together and which under a new name can solve complex tasks.
Magnetic contact	Magnetically operated protective contact (e.g. reed contact) in the *EIB* system to monitor the closed status of windows, doors, etc.
Mailbox	Electronic post box into which messages for other mailbox users can be written.
Main group	Part of the group address.
Main line	Component in the installation bus system. Connects several line couplers together and these possibly with the allocated area couplers. This facilitates data exchange across the area and included lines.

Mains impedance	See impedance
Mains signalling	Transmission of information in a power installation using signals that typically lie in the 100 kHz range
Maintenance contract	Defined service agreement for the purpose of maintaining good operation.
Mask	Operative representation on the screen; screen contents.
Mask element	Element of the mask, e.g. print key or display element.
Master/slave	In a system with a master/slave configuration, one device (master) leads the functional process in the exchange of information. All other devices (slaves) are dependent on the master. With the *EIB* installation bus all devices are equal.
Media coupler	Interface between different bus transmission methods.
Medium	Term for the means of transmission of information, e.g. copper wiring, infrared, radio, coaxial cable, fibre-optic cable.
Menu	List of possible actions represented on the screen, which can be executed via the user interface.
Menu structure	The grouping of individual menus to form a hierarchic or linked overall arrangement with possible crossovers (menu tree: hierarchic, menu graph: linked)

Message category	A pictograph is used to represent the type of incoming message at the HomeAssistant (danger, emergency etc.).
Message escalation	Automatic mechanism in the message system, which orders messages according to their urgency and depending on the reaction, allows the running of various escalation levels with various actions.
Message profile	Description of the properties of a message.
Message profile for external communication paths	This message profile is designed for remote control.
Message system	Via the HomeAssistant, this system informs the user of different types of event, from danger messages up to tips and advice. Messages, in particular those with higher priority such as alarms and emergencies, can also be transmitted to external locations.
MessLog	Message log
MessQueue	Message queue
MFC	Microsoft Foundation Classes; almost standard library of classes from Microsoft with a common interface.
MFV	Multi-frequency dialling method, see DTMF

Microcomputer	Computer based on a microprocessor.
Microprocessor	Central element for controlling and processing data in a computer, in the form of a highly integrated circuit, see CPU.
Middle group	Part of the group address.
Mini LCD	See display unit, info display
Mixed installation	*EIB* installation with various transmission methods.
Modem	Modulator-demodulator; device used for the transmission of data via the telephone line (analogue network) using FSK modulation.
Modulation	The modification of a carrier by the information to be transmitted.
Modulation method	The modification of one or more signal parameters of a carrier by another signal. These parameters include amplitude, frequency and phase. If the carrier is sinusoidal, we differentiate between amplitude, phase and frequency modulation. If the carrier is pulsed, the methods are pulse amplitude, pulse frequency and pulse phase modulation. The modulation of sinusoidal carriers with digital signals is called keying, e.g. frequency keying.
Module	Element of a compound system (hardware, software).

Monitor	– Screen for the representation of computer data, graphics, video sequences – Program for the visualisation of statuses in systems, e.g. bus monitor
Monitoring function	Measures for monitoring the expected/actual value deviation.
Motherboard	Main board of a computer with the microprocessor, memory (RAM) and other important elements; baseboard.
Mouse	Operating device with a ball whose two-dimensional movement moves a cursor on the screen. Commands can be entered using the two or three keys. A variant is the mouse with a reflex light barrier whose movement across a specially indexed background describes the position of the screen cursor.
Mouse click	Possibility of entering PC commands
Movement detector or sensor	Device to detect moving persons, animals or other objects, e.g. using infrared or ultrasound technology.
MPEG	Motion Picture Expert Group; committee to define a method of digital video compression
MPR II	Recommendations for low-radiation screens (Swedish standard)
Multi-frequency dialling method	MFV, see DTMF

Multimedia	Information system which uses various media
Multimedia PC	PC for representing different types of information
Multiplexing	Method of simultaneously (or virtually simultaneously) transmitting several items of information on one transmission channel.
Multitasking	Several applications and system programs can run simultaneously.
Music-on-hold	Playing music whilst a conversation is on hold.
NAK	Negative acknowledgement for data transmissions (characters have been received but not understood).
Navigational element	Aid to find a desired setting in a program.
Network	General term for a connected system for the transmission of energy and/or information. Examples: – Power network – Data network – Telephone network – D network Or: The general term for every type of data connection between more than one device, see LAN, WAN
NG	Power Supply Unit

Night reduction	Heating program to save energy.
Node	Nodal point, branching point; network node, connection point for branching in data networks.
Noise immunity	See electromagnetic compatibility.
Noise radiation	See electromagnetic compatibility.
Numerical characters	Character set consisting of numbers only.
NVRAM	Non Volatile RAM
Object	An object is a quantity of information, which is embedded in another file or can be linked with it such as for example, a diagram or a graphic.
Occupied house	See simulation of occupancy
OCR	Optical Character Recognition; method for the optical detection of characters, especially hand-written characters.
OCX	OLE controls, see OLE
ODBC	Open Data Base Connectivity; database driver under Windows.
OEM	Original Equipment Manufacture; manufacturers of hardware and software
OLE	Object Linking and Embedding; the linking and embedding of objects to form a compound document.

Online	Physical and electronic connection of a computer with its peripherals; electronic connection of computers in data networks.
Online help	Help on data networks.
Online service	Supply and management of services in data networks.
Open-loop control	Process by which the input values influence the output values. Also referred to as sequence control, logic control.
Operating device	Device for the input and output of information between the user and *EIB* system
Operating element	Button representation on the touch-sensitive screen
Operating system	Program package, which controls, coordinates, monitors the sequence of programs in a computer and regulates access to the peripheral devices.
Opto-interface	Interface between optical and electronic data transmission.
OS	Operating System
OSI; OSI layer model	Open Systems Interconnection; theoretical model standardised by ISO for the subdivision of communication processes into (seven) different session layers (structured software) for the development of open transmission systems.

Overshooting	Transmission that in open transmission media (*EIB powerline*/*EIB radio*) goes beyond the usual dimension due to the local conditions.
p.m.	Post meridiem; after midday (12-24 hours)
Pager	– see Radio call receiver; depending on the call class the message is made audible by acoustic signals or shown on a display as numeric or alphanumeric characters. – See City call, Scall
Paging	Search function for cordless phones, where the transmission from the fixed station to the hand-held device is reproduced as an acoustic signal.
Paging system	Personal calling system.
Parallel transmission	Simultaneous transmission of n-bit words via n connection paths.
Parameter	Variable setting in the *EIB* system
Parameterisation	Procedure by which the bus devices are provided with addresses and any necessary application software.
Parity bit	Means of detecting errors in data fields to detect transmission errors. A 1 or 0 is added to the end of a series of binary digits, to make the overall sum odd or even.
Parity checking	Safety mechanism using a check bit for a coded character sequence.

Partner installer	Marketing measure for the distribution of the *EIB*.
PAS	Equipotential busbar
Password	Word or sequence of characters for the purpose of identification. Passwords are used to restrict access to programs and files.
PBX	Private Branch Exchange
PC card standard	Standardised system of multifunctional plug-in computer cards, development of the PCMCIA standard.
PCI-BUS	Peripheral Components Interconnection Bus; internal computer bus system, data width 32 bits (double word).
PCM	Pulse Code Modulation; digitalisation of analogue signals by periodic keying (sampling) and quantising.
PCMCIA	Personal Computer Memory Card International Association; committee for the standardisation of highly integrated memory elements in credit card format. Other applications of the PCM housing include peripheral components such as modems, LAN adapter, data acquisition cards etc. See PC card.
PDA	Personal Digital Assistant.
PEI	Physical External Interface

PELV	See Protective Extra Low Voltage
Pen entry	Entry of hand-written notes and characters into a computer by moving the pen across a touch-sensitive display.
Pendant PA	Personal alarm worn around the neck, which can easily be used by old or handicapped people. It is used to trigger emergency calls or alarms via the telephone. Security equipment can also be incorporated into the system, such as window contacts etc., which also activate alarms when triggered. Emergency calls can also be transmitted when a specified check key is not pressed within a defined time limit (automatic alarm).
Performance spec	(Performance specification). Description of the scope of supply and functionality based on a translation of the customer requirements in a system-based environment. The specification defines HOW and WITH WHAT the requirements are to be implemented (DIN 19 246) See specifications.
Personalisation	The saving of certain personal options of multiple users in the HomeAssistant.
PFAT	Person - Firm - Address - Telephone (tables). Data relations can exist between the person, firm, address and telephone tables. With the search function (linking) it is possible to create a new table.

PGV	Program-controlled distributor
Phase coupler	Component in *EIB powerline* for the defined coupling of signals on all active conductors.
Phase keying	With phase keying, the information to be transmitted is superimposed with the phase of a carrier. For example, if the information for transmission is digital, the phase of the carrier is increased by a certain amount with a logical 1 and reduced by this amount with a logical 0.
Photo-CD	Digital disc for a maximum of approx. 100 colour stills as well as for combinations of picture and sound.
Physical address	Unique code of a bus device in the *EIB* installation bus system. The physical address includes area, line and bus device number.
Physical external interface, PEI	Interchange point between the bus coupling unit and an *EIB* bus device or the communication interface/*EIB* device. Mechanical, electrical and if applicable data technical interface between the bus coupling unit and the application module/ terminal.
Pictograph	Picture or character with established, internationally agreed meaning.
PIN	Personal Identification Number

Pixel	Luminous point on the screen generated by the computer; the greater the number of pixels per unit surface area of screen, the higher the resolution of a picture on the screen.
PK	Primary Key; used as the unique identification of a data set in a table.
PL	Powerline
PLC	Programmable Logic Control
Plug and play	Immediate operability of devices after connecting the power supply, no assembly or configuration problems.
Polling	Remote calling of data; calling up of messages; cyclic enquiry
Potential equalisation	The lightning protection system is connected to the potential equalisation to prevent unchecked flashovers.
Power down	Energy saving circuit. See green mode, sleep mode.
Power line signalling	See mains signalling.
Power management	Energy saving technology such as for example APM, which reduces the energy consumption of a computer in 4 stages.
Power manager	Energy saving function for picture tube monitors, three-stage, with energy saving effects > 90%.

Power supply	Basic component which within the scope of *EIB*, supplies the bus devices within a line (electrical segment) with power. Used in combination with a choke.
Power supply unit	See power supply
Powerline	Power supply network 230/400 V
Preparatory cabling	Electrical installation prepared for future expansion.
Preset	The pre-setting of specific parameters (e.g. programming for a TV).
Primary protection	See lightning arrester
Prime	To set an alarm system so that it is ready or switched on, e.g. via a block lock
Priority	Privilege, precedence, sequence of access. Processes can be arranged according to priority levels.
Private key	Operating element to select personalised programming
Process	Progression, course, e.g. a computer program that is currently running.
Process control	Technical procedure in which process data is fed into the computer and which after processing in predefined algorithms is fed back into the process as correcting variables.

Product database	Colloquial term for a diskette containing manufacturer-specific product data for the project design and commissioning of an *EIB* installation.
Product management	System module of the ETS 2
Product-specific CD-ROM	Disc containing product-specific data for the integration of a bus-compatible device into an *EIB* installation with a HomeAssistant.
PROFI bus	Process Field Bus; a bus defined in DIN V 19245 for automation procedures.
Program	A sequence of commands or instructions to solve a problem.
Programming	In building systems engineering this term is used for – Assigning addresses – Entering switching times – Establishing links – Establishing threshold values – Loading data into the bus devices
Project design, team oriented	Characteristic feature of ETS 2
Project management	Characteristic feature of ETS 2
Propagation	E.g. the propagation of electromagnetic waves in a medium.

Property	Here it means the property of an *EIB* communication object (program part). The *EIB* object has compulsory properties (type, access) and also sometimes optional properties.
Protective Extra Low Voltage, PELV	Functional low voltage with protective separation according to DIN VDE 0100 part 410/11.83 section 4.3.2. Modification draft A2/8.88 Future: Low voltage with earthed circuit; the circuit earth can be achieved with a suitable connection to earth within the source of electricity.
Protocol	Regulations and requirements with which data transmission between a computer and its accessories is established.
Prototype	E.g. the initial design of a household appliance that has been developed far enough to allow the series construction.
PS	Power Supply
Public domain	Freely available programs or information, no charge. See freeware.
Pulse Code Modulation, PCM	This is a method of modulation by which a digital signal is obtained from an analogue signal by sampling and quantising. See A/D converter
Pushbutton	Also used to describe an active symbol on a computer screen.

QMS	Quality Management System
Quad word	A 64 bit data word
Quality audit	Assessment of the effectiveness of the quality control system or its parts.
Quality control	All measures to guarantee high quality, from the planning right through to the supply and after sales service for a product/project.
Quality control system	The established layout and organised procedure for carrying out quality control.
Questionnaire	List of questions to determine customer requirements
Radio code	Coded, wireless message, which by identifying authorisation allows the remote control of devices and systems.
Radio interference	High frequency voltage that is generated by electrical devices and has a reverse effect on the supply network.
Radio nodes	Radio nodes are devices within a bus system that are connected with other bus devices in the system via radio.
Radio transmission	With radio transmission the information is radiated from an antenna transmitted through the air and received at a different antenna.
RAM	Random Access Memory; read/write memory - electrically erasable and programma-

	ble semiconductor memory. Without a battery supply, the memory contents are lost when the power is switched off.
Read Only Memory, ROM	Permanent memory with a constant, unchangeable content, e.g. program, constants. The content is retained when the power supply is removed.
Real-time	New data is processed as soon as it occurs.
Receiver	Part of a system that receives information, with the *EIB* installation termed an actuator.
Redundancy	Generally used term for the mirrored layout of a technical solution to increase the availability.
REG	DIN Rail Mounted Device
Remote control	– Technical device, – Method for operating remote devices, fittings and accessory equipment, either with or without cables, – Method for controlling vehicles, aeroplanes, etc. usually without wires.
Remote control, infrared	Remote control using infrared light as the transmission medium.
Remote diagnosis	Remote polling of the functionality and status of devices, fittings and accessory equipment.
Remote maintenance	After remote diagnosis has taken place, a means of providing maintenance for devices and equipment situated at remote

	locations.
Remote monitoring	See remote diagnosis
Remote operation	See remote control
Remote polling	Transmission of the status of a system, e.g. via the telephone network.
Remote system	E.g. a distant (third-party) computer.
Reparameterisation	Changing the parameterisation.
Repeater	Component in the *EIB* installation bus system that boosts signals in order to increase the transmission range or to connect two electrical segments together.
Reset	Command to return the computer to its original status.
Resource management	Application for the management of resources in the compound system, without exceeding predefined threshold values.
Resource sharing	Shared usage of common resources
Response time	Time period between the entry of a command in a computer and its execution.
Restart (wake-up)	Starting the computer after the end of the green or sleep modes.

Review	Here it means talking through the results and discussing how to proceed.
RF	Radio Frequency
RFI	Radio Frequency Interference; high frequency interference.
ROM	Read Only Memory
RS 232 interface	Serial (voltage) interface for data transmission between the computer and peripheral devices (V.24 interface)
RS 485 interface	Serial (current) interface
RTTY	Radio Teletype
RX	Receiver
Safety Extra Low Voltage	Protective low voltage according to DIN VDE 0100, part 410/11.83, section 4.1 Modification draft A2/8.88 Future: Extra low voltage with non-earthed circuit; active parts must not be connected with earth nor with active parts of other circuits and must be electrically isolated from higher voltage circuits.
Sample depth	Differentiation of the volume differences for every sample
Sample rate	Number of measurements of analogue signals per second
Sampling	Conversion of analogue signals into digital values.

Scall	Cable-free message service from the German Telecom on a numeric basis without feedback. When transmitting a call, the message (as a sequence of numbers) is either sent by MFV or speech input.
SCART box	Video-audio box on the television receiver with signal inputs and outputs.
Scenario	Sequence of desired functions
Scenario manager	In the HomeAssistant it is possible to use the scenario manager to combine various actions together and with that to create scenes.
Scene	A scene is a universal, programmed situation and setting within the system that can be invoked.
Screen	See shielding
Screen ergonomics	Minimum requirements for the ergonomic design of screens (non-flicker, contrast, brightness) in ISO 9241-3.
Screen text (Btx)	Data service of the German Telecom.
Scroll	Roll the screen contents upwards, downwards or side to side.
Scroll bar (display)	Scrolled linear display which can be moved to the desired position using two keys (>/<).
Secondary protection	Surge arrester

Security	Needs to be defined in more detail, e.g.: – Security against electric shock, fire and other dangers – Functional system security – Intrusion protection, protection against break-ins – Security of the system and its components against overvoltage
Security circuit	Combination of several operational functions for the simple transfer of emergency calls.
Security lighting	The switching on of all lighting (or the larger lighting groups) in the house and garden via a switch or via a button on the touchscreen.
Security scenario	Sequence of actions with the sensors and actuators installed via the *EIB* to check or guarantee security.
SELV	See Safety Extra Low Voltage
Sensor	Element for converting physical quantities into electrical values. Bus device in the *EIB* system, which processes physical quantities and possibly transmits telegrams on the bus. Examples: – Touch sensor/Push button – Temperature sensor – Brightness sensor
Sensor element	Element for converting physical quantities into electrical values. Examples:

	– Temperature – Brightness – Humidity
Separation	The separation of *EIB* lines from lines of other circuits. See DIN VDE 0100-410 (HD 384.4.41.S2), section 411.1.3.2, Appendix D.
Serial data interface	Standardised interface
Serial transmission	The transmission of data in a temporal sequence via a connection path. Staggered transmission of different information via a line. As an example, only one twisted pair is needed for the transmission of 8 bits of information.
Series filter	See band stop.
Server	Central computer in a networked system. A large part of the data and programs are stored here.
Service	Here, it means the services provided by the operators of telecommunication equipment. This includes for example, telephone services, teletext or telex, telefax and others.
Set	Pre-setting of analogue and digital controller outputs. Example: Setting the volume on the radio.
Set point generator	Also called a command generator. In regulating circuits it specifies the set point and

	in control circuits the actuating variable. With *EIB* it belongs to the sensors group.
SFSK	See Spread Frequency Shift Keying
Shareware	Generally accessible software, which can be tried out for free before buying.
Shell	Specific, limited area of the operating system.
Shielding	With cables a conductive film or covering, with devices for example, a metal housing, to reduce possible EMC problems.
Shutters	Retractable coverings for windows or doors.
Signal delay	Propagation time of electrical signals on the bus line between two bus devices in an electrical segment.
Signal/noise	Ratio of useful voltage to noise.
Sill cavity	Form of cable channel.
SIM	– Subscriber Identity Module; chip card with processor and memory for the D1 telephone network – Computer memory module (DRAM type).
Simulation	Realistic recreation of a process.
Simulation of occupancy	See "occupied house", pre-programmed scenario involving the switching on and off of lights, the moving of blinds etc. to

	create the illusion of occupancy when the inhabitants are away from home.
Single actuator group	Possibility of an exactly defined address allocation
Single room temperature control	Autonomous combination of the position of the temperature controller and servo valves on the radiators for every room.
Slat position	Tilt position of the blind slats.
Slave	See master/slave
Sleep mode	Energy saving circuit where only one part of the mains supply function is active whilst all other modules of the computer are switched off.
Sleep timer	Switch-off function (stand-by) for devices according to a pre-defined time. This time is controlled by the internal clock of a TV, radio device or multimedia PC.
SMS	Short Message Service (mobile phone)
SO interface	The international SO interface forms the actual user connection in the ISDN and with that the boundary between partner devices and the public telephone network.
Soft key	Programmable function key.
Software	General term for computer programs, i.e. operating systems, auxiliary programs or applications, as well as the accompanying literature.

Software tool	Aid to create computer programs.
Sound card	Computer module for the digital processing of analogue audio signals (voice, music, noises, etc.) with input and output functions as well as software for data compression.
Source address	In networked systems this is the code of a device that is sending information.
Source document	The document from which an object originates.
Special characters	All characters that are neither letters or numbers.
Specifications	Totality of the contractor's obligations as regards the services and functions demanded by the customer. This document defines WHAT is to be solved and WHY. The specifications are either written by or on the request of the customer and used as the tender and/or contract documentation (DIN 19 246). See performance spec.
Spread Frequency Keying	Stands for frequency keying in spread spectrum technology. Two carrier frequencies with a large frequency separation are used for the transfer of binary information (logical "0" or "1").
Spring Connection block	Connection element for connecting DIN rail mounted units.
SQL	Standard Query Language; communication language for databases. Database software (Watcom, Sybase), based on SQL, helps the HomeAssistant process *EIB* information (ETS) as well as non-*EIB* information (user databases).
Star	See topology
Star code	See equipment level.
Star structure	Type of wiring arrangement.
Status bar	The status bar is an integral part of the header line. It is always visible when mask-specific information is to be displayed (advice on operation, tips for proceeding etc.).
Status communication object group	Possibility to attribute an exactly defined address.
Store	Used here to indicate the storage of messages, synonym for database.
Style guide	Design rules and recommendations for the user interface of the HomeAssistant.
Sub group	Part of the group address.
Sub-bus	Stand-alone bus that has become a sub-bus by being integrated into another bus network.
Surface-mounted device	Device for installation on the wall.

SVGA	Super Video Graphics Adapter; see VGA
Synchronous transmission	Type of data transmission in which transmitter and receiver run in absolute synchronicity at all times. Usually guaranteed by the constant transmission of a timing signal.
System code	See system ID
System components	Code for bus devices which carry out general functions independent of the application, e.g. line coupler. See basic components.
System events	Alarm messages, operating and error messages for devices.
System function column	The system function column on the left-hand side of the HomeAssistant screen contains functions that are made available by the base software of the HomeAssistant.
System ID	A code in telegrams to separate an *EIB powerline* system. A telegram received by a device that has a different system ID will not be evaluated.
System manager	Contact person who covers all building disciplines, services
System settings	Operating element in the HomeAssistant for system functions, which can activate switching processes in all applications.
TAPI	Telephone Application Programming Interface

Target address	Group address of the bus device(s) which is (are) to receive the telegram. When programming (commissioning) it is the physical address of the bus device.
Target document	The document into which an object is to be placed.
Target selection	Creation of a connection by pressing a single button.
Tariff management	Application to optimise energy costs.
Teaching program	Software for the teaching of any desired areas, installed on the HomeAssistant.
Technical connection requirements	Requirements of the electric power company concerning the design of electrical installations to ensure they do not have an adverse feedback effect on the supply network.
Tel. no. type	Telephone number type. We differentiate between private and business telephone numbers, fax numbers, mobile numbers etc.
Telecommunication	Telecommunication denotes all types of communication that exceed the audible or visible ranges. It is irrelevant whether this involves the exchange of information between man and/or machines or other equipment. In the field of data transmission, this term covers everything from voice, picture, text and data transmission technologies and equipment as well as

	the exchange techniques.
Telecontrol engineering	Methods of remote control, remote operation, remote maintenance.
Telefax	Remote copying of documents, texts and graphics via the telephone network.
Telegram	A sequence of bits which contains all necessary data to identify the bus devices and transfer the information.
Terminal	Unit for the input and output of data in a computer system, see console. See application module.
Terminating resistor	Resistance that is necessary for some networks in order to avoid the reflection of signals. Not needed for the *EIB* installation bus.
Test log	Form for entering the results of testing an electrical system. Obtained from WFE, Postfach 90 03 70, 60443 Frankfurt, Germany, Tel: ++49 (0) 69/24 77 47-0, Fax:++49 (0) 69/24 77 47-49.
Thread	Execution path, sub-process; subject branch in messages.
Time division multiplex, TDM	See multiplexing
Time sharing	A mode of operation in which several users can work on a computer (seemingly simultaneously).

TL	Transport Layer
Token	– Character – Access method using a bit pattern ("free characters", "occupied characters"), which allows network devices to exchange information without collision.
Token ring	Bus in a ring structure with a standardised access procedure, medium and organisation, Not used in the *EIB* installation bus.
T-Online	Service provided by the German Telecom via the telephone network, see Datex J, Btx
Tool	Hardware or software
Tool kit	Help for programmers, programming tools.
Topology	– Basic design of the wiring arrangement in a data network – Structural information concerning the number and position of rooms as well as external systems within *EIB* installations. – Term for the network structure and system layout, see DIN VDE 0829-522, AppendixD
Total load characteristic	Criterion to determine the possibility of usage of *EIB powerline*.
Touchscreen	Touch sensitive screen for activating control functions.

TP	Twisted Pair
Tracer	Possibility for identifying a line
Track ball	A type of upturned mouse. Rotating the protruding ball causes a corresponding movement of the cursor on the screen.
Transmission	See asynchronous / synchronous transmission.
Transmission distance	Length of the transmission path between two devices.
Transmission duration	Signal transmission time.
Transmission path	See bus.
Transmission reliability	Totality of the parameters defined in the transmission system, which guarantee the perfect transmission of information and with that the proper functioning of the system. E.g. the mechanisms included in the telegram that provide secure transmission. See protocol.
Transmission speed	Number of bits transmitted within a specific time period. Measured in bit/s. See Baud rate.
Transmitter	Part of the system that transmits information. With *EIB* it is called a sensor.

Transmitter level	The field intensity radiated at the transmitter antenna.
TT profile	Time temperature profile, desired sequence of temperature changes over a period of time. See daily profile.
TTY	Teletype
TVI	Television Interface
Twisted pair, TP	Twisted wire pair for bus transmission. See bus line.
TX	Transmitter
UART	Universal Asynchronous RX/TX; device for converting serial data streams into parallel data streams (and vice versa) in receivers and transmitters.
Universal Asynchronous Receiver Transmitter, UART	Switching circuit that converts parallel data, which is to be transmitted, into serial data, and serial received data into parallel data.
Update	Updating for programs and files.
Upload	Transferring data from your own computer to a third party computer.
UPS	Uninterruptable Power Supply; can be used as a backup for example, to supply a computer or the *EIB* to avoid data loss in the case of mains power failure.

Upwards compatibility	A program of an older version which also works under the operating system of a newer version.
Usability lab	Examination site for questions of usage and ergonomics of systems and devices.
Usability test	Here in particular, an analysis of the usability of application programs by unpractised users.
Use of the second wire pair	Two wires of the four-wire bus line can be used for other purposes.
Useful data	Part of the data field, which represents the data to be transmitted. With the *EIB* installation bus, a minimum of 1 byte and a maximum of 15 bytes, e.g. for on/off, temperature values etc. See telegram.
User interface	Generally used term for the interface between man and machine, in data processing for the interface between software and user
User manual	Functional and operating instructions for the user.
UTC	Universal Time Co-ordination; world-wide, see GMT
Utility	An auxiliary software program to simplify routine processes
V.24	See RS 232 interface

VAL	Virtual Device Abstraction Layer; driver interface for virtual resources at the communications system core.
VDE	Association of German Electricians
VDEW	Organisation of German Electric Power Companies
VDRG	Association of German TV and Radio Traders
VEG	German Association of Electrical Traders
VESA feature connector	Standardised interface on graphic cards, to which it is possible to connect an MPEG adapter for example (generally board connectors or rod connectors on graphic cards).
VGA	Video Graphics Adapter (Video Graphics Array); graphics card for a video operating mode with a higher resolution for the representation of texts and graphics on the screen. Monitor control with analogue signals for improved colour reproduction. Even greater improvement in the resolution with the SVGA.
Video CD	Digital video-CD for MPEG standard. See CD-V, CD-IV.
Video connection	Television connection.
Video text	Auxiliary programs from television companies, which with the use of a special

	decoder allow texts to be shown on the TV screen (the blanking intervals are used for transmission).
ViRes	Virtual Resource; virtual representation of concrete resources, which are stored in the VAL.
Virus	Sabotage program, which changes programs and damages or even destroys data.
Visualisation	Make visible; representation of processes on the screen in the form of text or pictures.
Visualisation program	Software to represent information on the screen.
Voice input	– Input of commands and information at the computer using speech – Words or sentences are written to memory after they have been digitised and can then be output as required, either individually or in new sequences. See voice output
Voice output	Words or sentences saved in digitised form are made audible after digital-analogue conversion.
VxD	Virtual Device Driver; see HAL
WAN	Wide Area Network; network covering a wide area, usually composed of several LANs connected together.

Watchdog	Device for data backup in computers in the case of malfunction (e.g. power failure); cyclic checking of the software installation; processor reset after the absence of cyclic control signals.
Wave file	File into which digitised sound signals are written.
Western connector	A form of connector for junction box cables according to the American standard, e.g. RJ12, RJ45.
Window	A Windows element in which a mask is represented.
Window contact	Contact to monitor the closed status of a window. See magnetic contact.
Word	In data technology, a word represents the number of bits a computer can process in parallel. With microprocessors, word lengths of 8, 16 and 32 bits are usual; mainframe computers have word lengths of 64 bits and more.
Working area	A section of the screen that serves as the working area in representing operating and display elements of the individual applications.
WWW	World Wide Web; Internet service, multimedia part of the Internet
X.25	X.25 describes the lowest three layers of the ISO/OSI layer model for the interface

between data terminals and data transmission devices in public data package exchange networks.

X.xx interface, X.21
Selection of standardised interfaces in public data networks.
All interfaces denoted X.xx have been standardised by CCITT or represent recommended standards for public data networks. X.21 describes the physical meaning of the lines and the electrical properties of a connection of terminal and data transmission device with synchronous operation.
See International Telecommunication Union, ITU.

ZVEH
Association of German Electrical Contractors

ZVEH calculation aid
ZVEH Help for the calculation of electrical systems.

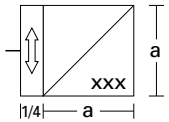
ZVEI
Association of German Electrical and Electronic Industries

Appendix C Symbols

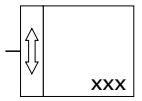
General information

The overall symbol consists of a square of side length “a” into which the individual symbols are entered. The transmission electronics are represented by a rectangle with dimensions a x a/4, which depending on the function of the device, is attached to one or two sides.
The “bus arrow” is inserted into the a x a/4 rectangle representing the transmission electronics. Individual symbols are inserted into the square, side length a, to represent the function. These symbols are identical to those of the DIN 40 900 standard.
The direction of information flow can, if desired, be represented by arrows on the bus line.
The following symbols should be used for bus devices that cannot be represented by the specified symbols:

Sensor

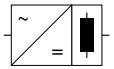
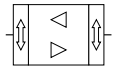
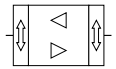
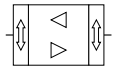
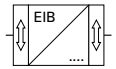
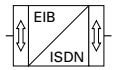
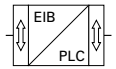
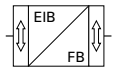


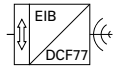
Actuator



xxx = alphanumeric term

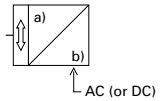
Basic components and system components

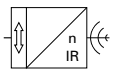
Product name	Abbrev.	Symbol
Bus coupling unit	**BCU**	
Choke	**CH**	
Power supply	**PSU**	
Power supply with integrated choke Power supply unit	**PSUTCH**	
Line coupler	**LC**	
Area coupler	**AC**	
Repeater	**RE**	
Data interface RS 232 interface	**RS232** **(V 24)**	
External interface Gateway	**GAT**	
E.g. to ISDN		
PLC interface		
Field bus interface		

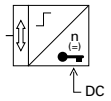
Product name	Abbrev.	Symbol
DCF77 interface		
Application controller Application control Control element Scene element Logic element Linking element Time profile control		
Connector		
Band stop		
Phase coupler / repeater		

Sensors

n = number of inputs [1, 2, 3,...]

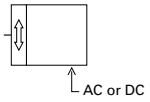
Product name	Abbrev.	Symbol
Sensor, general a) Field to identify the application software b) Field for physical input quantities to identify the input channels		
Sensor, general – With auxiliary supply		
Binary sensor Binary input Binary device Input terminal Pushbutton interface b) Field for physical input quantities to identify the input channels		
e.g. for DC		
e.g. for AC		
e.g. 2 inputs, AC		
Binary / analogue sensor Binary / analogue input Binary / analogue device		

Product name	Abbrev.	Symbol
Analogue sensor Analogue input Analogue device		
Touch sensor Pushbutton		
Dimming sensor Dimming push button		
Control touch sensor Control push button		
Blind sensor Blind push button		
IR transmitter		
IR receiver		
IR receiver with n-way pushbutton		
IR decoder		
IR receiver / decoder		
Brightness sensor		
Brightness detector Brightness value switch Twilight push button		

Product name	Abbrev.	Symbol
Temperature sensor		
Temperature detector Temperature value switch Room thermostat		
Movement sensor PIR = Passive Infrared US = Ultrasound		
Movement detector		
Clock Time sensor		
Timer Time value push button		
Wind speed sensor		
Switch lock		
Automatic cutout monitoring		

Actuators

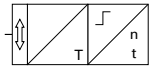
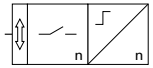
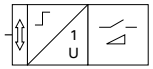
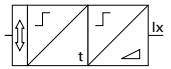
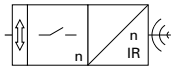
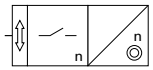
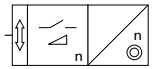
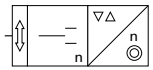
n = number of outputs [1, 2, 3,...]

Product name	Abbrev.	Symbol
Actuator, general		
Actuator with auxiliary supply		
Actuator, general with time delay		
Switching actuator Switching device Binary output Binary device Output terminal		
Blind actuator Blind switch		
Dimming actuator Switching / dimming actuator		
Display panel Display unit Display terminal Info display, e.g. 8-way		
Analogue actuator Analogue output Analogue device Regulator Control unit		

Product name	Abbrev.	Symbol
Pulsed switch e.g. for electrical heating/heating valve *) Function: Switching output ON/OFF (0-100%); i.e. if 60% is entered as an analogue value, the output is at ON for 60% of the time and at OFF for 40% of the time. (Time units of approx. 64 seconds are used.)		
Valve Proportional valve positioner		
Binary display		

Combination devices

n = number of inputs/outputs [1, 2, 3,...]

Product name	Abbrev.	Symbol
Combination of sensor functions in one device E.g. Temperature sensor and time value switch		
Switching device E.g. binary input and binary output		
Switching device E.g. dimmer and binary input		
Bus coupling unit module with timer and light intensity switch (with brightness sensor)		
Switching actuator with n-way infrared receiver		
Switching actuator with n-way pushbutton		
Dimming actuator with n-way pushbutton		
Blind actuator with n-way pushbutton		

Appendix D Regulations, standards and requirements

DIN VDE 1000-10	Safety requirements for persons working in the field of electrical engineering
DIN VDE 0100	Erection of power installations with rated voltages below 1000 V
-200	– Definitions
-410	– Protective measures; protection against electric shock
-420	– Protective measures; protection against thermal effects
-430	– Protective measures; protection of cables and cords against overcurrent
-510	– Selection and erection of equipment; common rules
-520	– Selection and erection of equipment; wiring systems
-610	– Verification; initial verification
-725	– Auxiliary circuit
DIN EN 501 10-1	Operation of power installations
DIN VDE 0105	(operation of electrical installations)
-1	– General requirements
DIN VDE 0106	Protection against electric shock
-1	– Classification of electrical and electronic equipment
-100	– Actuating members positioned close to parts liable to shock
-101	– Basic requirements for protective separation in electrical equipment

DIN VDE 0110	Insulation co-ordination for equipment within low-voltage systems
-1	– Fundamental requirements
DIN VDE 0160	Electronic equipment for use in electrical power installations and their assembly into electrical power installations
DIN VDE 0185	Lightning protection system
-1	– General data with regard to installation
V-100	– Protection of structures against lightning (tentative standard)
E-102	– General principles; guide; planning, set-up, maintenance, testing
E-103	– Protection against electromagnetic lightning pulses (LEMP)
V-110	– Manual for testing lightning protection systems (tentative standard)
DIN VDE 0207	Insulating and sheathing compounds for cables and flexible cords
DIN VDE 0470-1 EN 60529 DIN EN 50102	Degrees of protection provided by enclosures (IP code)
VDE 0470-100	Degrees of protection provided by enclosures for electrical equipment against external mechanical loads (IK code)
DIN VDE 0472-508	Dielectric test on cables, wires and flexible cords for power installations.
DIN VDE 0603	Consumer units and meter panels, 400VAC
-1	– Consumer units and meter panels

DIN VDE 0604	Ducts mounted on walls and ceilings for electrical installations
-1	– General requirements
DIN EN 50086-1 VDE 0605-1	Conduits and fittings for electrical installations
DIN VDE 0606	Connecting material up to 600 V
-1	– Installation boxes for accommodation of equipment and/or connecting terminals
DIN EN 60999 DIN VDE 0609-1	Connection material; safety requirements for terminal screw points and screwless terminal points for electrical copper wire
DIN VDE 0641-11	Circuit breakers for overcurrent protection for household and similar applications
DIN EN 60099 DIN VDE 0675	Guiding principles for overvoltage protective devices
-1	– Non-linear resistor-type lightning arresters for alternating voltage networks
E-6	– Surge arresters for use in a.c. supply systems with rated voltages ranging from 100 V to 1000 V
DIN VDE 0800	Telecommunications
-1	– Requirements and tests for the safety of facilities and apparatus
-2	– Earthing and equipotential bonding
-4	– Erection of telecommunication lines
DIN VDE 0815	Installation cables and lines for telecommunications and information processing systems

DIN EN 50090	Home and Building Electronic Systems (HBES)
-2-1	– System overview; System architecture
-2-2	– System overview; General technical requirements
DIN V VDE 0829	
-100	– Standardization structure; Definitions
-230	– System overview; General technical requirements for installation devices
-240	– Technical report – Guidelines for the specialised laying of cables with twisted pairs, class 1
-521	– Twisted pair class 1; Safety layer
-522	– Bus line with twisted pair class 1
DIN EN 50081 / VDE 0839-81	Electromagnetic compatibility (EMC); Generic emission standard
-1	– Residential, commercial and light industry
-2	– Industrial environment
DIN EN 50082 / VDE 0839-82	Electromagnetic compatibility (EMC); Generic noise immunity standard
-1	– Residential, commercial and light industry
-2	– Industrial environment
DIN VDE 0845	Protection of telecommunications systems against lightning, electrostatic discharges and overvoltages from electric power installations
-1	– Provisions against overvoltages
E-2	– Requirements and tests of overvoltage protection devices and telecommunication apparatus

DIN 18015	Electrical installations in residential buildings
-1	– Fundamentals of planning and design
-2	– Type and scale of minimum equipment
-3	– Layout of cabling and electrical equipment
DIN 19226	Automatic control engineering
-1	– Definitions, fundamentals
supplement 1	– Keyword index
DIN 19246	Measurement, logic and sequence control, closed-loop control; project handling; terminology
DIN 31051	Maintenance; terms and measures
DIN 32541	Operation of machines and comparable technical equipment; terms used for operator activities and functions
DIN V 32734	Digital automation for technical installations in buildings; General requirements for design, planning and execution (digital building services automation)
DIN 40719	Connection diagrams
-2	– Identification of electrical equipment
DIN 40900	Graphical symbols for wiring documents (symbols for contact units and switching devices)
DIN 43871	Small distribution boards for built-in devices up to 63A

DIN 43880	Built-in devices for electrical installation; Enclosure and mounting dimensions
DIN 49073	Apparatus sockets made of metal or insulating materials for the connection of installation equipment of up to 16A, 250V
-1	– Main dimensions
DIN EN 50022	Industrial low-voltage switchgear; Mounting rails, DIN rails, 35 mm width for snap-on mounting of devices
DIN EN 61082	Documents in electrical engineering
-1	– General rules
FTZ 731 TR1	Distributing pipes and other concealed conduits for telecommunication lines in buildings; Technical description
VBG 4	Rules for prevention of accidents, "Electrical Installations and Equipment"

Please note:

Draft standard (e.g. DIN E VDE)
Recommendation for a standard. It is generally used as a basis to raise objections to, to vote on or to approve a standard.
Because the intended standard may differ from the existing draft, such drafts are used at one's own responsibility and must be specially arranged.

Tentative draft (e.g. DIN V VDE)
A tentative draft is the result of a standards session, which because of certain reservations concerning the content or DIN having taken up a position opposed to it, has not been issued as a standard. Tentative standards deal with subjects that are in need of being standardised. Linked to this is the expectation that tentative standards will at some point be converted into accepted standards after the necessary changes according to the usual procedures, or alternatively withdrawn.

International standard (e.g. DIN EN)
Standard that has been accepted by an international standardisation committee and is available to the public.

Appendix E Selection of relevant literature on the subject of electrical installations

Title	ISBN	Publishing house
EIB manual Project Engineering for *EIB* Installations, Basic principles		WFE, Frankfurt, Germany
EIB manual Project Engineering for *EIB* Installations, Applications		WFE, Frankfurt, Germany
Mathematical and Electrotechnical Fundamentals*	3-8023-1571-5	Vogel
Electrical Installation Technology*	3-8023-1525-1	Vogel
Household Appliances, Lighting and Air Conditioning Technology*	3-8023-1580-4	Vogel
Electrical Measurement and Closed-Loop Control*	3-8023-1463-8	Vogel
Digital Technology*	3-8023-1440-9	Vogel

Title	ISBN	Publishing house
Microprocessor Technology*	3-8023-1453-0	Vogel
Electrical Control and Drive Technology*	3-8023-1556-1	Vogel
Taking Measurements, Protective Measures DIN VDE 0100*	3-7905-0702-4	Pflaum
Electrical Installation in Practice*	3-7905-0519-6	Pflaum
EIB Building Systems Engineering*	3-7905-0712-1	Pflaum
Modern Electrical Installations*	3-7785-2410-0	Hüthig
Compliant Electrical Installations in Residential, Commercial and Industrial Buildings*	3-7785-2410-0	Hüthig
Building Systems Engineering in Residential and Functional Buildings with *EIB**	3-7785-2391-0	Hüthig
Electrical Installations in Residential Buildings, VDE Regulations*	3-8007-2108-2	VDE

Title	ISBN	Publishing house
Safety Tests in Electrical Installations with Voltages below 1000 V*	3-8007-2027-2	VDE
Security in Telecommunications and Information Engineering*	3-8007-1716-6	VDE
The Electricians Selection* (with subscription)		VDE
The Electricians Trade, DIN Standards*	3-410-13548-0	Beuth
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Electrical Installation Handbook	3-8009-4138-4	Siemens

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as at March 1998

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Appendix G Requirements for the EIB bus line

1	Regulation	The bus line must meet the conditions of IEC 189-2 or the equivalent national regulation, if not otherwise stipulated in the following list of requirements.
2	Conductor diameter 1)	Minimum: 0.8 mm, maximum: 1.0 mm
3	Conductor material	Copper, single and multi-wired
4	Line layout	
4.1	External covering	Casing is required
4.2	Wires	2 = One twisted pair 4 = Two twisted pairs Type 1: 2 twisted pairs, paired Type 2: 4 twisted wires, spiral quad All wires should have different colours
4.3	Electric shock	Minimum 5/m
4.4	Shielding	Necessary Shielding should cover the entire circumference Tracer: min. diameter 0.4 mm

5	Capacity conductor / conductor	Max. 100 nF/km (800 Hz, 20°C)
6	Crosstalk attenuation	1 kHz: greater than 80 dB 10 kHz: greater than 70 dB 100 kHz: greater than 60 dB
7	Tension	2-wire line: min. 50 N 4-wire line: min. 100 N
8	Insulating resistance	100 MOhm x km (20°C) or 0.011 MOhm x km (70°C)
9	Testing voltage wire / wire	800 V
10	Additional high-voltage test	Test according to DIN VDE 0472-508, test type A or HD 21.1 S2 and HD 21.2 S2 However: – Testing voltage: 2.5 kV 4 kV 50 Hz – Testing duration: 5 minutes 1 minute – Test set-up: All wires and shielding connected to the external surface of the covering; in a water bath
11	Quality control system of the manufacturer	At least DIN ISO 9002, corresponds to EN 29002, corresponds to ISO 9002

1) A bus connection terminal should be used; see chapter 2.5.1.2.4

Remarks:
The DIN V VDE 0829 standard specifies the value of the testing voltage for the additional high-voltage test at 2.5kV .

The following lines are recommended for the *EIB* application (see chapters 2.5.1.2.2 and 2.5.3):

YCYM 2x2x0.8 Testing voltage 4 kV	*EIB* specification, for laying arrangements see Table 2.5-2
J-Y(St)Y 2x2x0.8 Testing voltage 2.5 kV	*EIB* specification, for laying arrangements see Table 2.5-2
JH(St)H 2x2x0.8	Halogen-free line, lay with separation
A-2Y(L)2Y or A-2YF(L)2Y	Underground telecommunications cable, lay outside

Appendix H Load characteristics for EIB powerline

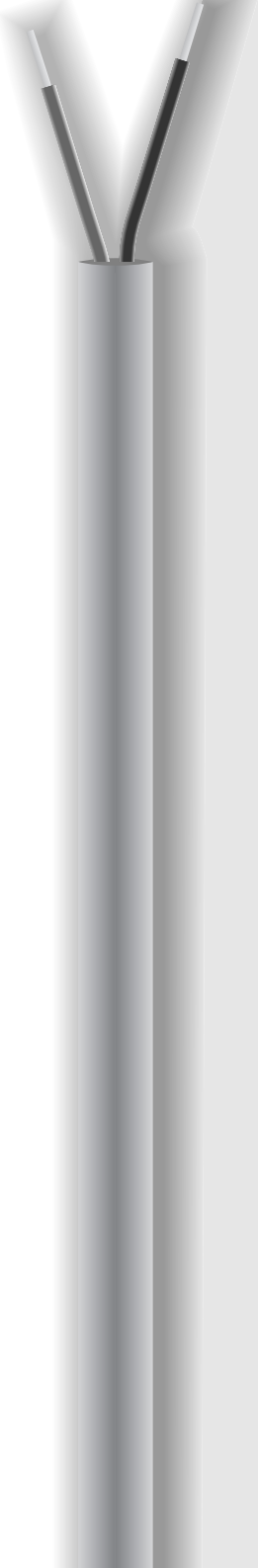
Characteristic K = 1 (devices with low noise load)	– Conventional plugable power supplies – Conventional low-voltage halogen transformers – Filament lamps – Blind and awning drives – *EIB powerline* devices
Characteristic K = 10 (devices with mid-level noise load)	– Small electrical devices such as for example, fan heaters, irons and other household devices – Electric ovens – Refrigerators and freezers – Power tools and other small machines – Garden tools (e.g. lawnmower) – Vacuum cleaners – Fans and ventilators – HiFi and video equipment – Fax machines – Energy-saving lamps
Characteristic K = 50 (device with high noise load)	– Heating controls – Personal computers (PCs) – Monitors – Televisions – Copiers – Electronic transformers – Fluorescent lamps with electronic ballast – Air conditioning units – Solariums

Characteristic K = 1000 (critical consumers)	– Inverters – Carrier frequency transmission systems, such as for example, mains-based baby intercoms – UPS systems

This table only lists a small number of the appliances that could be used in practice. In all situations where critical consumers are included in the system, a field trial will provide information on the quality of transmission.

Index

The index contains all sub-chapter headings that are not included in the list of the contents.



European Installation Bus

Project Engineering for EIB Installations

Applications

1st edition

Project Engineering for *EIB* Installations Applications

A preview

This document, "Project Engineering for *EIB* Installations, Applications" is aimed at technical staff and other interested parties who are already familiar with the fundamental principles of building systems engineering using *EIB*.

This manual illustrates to electricians, planners, manufacturers and operators alike just how flexible, adjustable, energy-saving, clear and installation friendly the *EIB* system is.

It contains selected examples of representative *EIB* installations.

It soon becomes clear that with the help of *EIB*, it is both possible and useful to create installations which cover many building disciplines, including water, gas and electricity.

All examples include statements on functional processes, links and addresses as well as recommendations on parameterisation.

Layout

Lighting controls
Blind, shutter and awning controls
Heating, ventilation and air conditioning system control
Load management
Monitoring, displaying, reporting and operating
Special applications

Contents

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