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AUTOMATION

User Manual

Configuring and installing the INTERBUS Inline product range

07/2008

Designation: IB IL SYS PRO UM E

Revision: 03

Order No.: 2743048

This user manual is valid for:

Inline Modular IO automation terminals for the INTERBUS bus system

Please observe the following notes

In order to ensure the safe use of the product described, you have to read and understand this manual. The following notes provide information on how to use this manual.

User group of this manual

The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

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Explanation of symbols used and signal words



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



DANGER

This indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

This indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The following types of messages provide information about possible property damage and general information concerning proper operation and ease-of-use.



NOTE

This symbol and the accompanying text alerts the reader to a situation which may cause damage or malfunction to the device, either hardware or software, or surrounding property.



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1 Documentation landscape for Inline Modular IO on INTERBUS

The documentation for Inline Modular IO is modular, providing you with the optimum information for your specific bus system or Inline terminal.



The documentation can be downloaded at www.download.phoenixcontact.com.

For a comprehensive list of the documentation, please refer to the ordering data (see "Ordering data" on page 8-3).

Terminal-specific documentation can be found in the download area for the corresponding device.

Make sure you always use the latest documentation.

The following documentation is available for the **INTERBUS** bus system in association with Inline Modular IO:

1.1 INTERBUS



"General introduction to the INTERBUS system" user manual, IBS SYS INTRO G4 UM E

This manual provides a general introduction to the INTERBUS system. This includes a description of the data transmission method and the topology, as well as an overview of the products.



"Configuring and installing INTERBUS" user manual, IBS SYS PRO INST UM E

This manual contains specifications for the configuration and installation of an INTERBUS system. It mainly describes the general specifications and the older product lines for use on INTERBUS (ST, RT, CT, SAB).



"INTERBUS & AUTOMATION - Terms and definitions" reference manual, IBS TERM RG UM E

This manual provides an overview of technical terms and definitions in the field of INTERBUS & AUTOMATION.



"INTERBUS fiber optic installation guidelines" data sheet, DB GB IBS SYS FOC ASSEMBLY

This data sheet contains technical data, installation guidelines, and assembly specifications for fiber optics. In addition, it also contains notes on power measurement and optical diagnostics, as well as a checklist for complete installation and a fiber optic measured value protocol.



**"INTERBUS addressing" data sheet,
DB GB IBS SYS ADDRESS**

This data sheet provides an overview of the addressing options for INTERBUS. In addition, it includes an overview of the assignment of process data, which is illustrated in the relevant terminal-specific data sheet, to the various control and computer systems.

1.2 Inline



"Automation terminals of the Inline product range" user manual, IL SYS INST UM E

This manual is the higher-level system manual for Inline and describes the use of terminals/modules in the Inline product range for all bus systems.

The following topics are covered:

- The device properties, which are the same for all bus systems
- Notes on the low voltage area
- Overview of the Inline product groups
- Structure and dimensions of Inline terminals
- Electrical potential and data routing
- Mounting and removal
- General technical data and ordering data
- Examples and tips



User manuals (system or special terminal)

The **IB IL SYS PRO UM E** user manual describes Inline Modular IO in association with the INTERBUS bus system. It provides information about all the bus-specific properties.

The additional user manuals describe a special Inline terminal (e.g., counter terminal, positioning terminal).

Each manual only describes the relevant terminal-specific special features. As the higher-level manual, the "IL SYS INST UM E" user manual also applies.



Quick Start Guides

A Quick Start Guide is available for various topics. A Quick Start Guide describes the startup of a system or a terminal step-by-step using an example (e.g., the Quick Start Guide for PC WorX describes an example project under INTERBUS).

Terminal-specific data sheets



The data sheet describes the specific properties of each Inline terminal. This includes at the very least:

- Function description
- Local diagnostic and status indicators
- Pin assignment/terminal point assignment and connection example
- Programming data/configuration data
- Technical data

"Summary of key data for Inline devices" data sheet, DB GB IB IL DEVICE LIST



This data sheet is also referred to as a device list.

In addition to terminal-specific data sheets, this data sheet also includes the key data of every Inline Modular IO device. This includes, for example:

- Programming data: ID code, length code, process data channel, I/O address area
- Error messages
- Power supply/current consumption

Application notes



Application notes provide additional information about special topics.

In conjunction with INTERBUS Inline terminals, these include, for example:

- General information about the safety-related segment circuit AH EN IL SAFE
- General information about use in zone 2 potentially explosive areas AH EN IL EX ZONE 2
- Information about firmware updates



Device-specific application notes are listed in the device-specific data sheet and are available in the download area for the relevant device.

Package slips



A package slip contains key information for the electrical installation of an Inline terminal or group of Inline terminals. This includes, for example:

- Short description
- Safety notes
- Mounting/removal
- Terminal point assignment
- Local diagnostic and status indicators

2 Integration of Inline into the INTERBUS system



This user manual is only valid in association with the IL SYS INST UM E user manual.
This user manual only describes the special features of an Inline system on **INTERBUS**.
For bus-neutral properties, please refer to the IL SYS INST UM E user manual.

2.1 The INTERBUS system

INTERBUS is a serial bus system that transmits data between control systems (e.g., PLCs, PCs, VMEbus computers, robot controllers, etc.) and spatially distributed I/O modules that are connected to sensors and actuators (operating and display units, drives, etc.).

INTERBUS has a ring structure. The ring structure enables data to be sent and received simultaneously.

INTERBUS is a single master system, i.e., a master (e.g., controller board, control terminal) controls all devices of an INTERBUS ring.

From the master, all devices are connected to the bus system. Each device has two separate lines for data transmission: one for forward data transfer and one for return data transfer. This eliminates the need for a return line from the last device to the first device, which is necessary in a simple ring system. The forward and return lines run in one bus cable. From the installation point of view, INTERBUS has a tree structure, as only one cable is led from one device to the next.

2.2 Example topology of an INTERBUS system

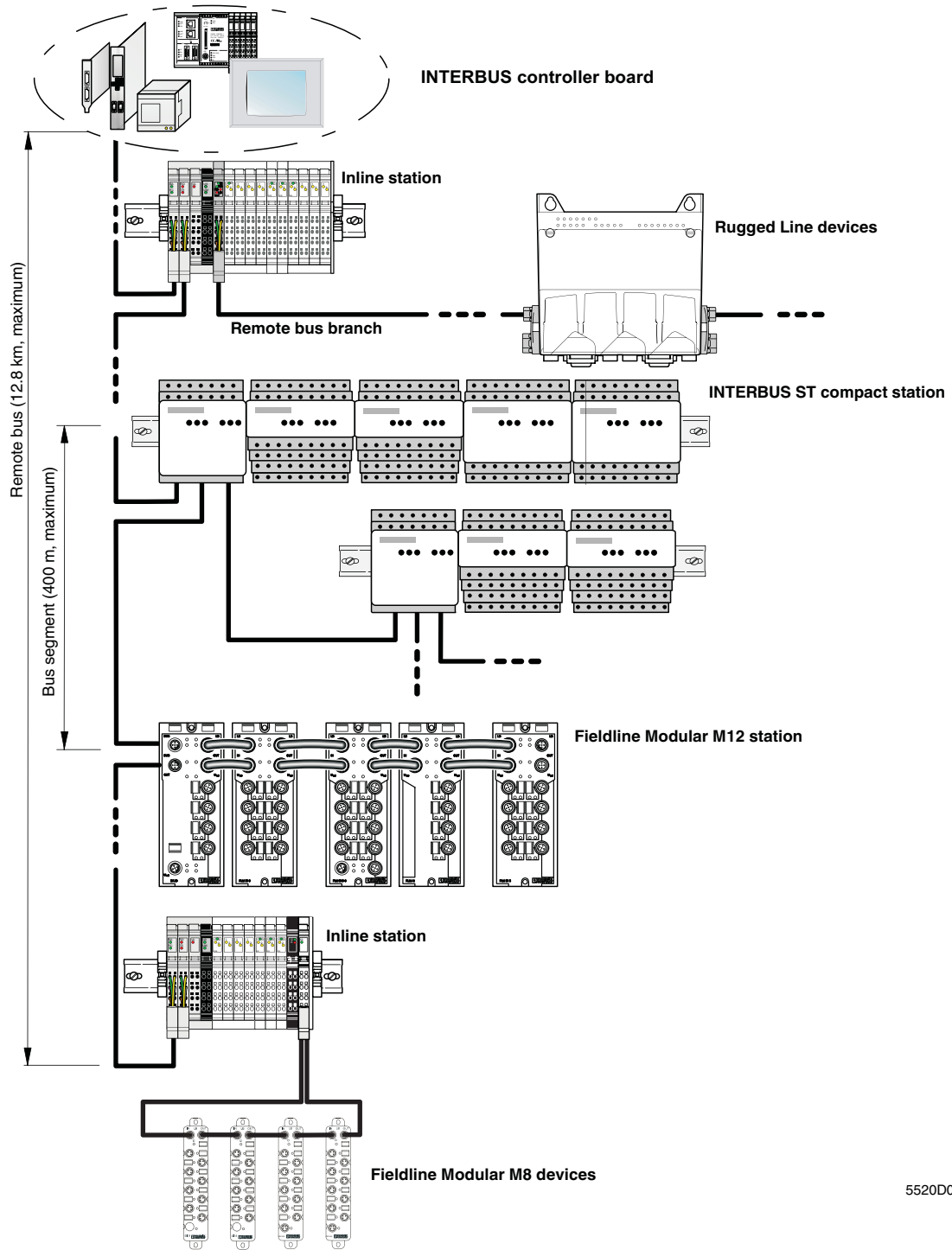


Figure 2-1 INTERBUS system

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Control technology	<p>Control technology from Phoenix Contact offers comprehensive networking options with INTERBUS. All control systems are suitable for central or distributed use.</p> <p>Basic tasks of control technology:</p> <ul style="list-style-type: none">– Transferring output data to the output modules– Receiving input data from the input modules– Monitoring INTERBUS– Sending error messages to the host system– Indicating diagnostic messages– Controlling the cyclic I/O protocol
– IEC 61131 embedded control systems	<p>Inline Controllers, Remote Field Controllers</p> <p>Additional tasks:</p> <ul style="list-style-type: none">– Compact control system for various performance classes– Programming via PC WorX– Integration into other systems via Ethernet supported
– PC-based IEC 61131 control systems	<p>Field Controllers, control panels, multi-functional control systems</p> <p>Additional tasks:</p> <ul style="list-style-type: none">– Control functions– System operation tailored to the application– Graphical user interface for operation and monitoring– Programming via PC WorX or high-level language
– Controller boards	<p>PC controller boards, PLC controller boards</p> <p>Additional tasks:</p> <ul style="list-style-type: none">– Connecting programmable logic controllers (PLCs) or computer systems (PC, VMEbus, etc.) to INTERBUS– Master function in the INTERBUS system– Controlling data traffic on the INTERBUS system, independent of the control or computer system in which it is installed
Bus terminal/bus coupler	<p>In the INTERBUS system, the head of an I/O station is referred to as a bus terminal module (e.g., ST) or bus coupler (e.g., IL) depending on the product group. The term bus coupler is used in this document, as this manual describes the Inline system.</p> <p>The first step in creating a modular I/O station is to connect a bus coupler to the INTERBUS remote bus. I/O modules may be installed branching off from this bus coupler, to create a local bus.</p> <p>A bus coupler divides the system into segments, thus enabling individual branches to be switched off during operation. It also supplies the communications power for the module electronics of the connected I/O modules.</p> <p>A bus coupler must be supplied with non-interruptible voltage. This means that the voltage must not be disconnected at the same time as the subsystem if the entire bus system is to continue operating. Supply voltage failure at a bus coupler stops the system and results in an error message for the bus segment.</p>

Tasks of the bus coupler:

- Coupling the remote bus and local bus
- Supplying the I/O modules with communications power
- Refreshing the data signal (repeater function)
- Electrical isolation of the bus segments
- Connecting or disconnecting the local bus via firmware
- Connecting or disconnecting the outgoing remote bus via firmware
- If necessary, indicating errors via a floating alarm output (e.g., buzzer, light signal)

Remote bus

The remote bus connects the controller board to the remote bus devices and interconnects the remote bus devices.

Remote bus devices are bus couplers, specific I/O modules or a mixture of both. Each has a local power supply and an electrically isolated outgoing INTERBUS segment.

Remote bus branch

A remote bus branch branches off the remote bus. A branch is connected to the main line of the remote bus via a special bus coupler. This bus coupler enables the connection and disconnection of the branching bus segment.

Local bus

A local bus is a bus connection that branches off from a remote bus via a bus coupler and interconnects the local bus devices. The bus coupler supplies the connected devices with communications power.

Local bus devices are I/O devices that are used to create a distributed substation in the control cabinet. The devices are connected to the remote bus via a bus coupler. Branching is not permitted within the local bus.

The maximum number of local bus devices depends on the bus coupler used.

Bus segment

A bus segment consists of a remote bus device and the I/O modules connected to it. The preceding cable is also part of the segment.

I/O modules

I/O modules connect INTERBUS to the sensors and actuators.



For additional information about the INTERBUS topology, please refer to the "General introduction to the INTERBUS system" user manual (IBS SYS INTRO G4 UM E) and the "Configuring and installing INTERBUS" user manual (IBS SYS PRO INST UM E).

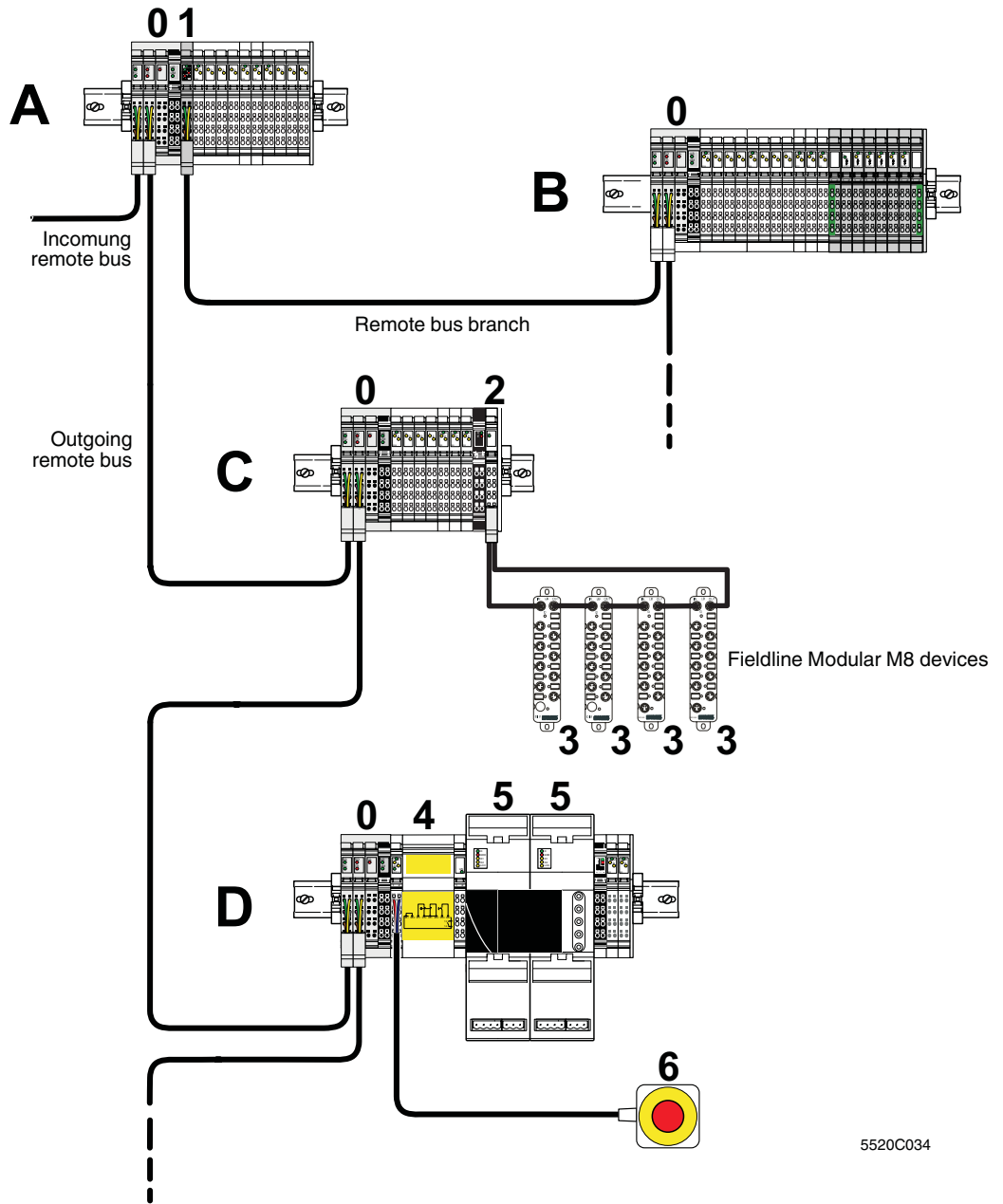
2.3 Inline, an INTERBUS product group

2.3.1 Features

Characteristic features of Inline:

- Can be easily installed side by side without tools
- Open, flexible, and modular structure
- Terminals of varying widths can be combined to create a time-saving, compact, and cost-effective station structure
- 2-slot terminals:
These terminals enable optimum adaptation to the desired configuration. They enable a flexible and compact station structure without unnecessary reserve installation space.
- 8-slot terminals:
These terminals provide a fast and effective station structure for larger stations.
- Functional orientation of the control box or control cabinet
The modular structure makes it possible to assemble standard function blocks in advance. Parts of the system can be started up independently of one another. This means that pretests can be carried out when the system is set up and the whole system can be adapted and extended.
- Automatic creation of isolated groups, potential circuits, and data circuits
- The amount of costly parallel wiring is reduced
Within a station, potential and data routing can be carried out without additional wiring.

2.3.2 Example of an Inline system



5520C034

Figure 2-2 Example of an Inline system

Figure 2-2 shows Inline stations for implementing different tasks within a system.

Key:

- A Station with terminals in the 24 V DC area
A remote bus branch branches off from this station.
 - B Station with terminals in the 24 V DC and 230 V AC areas
 - C Station with terminals in the 24 V DC area
In this station, Fieldline Modular M8 devices are integrated via a branch terminal.
 - D Station with safety terminal, power-level terminals, and terminals in the 24 V DC area
The power-level terminals are protected by an IB IL 24 SAFE 1-PAC safety terminal.
- 0 Bus coupler
 - 1 Terminal with remote bus branch
 - 2 Branch terminal
 - 3 Fieldline Modular M8 devices
 - 4 Safety terminal to ensure that the segment circuit is disconnected safely
 - 5 Power-level terminal
 - 6 Emergency stop button

2.3.3 System requirements

Controller board

A controller board with firmware Version 4.40 or later is required to operate the INTERBUS system. A Generation 4 (G4) controller board must therefore be used that can be operated with this firmware version.

ILC/FC/RFC

Firmware Version 4.4x or later is required to operate an Inline Controller, Field Controller or Remote Field Controller. A controller that can be operated with this firmware version must be used.

Software

For configuration, parameterization, and visualization of the system, CMD software Version 4.40 or later is available for standard controller boards. PC WorX software Version 1.30 or later is available for use with a Field Controller or Remote Field Controller.

2.3.4 Product description

Within the Inline product range, automation terminals are available for I/O functions, special functions, control functions, and power-level terminals.

Automation terminals consist of an electronics base and one or more connectors for connecting the I/O or power supply. The electronics base can be replaced without removing a single wire from the connector.

The Inline terminals are connected to INTERBUS via a bus coupler. Up to 63 local bus devices can be connected to a bus coupler as long as the limit parameters are not exceeded (see "Number of devices" on page 3-2).

Versions

The Inline product range offers terminals for all automation tasks:

- Bus couplers for connecting the Inline station to the INTERBUS remote bus. The remote bus can be connected using copper or fiber optic technology.
- Terminals with remote bus branch for opening a remote bus branch. The remote bus branch can be connected using copper or fiber optic technology.
- Supply terminals for supplying the supply voltages and segmenting the station (with and without fuse)
- Input and output terminals for digital and analog signals
- Function terminals (e.g., counters, incremental encoders)
- Power-level terminals for switching, protecting, and monitoring three-phase standard motors
- Branch terminals for integrating a Fieldline Modular local bus
- Control terminals with distributed intelligence
- Safety-related terminals
- INTERBUS Safety modules

Mounting location

Inline terminals (IP20 protection) are designed for use in closed housing. The compact structure means that most of the Inline terminals can be installed in standard terminal boxes.

Mounting

Inline terminals can be snapped onto DIN rails without tools. Potential and data jumpers are automatically created when the terminals are properly installed.

Bus connection

The Inline station is connected to the remote bus via a bus coupler. The bus is controlled by the Inline station through data routing.

I/O connection

The Inline terminals have connectors for 1, 2, 3, and 4-wire sensors or actuators. The wires are connected using spring-cage technology. For more detailed information, please refer to the individual sections.

3 Inline terminals specifically for INTERBUS

The following sections provide an overview of the Inline terminals for INTERBUS. For specific information about the individual terminals, please refer to the terminal-specific data sheets and the individual sections in this manual.

3.1 Bus coupler

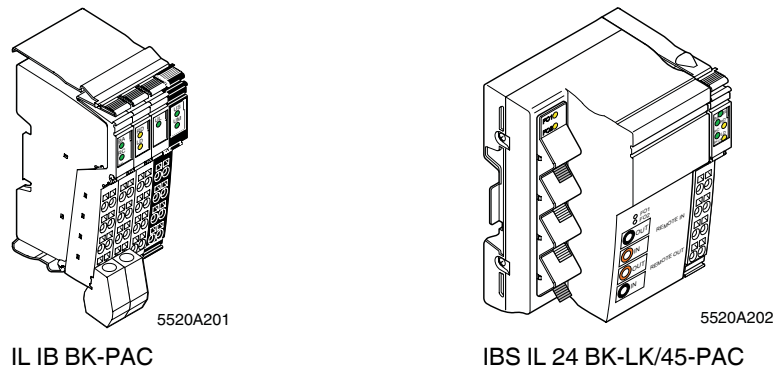


Figure 3-1 Examples of bus couplers

The bus coupler is available for connecting remote bus cables with copper or fiber optic technology.

Connecting the remote bus cables

Various bus couplers can be selected to connect to the INTERBUS remote bus via a copper connection. The INTERBUS remote bus is then connected via an Inline connector or a D-SUB connector.

Various bus couplers can be selected to connect to the INTERBUS remote bus via a fiber optic connection. The INTERBUS remote bus is then connected via an Inline F-SMA connector or an E2000 Compact fiber optic connector.

Functions

A bus coupler is used to amplify signals (repeater function), it divides the system into segments, and enables the outgoing remote bus and/or the connected station to be switched on or off during operation.

An Inline bus coupler forms the head of an Inline station. It connects the Inline station to the INTERBUS remote bus.

An Inline bus coupler provides the communications power U_L for the connected devices and the supply voltage for the connected analog terminals U_{ANA} from the supply voltage U_{BK} .

Number of devices

The maximum number of devices that can be connected to a bus coupler is determined by the following parameters:

- 1 The maximum number of devices in INTERBUS is limited to 512.
- 2 Up to 63 devices can be connected to an Inline bus coupler.
This number includes all the devices after the bus coupler, i.e., the Inline terminals, as well as the devices that are connected via a branch terminal. The number of devices on a connected remote bus branch does not affect the number of Inline station devices.
- 3 The maximum current that can be supplied by the bus coupler in the logic area (U_L) is limited (e.g., IL IB BK-PAC: 0.7 A).
- 4 The current carrying capacity of the potential jumpers is limited. For the limit values of the individual potential jumpers, please refer to the IL SYS INST UM E user manual.



Observe the specific values of each terminal when configuring an Inline station. This information is provided in the relevant terminal-specific data sheet and the DB GB IB IL DEVICE LIST data sheet.



The permissible number of devices that can be connected depends on the specific station structure. None of the parameters mentioned above may be exceeded.

End plate

The end plate is supplied as standard with the bus coupler. The end plate terminates an Inline station and must be placed after the last terminal of the station. It has no electrical function. It protects the station against ESD pulses and the user against dangerous contact voltages.

Protection

The bus coupler is protected against polarity reversal and surge voltage for the supplied voltages.

Functional earth grounding

The terminal is grounded when it is snapped onto the grounded DIN rail via the FE spring on the bottom of the terminal. This spring is connected to the FE potential jumper and to the terminal points for an FE connection (see "Required additional functional earth grounding").

Required additional functional earth grounding

In addition, connect the bus coupler to functional earth ground via the FE connection to ensure reliable functional earth grounding of the station even if the FE spring is dirty or damaged. Connect the terminal points for the FE connection to a grounded PE terminal (see the IL SYS INST UM E user manual).

Carrying capacity of the jumper contacts

The maximum current carrying capacity of the jumper contacts on the side is specified in the IL SYS INST UM E user manual.

Electrical isolation

The different potential areas within a bus coupler are shown in the figures below.



Figure 3-2 to Figure 3-4 show the electrical isolation in the bus coupler. The internal wiring is not important here. It is shown in the terminal-specific data sheet.



In Figure 3-2 to Figure 3-4, the graphic symbols are not explained because they are not important for indicating the electrical isolation. For an explanation of the graphic symbols, please refer to the corresponding data sheet or the IL SYS INST UM E user manual.

**Electrical isolation:
Incoming/outgoing
remote bus**

The incoming and outgoing remote bus interface potentials are isolated from one another and from the rest of the station electronics.

**Electrical isolation:
FE/FE capacitive**

FE and FE capacitive represent two individual isolated groups.

**Electrical isolation:
Other**

Other forms of electrical isolation depend on how the supply voltages are provided.

- 1 The bus coupler supply U_{BK} and the I/O supply U_M/U_S are supplied from separate power supply units:

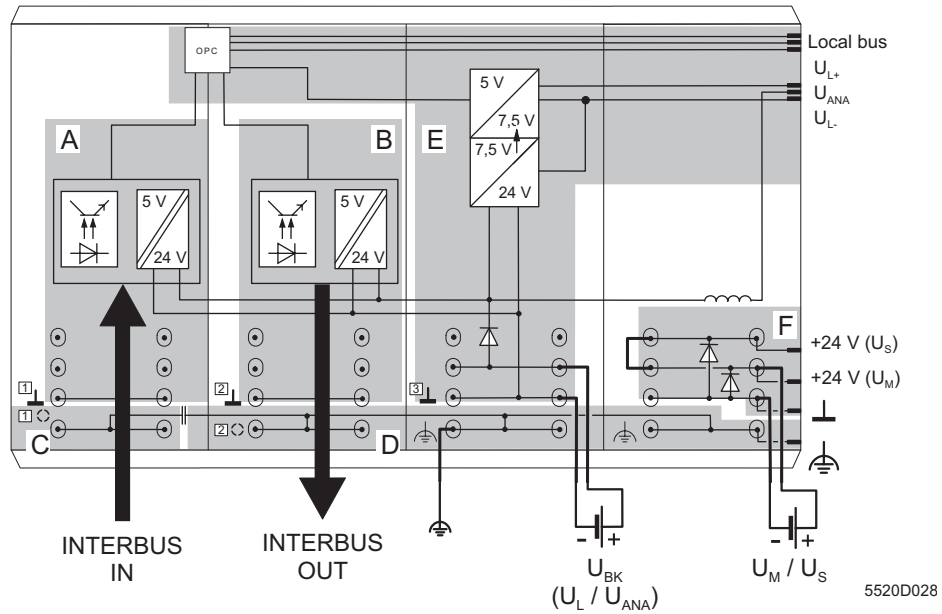


Figure 3-2 Electrical isolation in the IBS IL 24 BK-T/U-PAC bus coupler (separate power supply units)

Potential areas:

- A Area for incoming remote bus
- B Area for outgoing remote bus
- C Area for functional earth ground (FE) capacitive
- D Area for functional earth ground (FE)
- E Area for bus coupler supply U_{BK} from which the communications power U_L and the analog terminal supply U_{ANA} are generated
- F Area for the I/O voltages U_M and U_S

Electrical isolation can also be achieved if the power supply U_M/U_S is supplied via a power terminal from a separate power supply unit.

- 2 The bus coupler supply U_{BK} and the I/O supply U_M/U_S are supplied from one power supply unit:

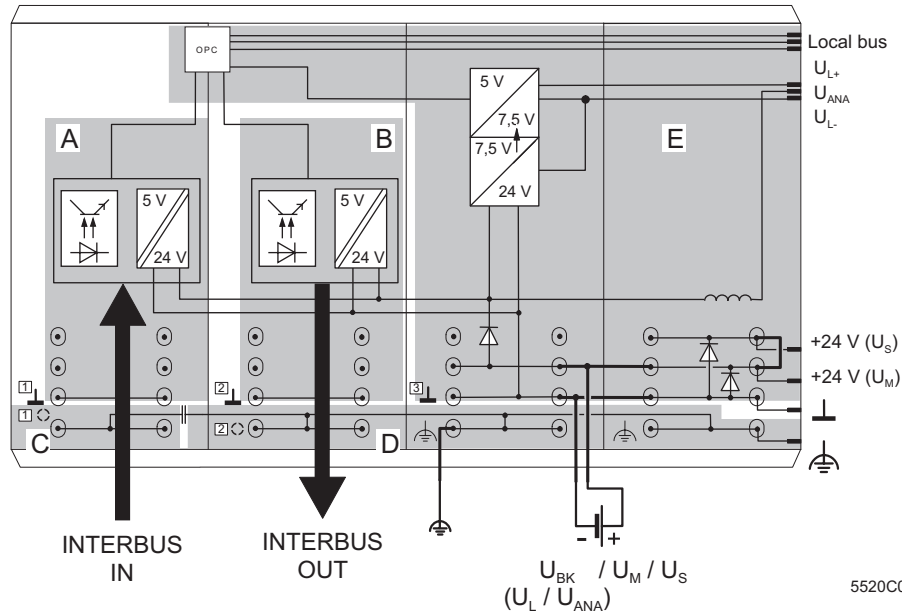


Figure 3-3 Electrical isolation in the IBS IL 24 BK-T/U-PAC bus coupler (one power supply unit)

Potential areas:

- A Area for incoming remote bus
- B Area for outgoing remote bus
- C Area for functional earth ground (FE) capacitive
- D Area for functional earth ground (FE)
- E Area for the bus coupler supply U_{BK} from which the communications power U_L and analog terminal supply U_{ANA} are generated **not isolated** from the I/O voltages U_M and U_S