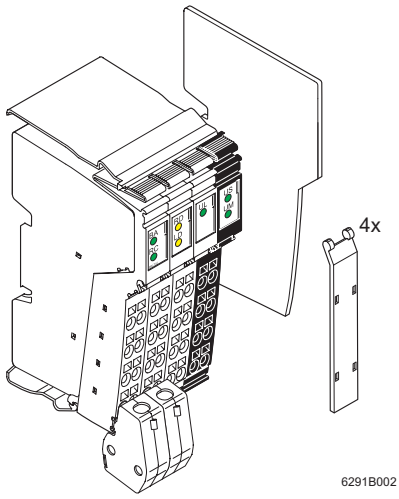
IBS IL 24 BK-T/U ...



Inline Bus Coupler for INTERBUS; Remote Bus Connections Using Copper Cables and Inline Connectors

AUTOMATIONWORX

Data Sheet
6291_en_02

Description

The bus coupler connects an Inline station to the INTERBUS remote bus and provides the supply voltages for the connected devices.

Features

- Remote bus connections using copper cables
- Can supply an Inline station with all of the required 24 V voltages for low-level signals
- Electrical isolation of the remote bus segments
- Automatic configuration of the outgoing interface as remote bus or local bus interface
- Supports the connection of up to 15 terminals with remote bus branch
- Approved for the use in potentially explosive areas (observe the notes on page 11)

The end plate is supplied with the bus coupler. Place this plate at the end of the Inline station. The end plate has no electrical function. It protects the station from ESD pulses and the user from dangerous voltage.

This data sheet is only valid in association with the IB IL SYS PRO UM E user manual.

Make sure you always use the latest documentation.
It can be downloaded at www.download.phoenixcontact.com.

A conversion table is available on the Internet at
www.download.phoenixcontact.com/general/7000_en_00.pdf.

This data sheet is valid for the products listed on the following page:

Ordering Data

Products

Description	Type	Order No.	Pcs./Pkt.
INTERBUS Inline bus coupler; complete with accessories (connectors, labeling fields and end plate); transmission speed of 500 kbps	IBS IL 24 BK-T/U-PAC	2861580	1
INTERBUS Inline bus coupler; without accessories; transmission speed of 500 kbps	IBS IL 24 BK-T/U	2742094	1
INTERBUS Inline bus coupler; complete with accessories (connectors, labeling fields and end plate); transmission speed of 2 Mbps	IBS IL 24 BK-T/U-2MBD-PAC	2862000	1
INTERBUS Inline bus coupler; without accessories; transmission speed of 2 Mbps	IBS IL 24 BK-T/U-2MBD	2855240	1

One of the listed connector sets is needed for the complete fitting of the IBS IL 24 BK-T/U and IBS IL 24 BK-T/U-2MBD terminals.

Accessories

Description	Type	Order No.	Pcs./Pkt.
Connector set for Inline bus coupler, copper	IB IL BK-PLSET	2727792	1
Connector set for Inline bus coupler, copper, with color print	IB IL BK-PLSET/CP	2860374	1

Documentation

Description	Type	Order No.	Pcs./Pkt.
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	2743048	1
"Inline Terminals for Use in Zone 2 Potentially Explosive Areas" application note	AH EN IL EX ZONE 2	7217	1

Technical Data

General Data	
Housing dimensions (width x height x depth)	48.8 mm x 120 mm x 71.5 mm
Weight	142 g (without connector), 214 g (with connector)
Permissible temperature (operation)	-25°C to +55°C
Permissible temperature (storage/transport)	-25°C to +85 °C
Permissible humidity (operation/storage/transport)	10% to 95% according to DIN EN 61131-2
Permissible air pressure (operation/storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Class of protection	Class 3 according to EN 61131-2, IEC 61131-2
Connection data for connectors	
Connection type	Spring-cage terminals
Conductor cross-section	0.2 mm^2 to 1.5 mm^2 (solid or stranded), 24 - 16 AWG

Interfaces (INTERBUS)	
Remote Bus	
Incoming remote bus	Copper cable (RS-422), connected with Inline shield connector; supply electrically isolated; shielding connected with a capacitor to functional earth ground
Outgoing remote bus	Copper cable (RS-422), connected with Inline shield connector; supply electrically isolated; shielding connected directly to functional earth ground
Recommended cable lengths	See INTERBUS System Data

Interfaces (INTERBUS) (Continued)

Branch/Local Bus

Connection	Through data routing
Level	5 V CMOS signal level
Number of Inline terminals that can be connected	
Limitation through software	63, max.
Limitation through power supply unit	Maximum logic current consumption of the connected local bus modules: $I_{max} \leq 2$ A DC

Observe the current consumption of the modules

Observe the logic current consumption of each device when configuring an Inline station. It is specified in every terminal-specific data sheet. The current consumption can differ depending on the individual terminal. The permissible number of devices that can be connected therefore depends on the specific station structure.

Functional

Interface configuration (internal)	When another terminal is snapped next to this terminal, the bus coupler configures the interface automatically. If the next device is a terminal with a remote bus branch, the interface is configured as a remote bus interface. For every other device (e.g., I/O terminal) the interface is configured as a local bus interface with diagnostics.

Transmission Speed

IBS IL 24 BK-T/U-PAC	500 kbps
IBS IL 24 BK-T/U	500 kbps
IBS IL 24 BK-T/U-2MBD-PAC	2 Mbps
IBS IL 24 BK-T/U-2MBD	2 Mbps

Common Data for 24 V Main Supply, Segment Supply, and Bus Coupler Supply

Connection	Through Inline connector; Terminal Point Assignment, see page 8
Connection method	Spring-cage terminals
Recommended cable lengths	30 m, max.; routing cables through outdoor areas is not admissible
Continuation	Via potential routing
Special demands on the voltage supply	U_M/U_S are electrically isolated from the bus coupler supply U_{BK} if they are supplied separately. This is only ensured if two separate power supply units are used.
Nominal value	24 V DC
Tolerance	-15% / +20% (according to EN 61131-2)
Ripple	± 5%
Permissible range	19.2 V to 30 V

Provide an external fuse for the 24 V area

Each 24 V area must be protected externally. The power supply unit must be able to supply 4 times (400%) the nominal current of the external fuse, to ensure that the fuse blows safely in the event of an error.

24 V Main Supply/24 V Segment Supply

Response in the event of voltage dips and interrupts	Voltages (main and segment supply) that are transferred from the bus coupler to the potential jumpers follow the supply voltages without delay.
Current carrying capacity	8 A, max.

24 V Bus Coupler Supply

Minimum current consumption at nominal voltage	0.10 A DC (At no-load operation, i.e., incoming remote bus connected, no local bus devices connected, bus inactive)
Maximum current consumption at nominal voltage	1.25 A DC consisting of: 0.75 A DC for communications power 0.5 A DC for analog voltage supply

U_L (7.5 V) and U_{ANA} (24 V) are generated from the 24 V bus coupler supply U_{BK}.

Communications and Analog Supply

Communications Power (Potential Jumpers)

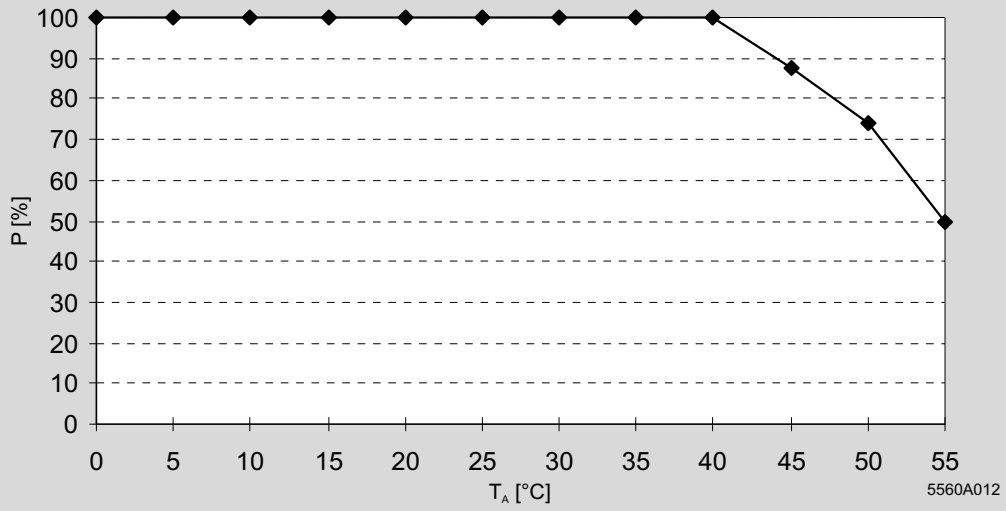
Nominal value	7.5 V DC
Tolerance	± 5%
Ripple	± 1.5%
Maximum output current	2 A DC (observe derating)
Safety equipment	Electronic short-circuit protection

Analog Supply (Potential Jumper)

Nominal value	24 V DC
Tolerance	-15% / +20%
Ripple	± 5%
Maximum output current	0.5 A DC (observe derating)
Safety equipment	Electrical short-circuit protection

Derating of the Communications Power and the Analog Terminal Supply

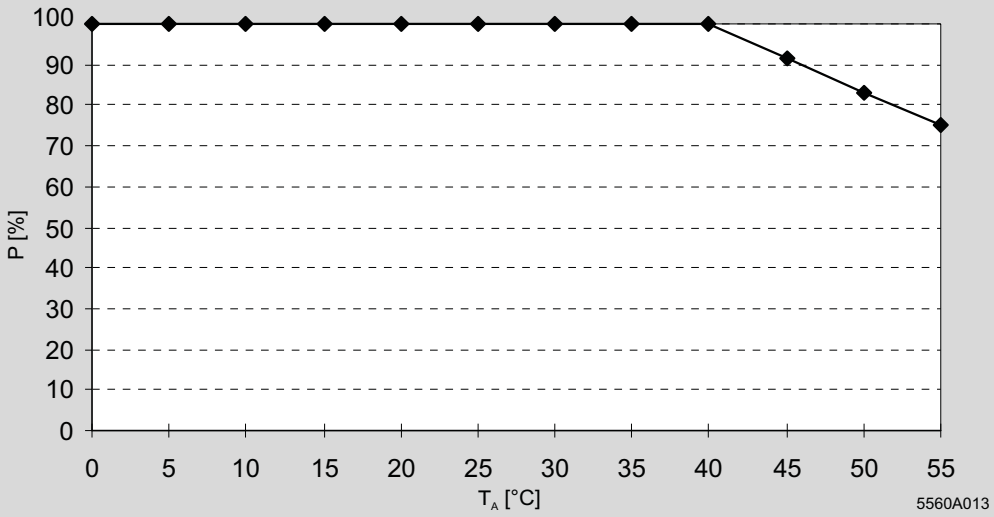
- I/O Supply Current Carrying Capacity at the Bus Coupler of 8 A, Maximum



P [%]	Current carrying capacity of the communications power (U_L) and the analog supply (U_{ANA}) in %
T_A [°C]	Ambient temperature in °C

Derating of the Communications Power and the Analog Terminal Supply (Continued)

- I/O Supply Current Carrying Capacity at the Bus Coupler of 4 A, Maximum



P [%]	Current carrying capacity of the communications power (U_L) and the analog supply (U_{ANA}) in %
T_A [°C]	Ambient temperature in °C

Power Dissipation

Formula to Calculate the Power Dissipation of the Electronics

$P_{EL} = P_{BUS} + P_{PERI}$

$$P_{EL} = 1.6\ W + \left(1.1\frac{W}{A} \times \sum_{n=1}^{a} I_{Ln}\right) + \left(0.7\frac{W}{A} \times \sum_{m=1}^{b} I_{Lm}\right)$$

Where	
P_{EL}	Total power dissipation in the terminal
P_{BUS}	Power dissipation for bus operation without I/O load (constant)
P_{PERI}	Power dissipation with I/O connected
I_{Ln}	Current consumption of device *n* from the communications power
n	Index of the number of connected devices (n = 1 to a)
a	Number of connected devices (supplied with communications power)
$\sum_{n=1}^{a} I_{Ln}$	**Total current consumption of the devices from the 7.5 V communications power (2 A, maximum)**
I_{Lm}	Current consumption of the device *m* from the analog supply
n	Index of the number of connected analog devices (n = 1 to b)
b	Number of the connected analog devices (supplied with analog voltage)
$\sum_{m=1}^{b} I_{Lm}$	**Total current consumption of the devices from the 24 V analog power (0.5 A, maximum)**

Power Dissipation/Derating

Using the maximum currents 2 A (logic current) and 0.5 A (current for analog terminals) in the formula to calculate the power dissipation when the I/O is connected results in the following:

P_{PERI} = 2.2 W + 0.35 W = 2.55 W

2.55 W correspond to 100% current carrying capacity of the power supply unit in the derating curves on page 4.

Make sure that the indicated nominal current carrying capacity in the derating curves is not exceeded when the ambient temperature is above 40°C. Corresponding to the formula, the total current carrying capacity of the connected I/O (P_{PERI}) is relevant. If, for example, no current is drawn from the analog supply, the percentage of current coming from the communications power may be increased.

Example:

Current carrying capacity of the I/O supply: 8 A

Ambient temperature: 55 °C

Nominal current carrying capacity of communications power and analog supply: 50% according to the diagram

I_{LLogic} = 1 A, $I_{LAnalog}$ = 0.25 A

P_{PERI} = 1.1 W + 0.175 W

P_{PERI} = 1.275 W (corresponds to 50% of 2.55 W)

Possible logic current if the analog supply is not loaded:

P_{PERI} = 1.1 W/A x I_{LLogic}+ 0 W

P_{PERI} / 1.1 W/A = I_{LLogic}

I_{LLogic} = 1.275 W / 1.1 W/A

I_{LLogic} = 1.159 A

Error Messages to the Higher-Level Control or Computer System

Peripheral fault	Yes, if the segment voltage U_S is not present

Safety Equipment

Surge voltage (segment supply/main supply/bus coupler supply)	Input protective diodes (can be destroyed by permanent overload) Pulse loads up to 1500 W are short circuited by the input protective diode.
Polarity reversal (segment supply/main supply)	Parallel diodes for protection against polarity reversal; in the event of an error the high current through the diodes causes the preconnected fuse to blow.
Polarity reversal (bus coupler supply)	Serial diode in the lead path of the power supply unit; in the event of an error only a low current flows. In the event of an error, no fuse trips within the external power supply unit.

If you want to protect the bus coupler supply U_{BK}, use a 2 A medium blow fuse.

Electrical Isolation/Isolation of the Voltage Areas

Common Potentials

When providing the 24 V bus coupler supply separately from the 24 V main supply/24 V segment supply	Main and segment supply galvanically have the same potential. From the bus coupler onwards, common ground is led through the potential jumper to the devices as the reference ground GND. Bus coupler supply, analog supply, and 7.5 V communications power have the same potential. From the bus coupler onwards, common ground is led through the potential jumper to the devices as the reference ground LGND.
When providing the 24 V bus coupler supply by jumpering the 24 V main supply/24 V segment supply	Main supply, segment supply, 24 V analog supply, and 7.5 V communications power galvanically have the same potential. From the bus coupler onwards, common ground is led through the potential jumper to the devices as reference ground LGND for the communications power and analog supply and separately as reference ground GND for the supply and segment level.

Separate Potentials

When providing the 24 V bus coupler supply separately from the 24 V main supply/24 V segment supply	The bus coupler supply is physically and therefore electrically isolated from the main and segment supply. The interface supplies for the incoming and outgoing remote bus are electrically isolated from one another and from the supplies.
When providing the 24 V bus coupler supply by jumpering the 24 V main supply/24 V segment supply	The bus coupler has two interface supplies for the incoming and outgoing remote bus that are electrically isolated from one another and from the primary/secondary supply. The main supply is electrically isolated from the interface supplies.

Electrical Isolation/Isolation of the Voltage Areas	
Test Distance	**Test Voltage**
5 V supply incoming remote bus / 5 V supply outgoing remote bus	500 V AC, 50 Hz, 1 min
5 V supply incoming remote bus / 7.5 V communications power, 24 V analog supply, 24 V bus coupler supply	500 V AC, 50 Hz, 1 min
5 V supply incoming remote bus / 24 V main supply, 24 V segment supply	500 V AC, 50 Hz, 1 min
5 V supply incoming remote bus / functional earth ground	500 V AC, 50 Hz, 1 min
5 V supply outgoing remote bus / 7.5 V communications power, 24 V analog supply, 24 V bus coupler supply	500 V AC, 50 Hz, 1 min
5 V supply outgoing remote bus / 24 V main supply, 24 V segment supply	500 V AC, 50 Hz, 1 min
5 V supply outgoing remote bus / functional earth ground	500 V AC, 50 Hz, 1 min
7.5 V communications power, 24 V analog supply, 24 V bus coupler supply / functional earth ground	500 V AC, 50 Hz, 1 min
7.5 V communications power, 24 V analog supply, 24 V bus coupler supply / 24 V main supply, 24 V segment supply	500 V AC, 50 Hz, 1 min
24 V main supply, 24 V segment supply / functional earth ground	500 V AC, 50 Hz, 1 min

Approvals

For the latest approvals, please visit www.download.phoenixcontact.com or www.eshop.phoenixcontact.com.

Local Diagnostic Indicators

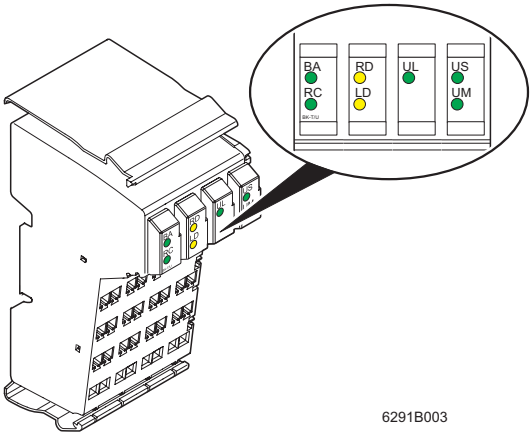


Figure 1 Diagnostic indicators of the terminal

Des.	Color	Meaning
BA	Green	Bus active
RC	Green	Remote bus cable check
RD	Yellow	Outgoing remote bus disabled
LD	Yellow	Local bus/remote bus branch disconnected in isolation after error
UL	Green	24 V bus coupler supply/7.5 V communications power /interface supply
US	Green	24 V segment supply
UM	Green	24 V main supply

Terminal Point Assignment

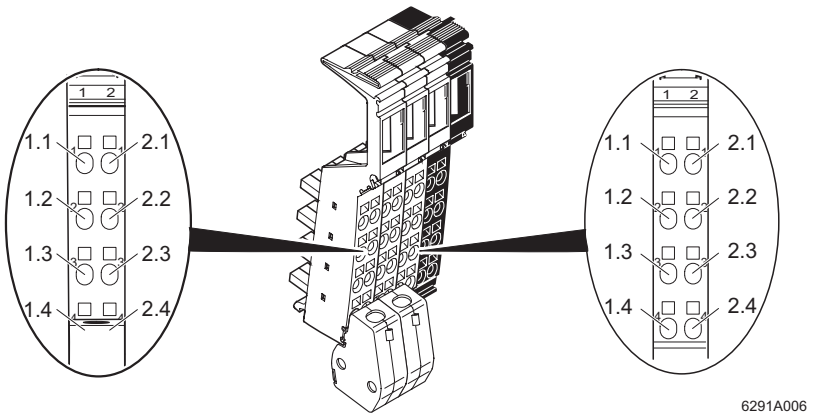


Figure 2 Terminal point assignment

Terminal Point	Assignment		Remark/ Wire Color in the INTERBUS Standard Cable
Connector 1	**Incoming Remote Bus**		
1.1	/DO1	Receive	Green
2.1	DO1	Receive	Yellow
1.2	/DI1	Send	Pink
2.2	DI1	Send	Gray
1.3	F-GND	Reference potential	Brown
2.3			Not used
1.4, 2.4	Shield		Shield potential is connected with a capacitor to functional earth ground (FE) of the potential jumper.
Connector 2	**Outgoing Remote Bus**		
1.1	/DO2	Send	Green
2.1	DO2	Send	Yellow
1.2	/DI2	Receive	Pink
2.2	DI2	Receive	Gray
1.3	R-GND	Reference potential	Brown
2.3			Not used
1.4, 2.4	Shield		Shield potential is connected directly to functional earth ground (FE) of the potential jumper.

Terminal Point	Assignment		Remark/ Wire Color in the INTERBUS Standard Cable
Connector 3	**Bus Coupler Supply**		
1.1, 2.1	Reserved		
1.2, 2.2	24 V DC	U_{BK}	24 V bus coupler supply Supply of the bus coupler power supply unit
1.3, 2.3	BK-GND	BK-GND	GND of the bus coupler supply This potential is reference ground for the bus coupler electronics.
1.4, 2.4	FE	Functional earth ground	Grounding of the bus coupler and therefore of the Inline station The contacts are directly connected to the potential jumper and the FE spring on the bottom of the housing. Functional earth ground is only used to discharge interference.
Connector 4	**Power Connector**		
1.1, 2.1	24 V DC	U_S	24 V segment supply The supplied voltage is directly led to the potential jumper.
1.2, 2.2	24 V DC	U_M	24 V main supply The supplied voltage is directly led to the potential jumper.
1.3, 2.3	GND	Reference potential	The reference potential is directly led to the potential jumper and is, at the same time, ground reference for the main and segment supply.
1.4, 2.4	FE	Functional earth ground	Grounding of the bus coupler and therefore of the Inline station The contacts are directly connected to the potential jumper and the FE spring on the bottom of the housing. Functional earth ground is only used to discharge interference.

Do not mix up the connectors

Do not mix up the connectors, especially the remote bus connectors and connectors for the voltage supply, as this may damage the terminal.

Observe the current carrying capacity

The maximum total current through the potential jumpers U_M and U_S is 8 A.

Ground the bus coupler

Connect the bus coupler to functional earth ground (FE) via one of the FE connections of connector 3 or connector 4. For this, connect the corresponding contact with a grounding terminal (see also Figure 6 on page 14).

24 V Segment Supply / 24 V Main Supply

The segment supply and main supply must have the same reference potential. Therefore, an electrically isolated voltage area on the I/O side cannot be created.

The main supply and the segment supply are protected against polarity reversal and surge voltage.

Ensure short-circuit protection

The main supply and segment supply do not have short-circuit protection.

The user must provide short-circuit protection. The rating of the preconnected fuse must be such that the maximum permissible load current is not exceeded.

24 V Segment Supply

You can supply/generate the segment supply at the bus coupler or one of the supply terminals.
There are several ways of providing the segment voltage at the bus coupler (connector 4):

1. The segment voltage can be supplied separately at terminal points 1.1 (or 2.1) and 1.3 (or 2.3) (GND) of the power connector (see Figure 6 on page 14).
2. You can jumper the connections 1.1 (or 2.1) and 1.2 (or 2.2) to ensure that the segment circuit is supplied from the main circuit.
3. A switch can be inserted between terminal points 1.1 (or 2.1) and 1.2 (or 2.2) to create a switched segment circuit (e.g., an emergency stop circuit).

24 V Bus Coupler Supply

The bus coupler supply is protected against polarity reversal and surge voltage. These protective elements are only used to protect the power supply unit.

Ensure short-circuit protection

The bus coupler supply does not have short-circuit protection.

The user must provide short-circuit protection. The rating of the preconnected fuse must be such that the maximum permissible load current is not exceeded.

Notes on Using the Terminals IBS IL 24 BK-T and IBS IL 24 BK-T/U (-PAC):

The IBS IL 24 BK-T/U (-PAC) bus coupler replaces the IBS IL 24 BK-T bus coupler in the catalog, which was supplied until now.

Differences between the bus couplers

	IBS IL 24 BK-T/U (-PAC)	IBS IL 24 BK-T
Number of terminals with remote bus branch that can be aligned	15	1
ID code with remote bus branch being connected	04_{dec}	12_{dec}
ID code without remote bus branch being connected	04_{dec}	04_{dec}

Please use the IBS IL 24 BK-T/U terminal for **new configurations**.

If you plan to **replace** an IBS IL 24 BK-T terminal in your system, you must check the replacement options:

– If, until now, the IBS IL 24 BK-T bus coupler has not been used in conjunction with an IB IL 24 RB-T terminal with remote bus branch, the terminal can be replaced with the IBS IL 24 BK-T/U (-PAC) terminal without any problems.

– If, until now, the IBS IL 24 BK-T bus coupler has been used in conjunction with an IB IL 24 RB-T terminal with remote bus branch, you should replace the terminal with the IBS IL 24 BK-T terminal.
If in this case you were to replace the IBS IL 24 BK-T bus terminal with the IBS IL 24 BK-T/U (-PAC) bus coupler, the system would need to be reconfigured due to the modified ID code.

Notes on Using the Terminal in Potentially Explosive Areas

Approval According to EC Directive 94/9 (ATEX)

II 3G Ex nAC IIC T4 X

This Inline bus coupler conforms to the requirements of protection type "n" and can be installed in a zone 2 potentially explosive area. This Inline bus coupler is a category 3G item of electrical equipment.

WARNING: Explosion hazard
Only Inline terminals that are approved for use in potentially explosive areas may be snapped next to this Inline bus coupler.

Before using an Inline terminal in a zone 2 potentially explosive area, check that the terminal has been approved for installation in this area.

For a list of terminals approved for zone 2 potentially explosive areas, please refer to the AH EN IL EX ZONE 2 application note.

Check the labeling on the Inline terminal and the packaging (see Figure 3).

Figure 3 Typical labeling of terminals for use in potentially explosive areas

WARNING: Explosion hazard

Before startup, ensure that the following points and instructions are observed.

1. When working on the Inline bus coupler, always disconnect the supply voltage.
2. The Inline bus coupler must only be installed, started up, and maintained by qualified specialist personnel.
3. Install the Inline bus coupler in a control cabinet or metal housing. The minimum requirement for both items is IP54 protection according to EN 60529.
4. The Inline bus coupler must not be subject to mechanical strain or thermal loads, which exceed the limits specified in the product documentation.
5. The Inline bus coupler must not be repaired by the user. Repairs may only be carried out by the manufacturer. The Inline bus coupler is to be replaced by an approved bus coupler of the same type.
6. During operation, only category 3G equipment may be connected to Inline bus couplers in zone 2.
7. Observe all applicable standards and national safety and accident prevention regulations for installing and operating equipment.

Restrictions

WARNING: Explosion hazard

When using terminals in potentially explosive areas, observe the technical data and limit values specified in the corresponding documentation (user manual, data sheet, package slip).

WARNING: Explosion hazard
Restrictions regarding the Inline system

The **maximum permissible current** flowing through the potential jumpers U_M and U_S (total current) is limited to **4 A** when using the Inline bus coupler in potentially explosive areas.

Internal Circuit Diagram

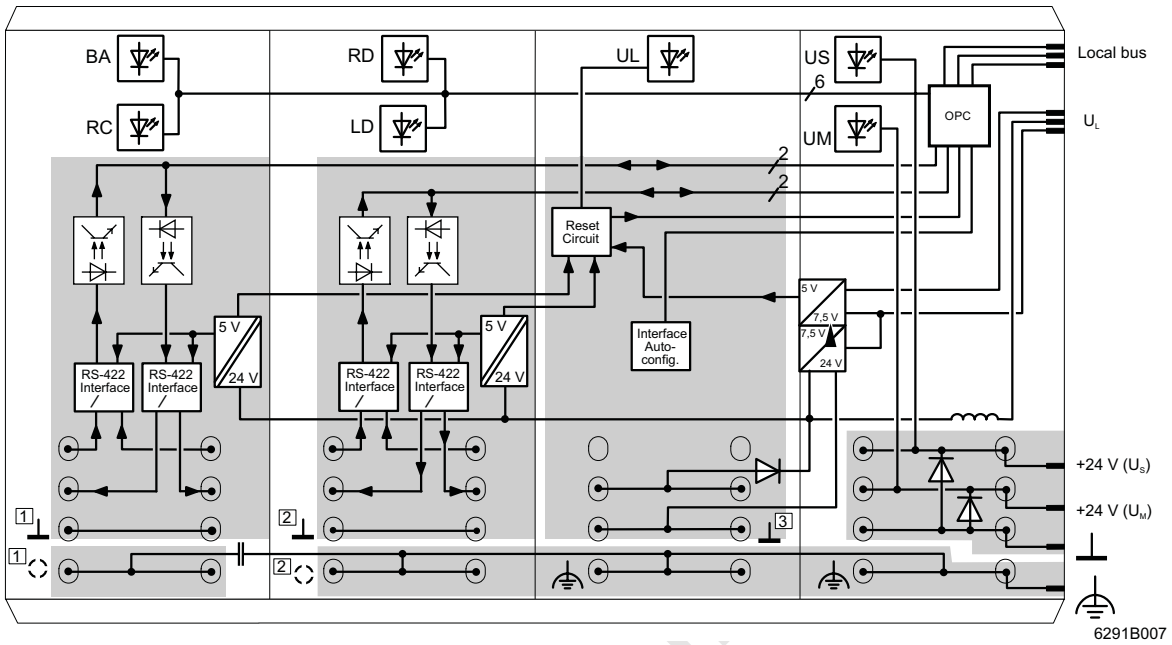


Figure 4 Internal wiring of the terminal points

OPC	Protocol chip (bus logic including voltage conditioning)	2	Reference potential R-GND (outgoing interface)
	LED	3	Reference potential BK-GND (bus coupler supply)
	Optocoupler	1	Shield potential; connected with a capacitor to functional earth ground (FE) of the potential jumper
	Electrically isolated area	2	Shield potential; connected directly to functional earth ground (FE) of the potential jumper
	Supply unit with electrical isolation	RS-422 Interface	Interface component
	Converter	Reset Circuit	Voltage monitor
1	Reference potential F-GND (incoming interface)	Interface Auto-config.	Switchover remote bus/local bus

Other symbols used are explained in the IB IL SYS PRO UM E user manual.

Electrical Isolation

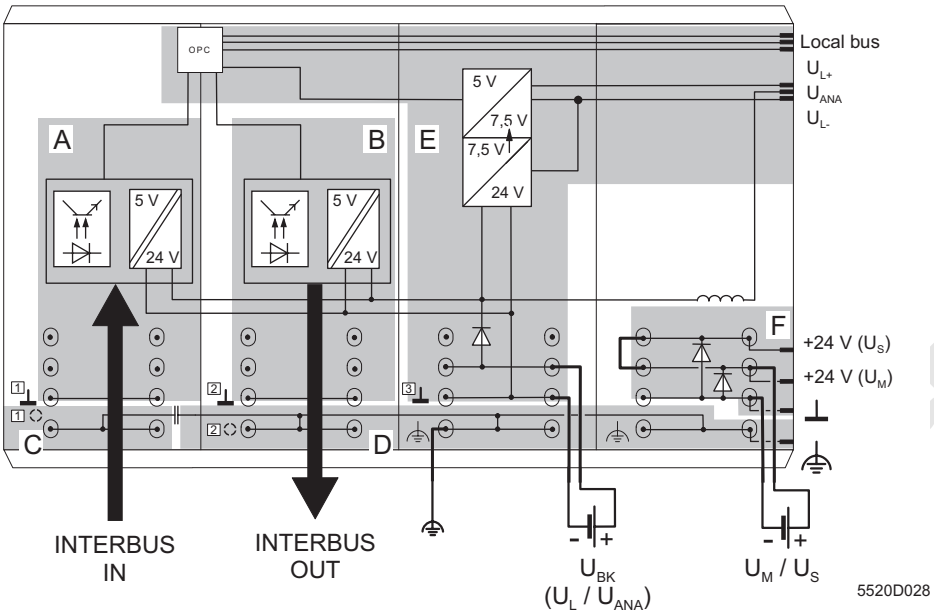


Figure 5 Electrical isolation of the individual function areas (separate power supply units)

Potential areas when using separate power supply units to supply U_{BK} and U_M/U_S:

1 Area of incoming remote bus
2 Area of outgoing remote bus
3 Area of functional earth using a capacitor (FE capacitive)
4 Area of functional earth ground (FE)
5 Area of bus coupler supply U_{BK} from which the communications power U_L and analog terminal supply U_{ANA} are generated
6 Area of the I/O voltages U_M and U_S

Connection Example

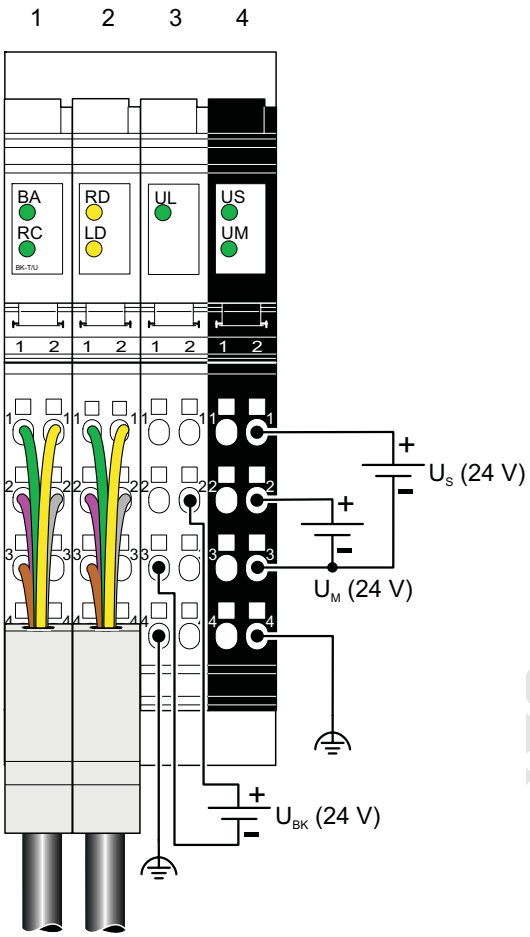


Figure 6 Typical cable connection at the bus coupler

To minimize heat generation, use both adjacent contacts to provide the main voltage and to provide/tap the segment voltage.

Programming Data

ID code	04_{hex} (04_{dec})
Length code	00_{hex}
Process data channel	0 bits
Input address area	0 bytes
Output address area	0 bytes
Parameter channel (PCP)	0 bytes
Register length (bus)	0 bytes