

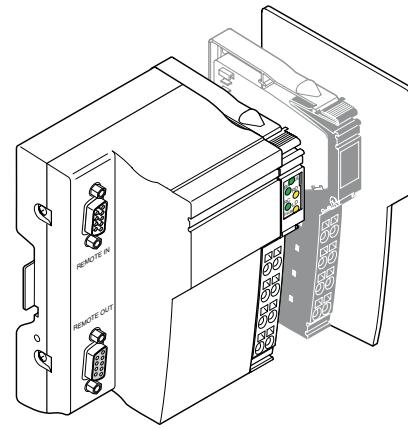
IBS IL 24 BK-DSUB ...

**INTERBUS Inline Bus Coupler;
Remote Bus Connections Via D-SUB Connectors**

AUTOMATIONWORX

Data Sheet
6362_en_03

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Description

The bus coupler connects an Inline station to the INTERBUS remote bus. It provides the supply voltages U_L and U_{ANA} for the connected devices.



When using a terminal with remote bus branch (IBS IL 24 RB-T...), please refer to page 14.

Features

- Remote bus connections using copper cables via D-SUB connectors
- Electrical isolation to the remote bus segments
- Automatic configuration of the outgoing interface as remote bus or local bus interface
- Support of up to 15 connected terminals with remote bus branch



Please note that the power terminal is not supplied with the bus coupler. To order this terminal, please refer to the "Ordering Data" on page 2 or to the latest "AUTOMATION" catalog.

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



A power terminal **must** be connected after the bus coupler to supply the main and segment voltage to the subsequent terminals.



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:

IBS IL 24 BK-DSUB ...

Ordering Data

Products

Description	Type	Order No.	Pcs./Pck.
INTERBUS bus coupler with D-SUB connection, without accessories; 500 kbps transmission speed	IBS IL 24 BK-DSUB	2742104	1
INTERBUS bus coupler with D-SUB connection, with accessories (connector and labeling field); 500 kbps transmission speed	IBS IL 24 BK-DSUB-PAC	2861593	1
INTERBUS bus coupler with D-SUB connection, without accessories; 2 Mbps transmission speed	IBS IL 24 BK-DSUB-2MBD	2855949	1
INTERBUS bus coupler with D-SUB connection, with accessories (connector and labeling field); 2 Mbps transmission speed	IBS IL 24 BK-DSUB-2MBD-PAC	2826123	1

Accessories

Description	Type	Order No.	Pcs./Pck.
 Two D-SUB connectors are required for connecting INTERBUS. The connectors are not supplied as standard.			
Bus connector, solder connection, male/female connector	IBS DSUB 9/L	2758473	1
Bus connector, crimp connection, male/female connector	IBS DSUB 9/C	2758486	1
 A connector is required to provide the bus coupler supply for the IBS IL 24 BK-DSUB and IBS IL 24 BK-DSUB-2MBD terminals.			
Inline connector, with color print	IB IL SCN-8-CP	2727608	10
Power Terminal, Complete With Accessories (Connector and Labeling Field), 500 kbps and 2 Mbps Transmission Speed			
Power terminal with fuse (U_M , U_S)	IB IL 24 PWR IN/2-F-PAC	2862136	1
Power terminal without fuse	IB IL 24 PWR IN-PAC	2861331	1
Power terminal with fuse (U_M , U_S)	IB IL 24 PWR IN/F-PAC	2861438	1
Power Terminal, Complete With Accessories (Connector and Labeling Field), for 500 kbps			
Power terminal with fuse (U_M , U_S) and diagnostics	IB IL 24 PWR IN/2-F-D-PAC	2862152	1
Power terminal with fuse (U_M , U_S) and diagnostics	IB IL 24 PWR IN/F-D-PAC	2861894	1
Power terminal with fuse (U_M , U_S) and diagnostics	IB IL 24 PWR IN/2F-DF-PAC	2863779	1
Power Terminal, Complete With Accessories (Connector and Labeling Field), for 2 Mbps			
Power terminal with fuse (U_M , U_S) and diagnostics	IB IL 24 PWR IN/2F-DF-2MBD-PAC	2863834	1
Power terminal with fuse (U_M , U_S) and diagnostics	IB IL 24 PWR IN/2F-D-2MBD-PAC	2863821	1

Documentation

Description	Type	Order No.	Pcs./Pck.
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	2743048	1

Technical Data

General Data

Housing dimensions (width x height x depth)	90 mm x 120 mm x 71.5 mm
Weight	210 g (without connector); 225 g (with connector)
Ambient temperature (operation)	-25°C to +55°C
Ambient 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
Protection class	Class 3 according to VDE 0106, IEC 60536
Connection data	
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 via D-SUB connector; electrically isolated supply; shielding connected with a capacitor to functional earth ground
Outgoing remote bus	Copper cable (RS-422), connected via D-SUB connector; electrically isolated supply; shielding directly connected to functional earth ground
Recommended cable lengths	See INTERBUS system data



Observe current consumption of the terminals

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)	If the next device is snapped on, the bus coupler automatically configures the interface. If the next device is a terminal with 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.
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24 V Bus Coupler Supply

Connections	See Figure 4 on page 11
Connection method	Spring-cage terminals
Recommended cable lengths	30 m, maximum; routing cables through outdoor areas is not admissible
Continuation	Via potential routing
Special demands on the voltage supply	The bus coupler supply U_{BK} is electrically isolated from U_M/U_S if it is 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
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
Safety equipment	For the bus coupler supply only
Surge voltage	Yes
Polarity reversal	Yes



Provide an external fuse for the 24 V area

This 24 V area must be externally protected. 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 Module 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

Communications Power (Interfaces)

Nominal value	2 x 5 V DC
Tolerance	±5%
Ripple	±1.5%
Maximum output current	2 x 0.15 A DC
Safety equipment	None

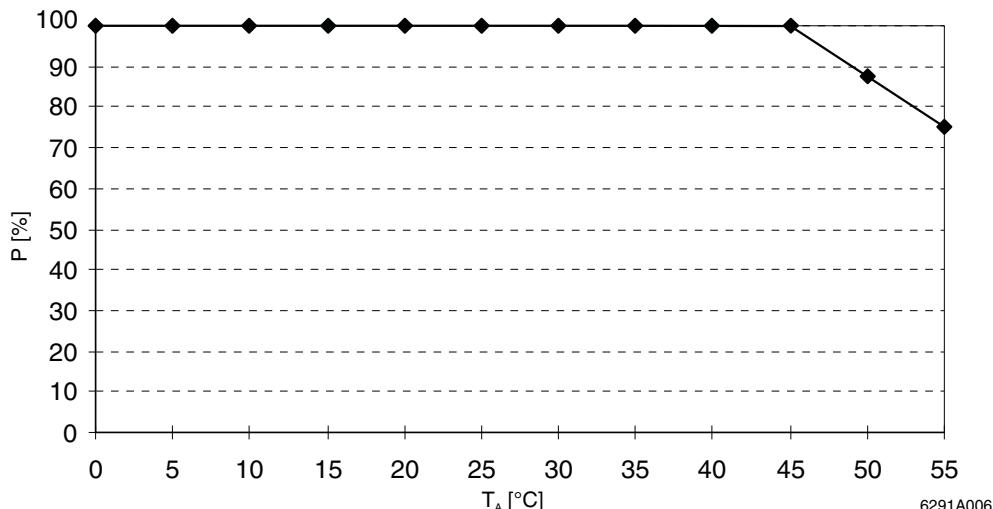
Communications Power (Internal)

Nominal value	1 x 5 V DC
Tolerance	±5%
Ripple	±1.5%
Maximum output current	1 x 0.15 A DC
Safety equipment	None

Analog Supply (Potential Jumpers)

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

Derating of the Communications Power and the Analog Terminal Supply



P [%]

Current carrying capacity of the power supply unit for communications power (U_L) and analog supply (U_{ANA}) in %

T_A [°C]

Ambient temperature in °C

Power Dissipation

Formula to Calculate the Power Dissipation of the Electronics

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

$$P_{EL} = 1.6 \text{ W} + (1.375 \frac{\text{W}}{\text{A}} \times \sum_{n=1}^a I_{Ln}) + (0.7 \frac{\text{W}}{\text{A}} \times \sum_{m=1}^b I_{Lm})$$

Where:

P_{EL} Total power dissipation in the terminal
 P_{BUS} Power dissipation for bus operation without I/O load (permanent)
 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
 m Index of the number of connected analog devices ($m = 1$ to b)
 b Number of connected analog devices (supplied with analog voltage)

$$\sum_{m=1}^b I_{Lm}$$

Total current consumption of the devices from the 24 V analog supply (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:

$$P_{PERI} = 2.75 \text{ W} + 0.35 \text{ W} = 3.10 \text{ W}$$

3.1 W correspond to 100% current carrying capacity of the power supply unit in the derating curves on page 5.

Ensure that the indicated nominal current carrying capacity in the derating curves is not exceeded when the ambient temperature is above 45°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:

Ambient temperature: 55°C

Nominal current carrying capacity of communications power and analog supply: 75% according to the diagram

$$I_{LLogic} = 1.5 \text{ A}, I_{LAnalog} = 0.375 \text{ A}$$

$$P_{PERI} = 2.0625 \text{ W} + 0.2625 \text{ W}$$

$$P_{PERI} = 2.325 \text{ W} \text{ (corresponds to 75% of 3.10 W)}$$

Possible logic current if the analog supply is not loaded:

$$P_{PERI} = 1.375 \text{ W/A} \times I_{LLogic} + 0 \text{ W}$$

$$P_{PERI} / 1.375 \text{ W/A} = I_{LLogic}$$

$$I_{LLogic} = 2.325 \text{ W} / 1.375 \text{ W/A}$$

$$I_{LLogic} = 1.691 \text{ A}$$

Error Messages to the Higher-Level Control or Computer System

I/O error

No

Safety Equipment

Surge voltage
(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
(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



Please note that the bus coupler supply U_{BK} must be supplied at the bus coupler and the supplies U_M/U_S must be supplied at a separate power terminal.

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, 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 the reference ground LGND.

When providing the 24 V bus coupler supply by jumpering the 24 V main supply/24 V segment supply

Bus coupler 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.

Electrical Isolation/Isolation of the Voltage Areas (Continued)

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/ 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 terminal 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 terminal supply

500 V AC, 50 Hz, 1 min

5 V supply outgoing remote bus / functional earth ground

500 V AC, 50 Hz, 1 min

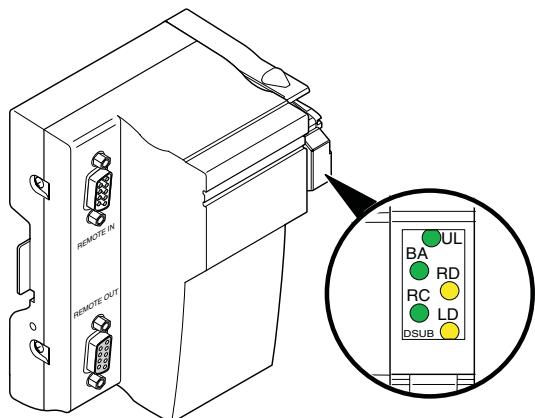
7.5 V communications power, 24 V analog supply, 24 V bus coupler supply / functional earth ground

500 V AC, 50 Hz, 1 min

Approvals

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

Local Diagnostic and Status Indicators

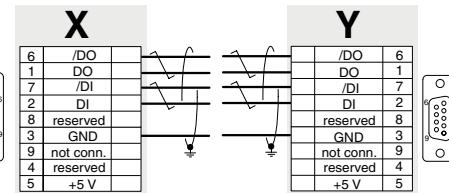
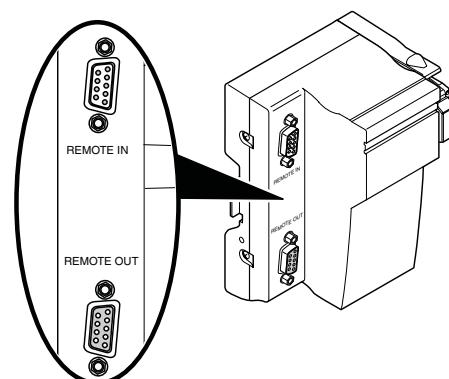


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Figure 1 Diagnostic indicators of the terminal

Des.	Color	Meaning
UL	Green	24 V bus coupler supply/ 7.5 V communications power/ interface supply
BA	Green	Bus active
RC	Green	Remote bus cable check
RD	Yellow	Outgoing remote bus switched off
LD	Yellow	Local bus disabled

Remote Bus Connections



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Figure 2 Assignment of the remote bus interfaces

X Remote OUT (outgoing remote bus)

Y Remote IN (incoming remote bus)

Connecting Bus Cables

- Assemble the D-SUB connectors according to the specifications in the following section.
- Plug the connectors into the appropriate connections.
- Secure the connectors using knurled-head screws.

Signal	Remark/ Wire Color in the INTERBUS Standard Cable
/DO	Green
DO	Yellow
/DI	Pink
DI	Gray
GND	Brown
Shield (incoming remote bus)	Shield potential is connected with a capacitor to functional earth ground (FE) of the potential jumper.
Shield (outgoing remote bus)	Shield potential is directly connected to functional earth ground (FE) of the potential jumper.

Assembling D-SUB Connectors

Type:

9-pos. D-SUB connector, male and female,
mechanical protection against polarity reversal

Order designation:

IBS DSUB 9/L (solder connection), Order No. 2758473
IBS DSUB 9/C (crimp connection), Order No. 2758486

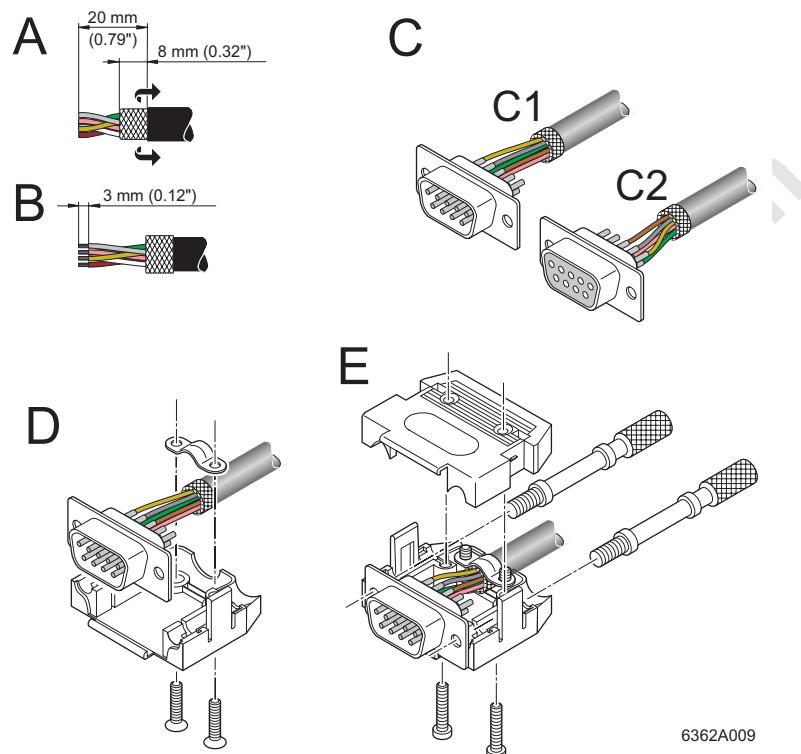


Figure 3 Assembling D-SUB connectors

- Strip 20 mm off the cable sheath (A).
- Shorten the shielding to 8 mm (A).
- Fold the shielding uniformly back over the sheath (A).
- Strip 3 mm off the wires. Cut off the white wire (B).
- Solder the wires to the contacts or crimp them using crimping pliers (C).

The contacts of a connector in crimp design must be inserted into the contact housing.



To ensure optimum shielding, as much of the shielding as possible must have contact with the shield connection clamp and the mounting base housing. The shield connection clamp also provides strain relief.

- Place the cables with their contact housing in the slot of the mounting base housing and connect the shielding of the cable with the shield connection clamp by screwing them together (D). Screw the shield connection clamp on tightly using the two countersunk screws.



The wires must not be squeezed between the housing parts.

- Insert the interlocking screws into the drill holes of the contact housing and place them into the guideways of the mounting base housing. Snap the upper part of the housing on the mounting base housing and fasten these parts together using the two socket-head cap screws (E).

Connection of the Bus Coupler Supply

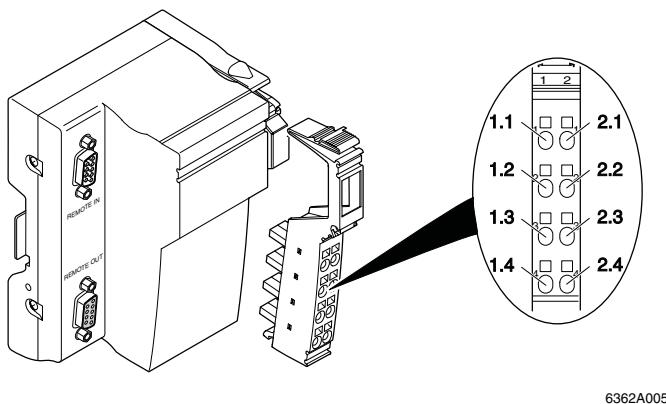


Figure 4 Terminal point assignment

Terminal Point Assignment

Terminal Point	Assignment		Remark/ Wire Color in the INTERBUS Standard Cable
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	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	Connection of the bus coupler and therefore of the inline station to functional earth ground 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.



Ground the bus coupler

Connect the bus coupler to functional earth ground via one of the FE connections of the connector. For this, connect the corresponding contact with a grounding terminal (see also Figure 7 on page 14). In addition, the bus coupler is automatically connected to functional earth ground by snapping it onto a grounded DIN rail.

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.

Internal Basic Circuit Diagram

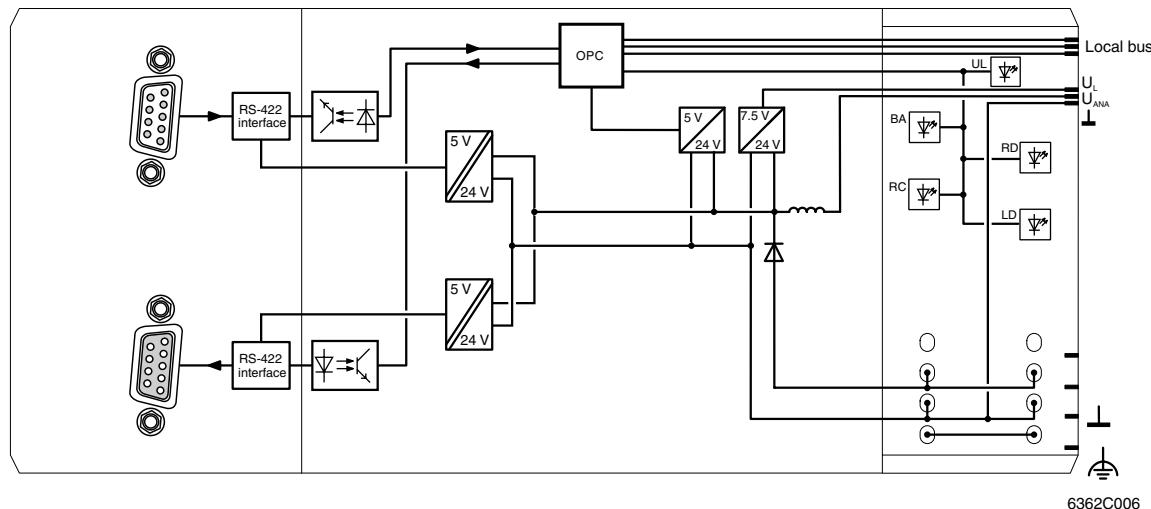


Figure 5 Internal wiring of the terminal points



D-SUB connector



Converter



RS-422 interface



INTERBUS protocol chip (bus logic including voltage conditioning)



Optocoupler



Diode



Power supply unit with electrical isolation

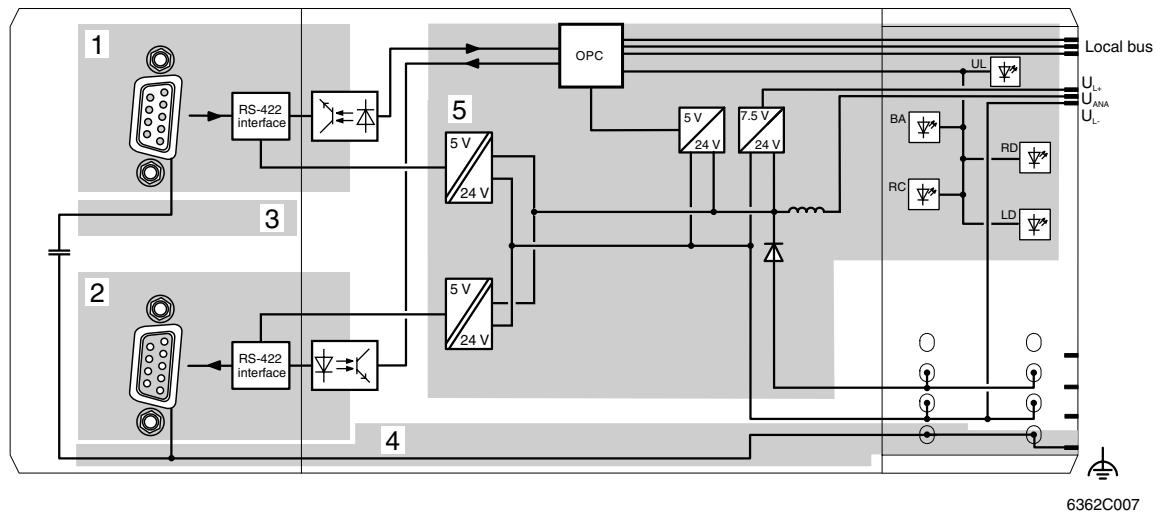


LED with function identification



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

Electrical Isolation



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Figure 6 Electrical isolation of 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 ground (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 the analog terminal supply U_{ANA} are generated

Connection Example

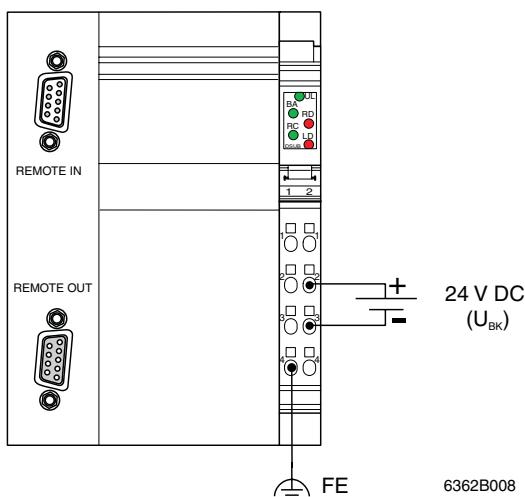


Figure 7 Typical connection of the cables to the bus coupler



Connect the cables according to the information in the "Configuring and Installing the INTERBUS Inline Product Range" user manual.

Information for Using Terminals With Remote Bus Branch

Up to 15 terminals with remote bus branch can be installed after the bus coupler.

As of hardware revision 02, the IBS IL 24 RB-T terminal with remote bus branch is no longer supplied from the segment circuit but from the analog circuit. This provides various options for supplying the main and segment voltage to the subsequent terminals.

The power terminal can be installed **before** the terminal with remote bus branch. In this case, only a power terminal, which is not a bus device, may be installed.

The power terminal can be installed **after** the terminal with remote bus branch. In this case, there are no restrictions.

Programming Data

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

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