

Rexroth Inline bus coupler for PROFIBUS DP with digital inputs and outputs

R911324351
Edition 04

Data sheet R-IL PB BK DI8 DO4/CN-PAC

PROFIBUS DP with extended functionality
8 digital inputs, 24 V DC
4 digital outputs, 24 V DC, 500 mA
Modular extensions possible using Inline terminals

10 / 2016



1 Description

The bus coupler is the link between PROFIBUS-DP and the Inline installation system. In addition, it is used to acquire and output digital signals.

61 Inline devices can be connected at any point to an existing PROFIBUS DP system using the bus coupler.

The bus coupler and the Inline devices form one station with a maximum of 63 local bus devices. Here, the inputs and outputs of the bus coupler form the first and second local bus devices.

Features

- PROFIBUS connection via 9-pos. D-SUB female connector
- Interface physics RS-485 for PROFIBUS
- Electrical isolation between PROFIBUS interface and logic
- Connection of up to 61 other Inline devices
- Connection of a maximum of 16 PCP devices
- DP/V1 for Class 1 and Class 2 masters
- Data transmission speed of 9.6 kbps up to 12 Mbps (automatic detection)
- Rotary encoding switches for setting the PROFIBUS address
- Supported PROFIBUS addresses 0 to 126
- Device description using GSD file
- I & M functions
- 8 digital inputs, 4 digital outputs
- Diagnostic and status indicators
- IO-Link call (firmware 2.0 or later)
- Approved for PROFIsafe



This data sheet is only valid in association with the "Automation terminals of the Rexroth Inline product range" application description (DOK-CTRL-ILSYSINS***-AW..-EN-P, MNR R911317021).



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3 Ordering data

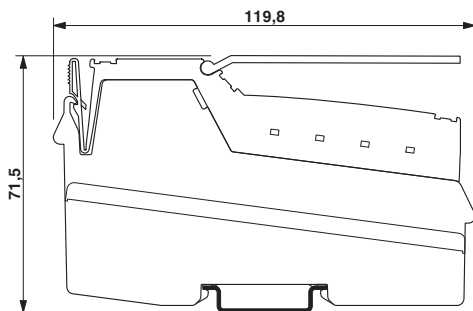
Description	Type	MNR	Pcs./Pkt.
Rexroth Inline, Bus coupler, PROFIBUS DP, D-SUB-9 female connector, Digital inputs: 8, 24 V DC, Connection method: 3-conductor, Digital outputs: 4, 24 V DC, 500 mA, Connection method: 3-conductor, Transmission speed in the local bus 500 kBit/s / 2 MBit/s, Degree of protection IP20, including Inline connectors and marking fields	R-IL PB BK DI8 DO4/CN-PAC	R911172194	1
Documentation	Type	MNR	Pcs./Pkt.
Application description Automation terminals of the Rexroth Inline product range	DOK-CONTRL-ILSYSINS***- AW..-EN-P	R911317021	1
Application description, English, Rexroth Inline bus coupler for PROFIBUS DP R-IL PB BK DI8 DO4/CN-PAC	DOK-CONTRL-ILPBBK- DIOCN-AW..-EN-P	R911324349	1

Additional ordering data

For additional ordering data (accessories), please refer to the product catalog at www.boschrexroth.com/electrics.

4 Technical data

Dimensions (nominal sizes in mm)



Width	80 mm
Height	119.8 mm
Depth	71.5 mm
Note on dimensions	Specifications with connectors

General data

Color	gray
Weight	320 g (with connectors)
Ambient temperature (operation)	-25 °C ... 60 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	10 % ... 95 % (according to DIN EN 61131-2)
Permissible humidity (storage/transport)	10 % ... 95 % (according to DIN EN 61131-2)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1

Connection data

Designation	Inline connector
Connection method	Spring-cage connection
Conductor cross section solid / stranded	0.2 mm ² ... 1.5 mm ² / 0.2 mm ² ... 1.5 mm ²
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm

Interface PROFIBUS DP

Number	1
Connection method	D-SUB-9 female connector
Number of positions	9
Transmission speed	9,6 kBit/s ... 12 MBit/s

Interface Inline local bus

Connection method	Inline data jumper
Transmission speed	500 kBit/s / 2 MBit/s (Automatic detection, no combined system)

System limits of the bus coupler

Amount of process data	max. 488 Byte (per station) max. 244 Byte (Input) max. 244 Byte (Output)
Number of parameter data	max. 244 Byte (including 14 bytes for the bus coupler, DP/V1, and the local inputs and outputs)
Number of configuration data	max. 244 Byte (including 5 bytes for the local inputs and outputs)
IN and OUT process data for I/O modules that can be aligned	486 Byte
IN process data for I/O modules that can be aligned	243 Byte
OUT process data for I/O modules that can be aligned	243 Byte
Parameter data for connectable I/O modules	230 Byte
Configuration data for I/O modules that can be aligned	239 Byte
Number of supported devices	max. 63 (per station)
Number of local bus devices that can be connected	max. 61 (on board I/Os are two devices)
Number of devices with parameter channel	max. 16
Response time of I/Os	typ. 4 ms (aligned I/Os; transmission speed: PROFIBUS 1.5 Mbps, local bus 500 kbps)
Number of supported branch terminals with remote bus branch	0



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.

Power supply for module electronics

Connection method	Spring-cage connection
Designation	Bus coupler supply U_{BC} ; Communications power U_L (7.5 V) and the analog supply U_{ANA} (24 V) are generated from the bus coupler supply.
Supply voltage	24 V DC (via Inline connector)
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	max. 0.98 A (from U_{BK})
Power dissipation	typ. 1.7 W (entire device)

Power consumption**NOTICE Electronics may be damaged when overloaded**

Provide external fuses for the 24 V areas U_{BK} , U_M , and U_S . The power supply unit must be able to supply four times the nominal current of the external fuse, to ensure that it trips in the event of an error.

Main circuit supply U_M	24 V DC
Supply voltage range U_M	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Power supply at U_M	max. 8 A DC (Sum of $U_M + U_S$)
Current consumption from U_M	max. 8 A DC
Segment circuit supply U_S	24 V DC
Supply voltage range U_S	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Power supply at U_S	max. 8 A DC (Sum of $U_M + U_S$)
Current consumption from U_S	max. 8 A DC
Communications power U_L	7.5 V DC $\pm 5\%$
Power supply at U_L	max. 0.8 A DC
I/O supply voltage U_{ANA}	24 V DC
Supply voltage range U_{ANA}	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Power supply at U_{ANA}	max. 0.5 A DC

Digital inputs

Number of inputs	8
Connection method	Inline connector
Connection method	3-conductor
Description of the input	EN 61131-2 type 1
Nominal input voltage	24 V DC
Nominal input current	typ. 3 mA
Current flow	Limited to 3 mA, maximum
Input voltage range "0" signal	-30 V DC ... 5 V DC
Input voltage range "1" signal	15 V DC ... 30 V DC
Delay at signal change from 0 to 1	typ. 2.9 ms
Delay at signal change from 1 to 0	typ. 2.9 ms
Permissible conductor length to the sensor	100 m
Reverse polarity protection	Suppressor diode

Digital outputs

Number of outputs	4
Connection method	Inline connector
Connection method	3-conductor
Nominal output voltage	24 V DC
Voltage difference with nominal current	< 1 V
Maximum output current per channel	500 mA
Maximum output current per device	2 A
Nominal load, ohmic	12 W
Nominal load, inductive	12 VA (1.2 H, 48 Ω)
Nominal load, lamp	12 W
Signal delay	typ. 2.9 ms
Maximum operating frequency with inductive nominal load	0.5 Hz (1.2 H, 48 Ω)
Behavior at voltage switch-off	The output follows the power supply without delay
Limitation of the voltage induced on circuit interruption	approx. -30 V

Digital outputs

Output current when switched off	max. 10 µA (When not loaded, a voltage can be measured even at an output that is not set.)
Behavior with overload	Auto restart
Behavior with inductive overload	Output can be destroyed
Reverse voltage resistance to short pulses	Reverse voltage proof
Resistance to permanent reverse voltage	max. 2 A
Overcurrent shut-down	min. 0.7 A
Short-circuit and overload protection	Free running circuit In output driver

Configuration data

ID number	0B50
Input address area	2 Byte (or 1 byte, selection in the GSD file)
Output address area	2 Byte (or 1 byte, selection in the GSD file)

Error messages to the higher level control or computer system

Short-circuit / overload of the digital outputs	Yes
Sensor supply failure	Yes
Failure of the actuator supply	Yes

Mechanical tests

Vibration resistance in acc. with EN 60068-2-6/ IEC 60068-2-6	5g
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	Operation: 25g, 11 ms duration, semi-sinusoidal shock impulse

Conformance with EMC Directive 2014/30/EU**Noise immunity test in accordance with EN 61000-6-2**

Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2	Criterion B, 6 kV contact discharge, 8 kV air discharge
Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) EN 61000-4-4/IEC 61000-4-4	Criterion A, all interfaces 1 kV Criterion B, all interfaces 2 kV
Transient overvoltage (surge) EN 61000-4-5/IEC 61000-4-5	Criterion B, supply lines DC: 0.5 kV/0.5 kV (symmetrical/asymmetrical), fieldbus cable shield 1 kV
Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A; Test voltage 10 V

Noise emission test as per EN 61000-6-4

EN 55011	Class A
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Approvals

For the latest approvals, please visit www.boschrexroth.com/electrics.

5 Internal circuit diagram

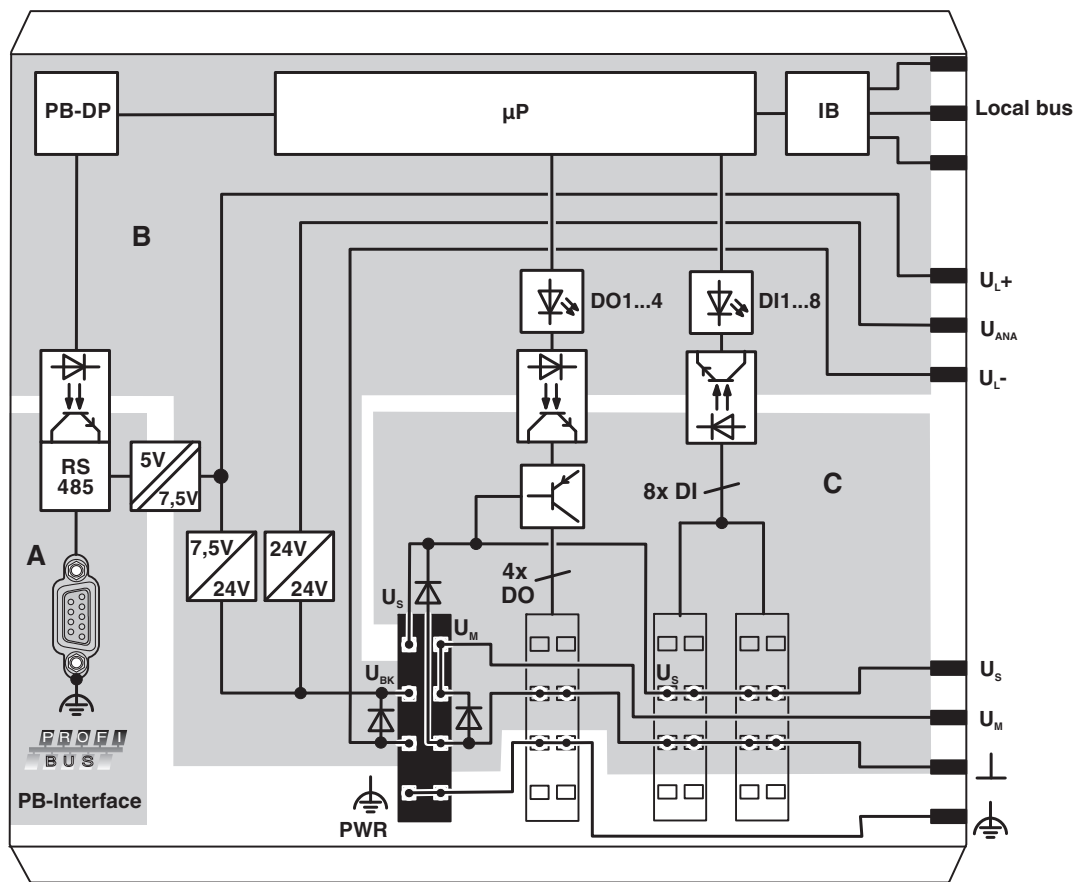


Fig. 1 Internal wiring of the terminal points

Key:

PB-DP	Protocol chip	RS-485	RS-485 interface
μP	Microprocessor		PNP transistor
IB	Protocol chip		Electrically isolated area
	LED	The gray areas in the basic circuit diagram represent the electrically isolated areas:	
	Optocoupler		
	Power supply unit with electrical isolation	A	PROFIBUS interface
	Power supply unit	B	Logic
		C	I/O devices



For an explanation of the other symbols used, please refer to the "Automation terminals of the Rexroth Inline product range" application description (DOK-CTRL-ILSYSINS***-AW...-EN-P, MNR R911317021).

6 Connection of PROFIBUS, power supply, actuators, and sensors

6.1 Connecting PROFIBUS

Connect PROFIBUS to the bus coupler using a 9-pos. D-SUB connector (see Ordering data). For the pin assignment, please refer to the figure and the table.

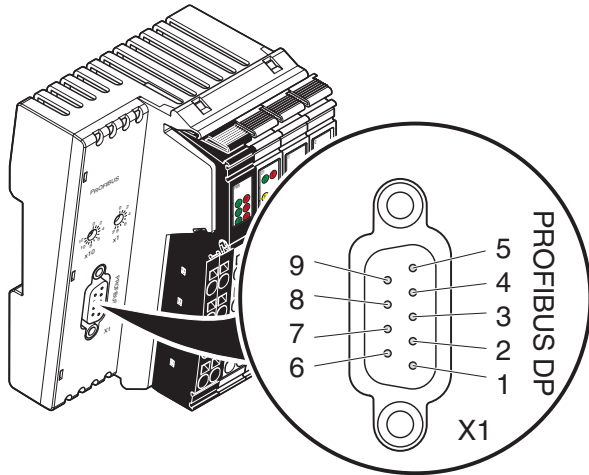


Fig. 2 Pin assignment of the 9-pos. D-SUB female connector

Pin	Assignment
1	Reserved
2	Reserved
3	RxD/TxD-P (receive/transmit data +), cable B
4	CNTR-P (control signal for repeater), direction control
5	DGND (reference potential to 5 V)
6	VP (+5 V supply voltage for termination resistors)
7	Reserved
8	RxD/TxD-N (receive/transmit data -), cable A
9	Reserved

6.2 Mains termination resistors

As PROFIBUS DP is a serial bus system in a line or tree structure, the individual branches must be terminated with a termination resistor. The bus coupler does not have a resistor of this type. For additional information, please refer to your PROFIBUS documentation. Appropriate PROFIBUS connectors with termination resistors that can be connected can be found at www.boschrexroth.com/electrics.

6.3 Hardware configuration

The address is set using two rotary encoding switches. The left switch is used to set the position in tens and the right switch is used to set the position in units. Addresses can be set between 1 and 126. The figure shows the address setting 74.

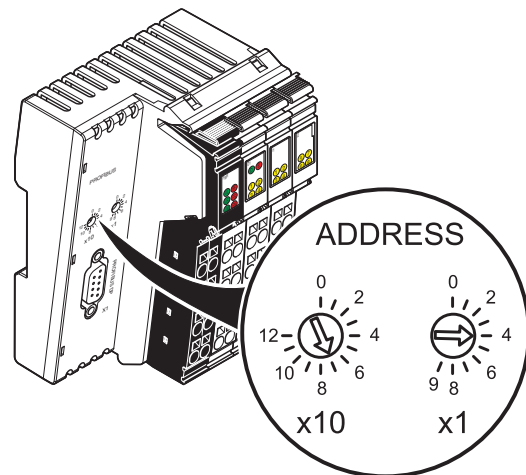


Fig. 3 (ADDRESS) rotary encoding switches

6.4 Terminal point assignment of input and output connectors

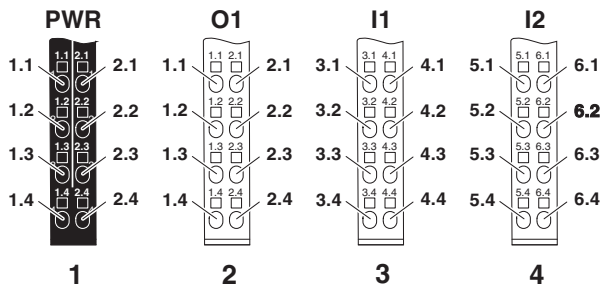


Fig. 4 Terminal point assignment

Terminal point assignment of the power connector (1)

Terminal point	Assignment	Terminal point	Assignment
1.1	U_S	2.1	U_M
1.2	U_{BK}	2.2	U_M
1.3	GND U_{BK}	2.3	GND U_M , U_S
1.4	Functional earth ground (FE)	2.4	Functional earth ground (FE)

Terminal point assignment of the output connector (2)

Terminal point	Assignment	Terminal point	Assignment
1.1	OUT1	2.1	OUT2
1.2	GND	2.2	GND
1.3	FE	2.3	FE
1.4	OUT3	2.4	OUT4

Terminal point assignment of the input connector (3)

Terminal point	Assignment	Terminal point	Assignment
3.1	IN1	4.1	IN2
3.2	U_S	4.2	U_S
3.3	GND	4.3	GND
3.4	IN3	4.4	IN4

Terminal point assignment of the input connector (4)

Terminal point	Assignment	Terminal point	Assignment
5.1	IN5	6.1	IN6
5.2	U_S	6.2	U_S
5.3	GND	6.3	GND
5.4	IN7	6.4	IN8

7 Connection example

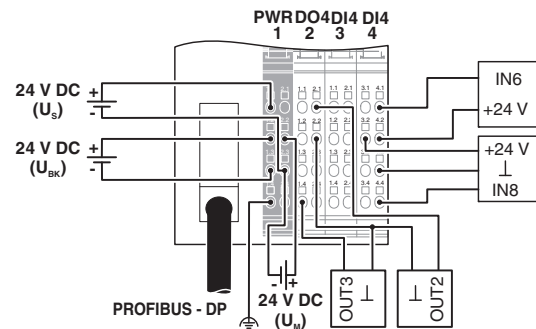


Fig. 5 Connection example

8 Local diagnostic and status indicators

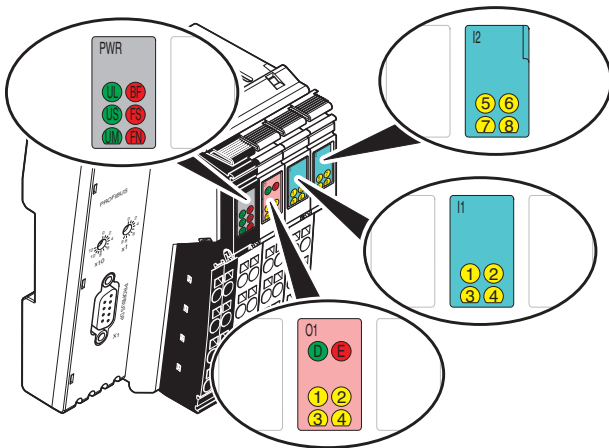


Fig. 6 Local diagnostic and status indicators

Designation	Color	Meaning	State	Description
UL	green	U _{Logic}	ON	24 V bus coupler supply/7.5 V communications power present
			OFF	24 V bus coupler supply/7.5 V communications power not present
US	green	U _{segment}	ON	24 V segment circuit supply present
			OFF	24 V segment circuit supply not present
UM	green	U _{Main}	ON	24 V I/O supply present
			OFF	24 V I/O supply not present
BF	red	Bus Fault	ON	No communication on PROFIBUS
			OFF	No error
FS	red	Failure Select	ON	If FS is on, FN indicates the error type
			OFF	If FS is not on, FN indicates the error number
FN	red	Failure Number	flashing	The number of flashing pulses indicates the error type or the error number, depending on whether FS is on or not For more detailed information on the blink codes, please refer to application description DOK-CONTRL-ILPBBKDIOCN-AW...-EN-P, material number R911324349.
			OFF	No error
D	green	Diagnostics	ON	Data transmission active within the station
			flashing	Data transmission not active within the station
E	red	Error	ON	I/O error, short-circuit/overload of outputs
			OFF	No I/O error
1 ... 4	yellow	O1	ON/OFF	Output is set/not set.
1 ... 8	yellow	I1, I2	ON/OFF	Input is set/not set.

9 Process data

Assignment of the terminal points to the output process data (slot 2)

(Byte.Bit) view	Byte	Byte 0							
	Bit	7	6	5	4	3	2	1	0
Module	Slot	2							
	Terminal point (signal)	Not used				2.4	1.4	2.1	1.1
	Terminal point (GND)	Not used				2.2	1.2	2.2	1.2
	Terminal point (FE)	Not used				2.3	1.3	2.3	1.3
Status indicator	Slot	2							
	LED	-				4	3	2	1

Assignment of terminal points to the IN process data (slots 3 and 4)

(Byte.Bit) view	Byte	Byte 0							
	Bit	7	6	5	4	3	2	1	0
Module	Slot	4				3			
	Terminal point (signal)	6.4	5.4	6.1	5.1	4.4	3.4	4.1	3.1
	Terminal point (24 V)	6.2	5.2	6.2	5.2	4.2	3.2	4.2	3.2
	Terminal point (GND)	6.3	5.3	6.3	5.3	4.3	3.3	4.3	3.3
Status indicator	Slot	4				3			
	LED	8	7	6	5	4	3	2	1



During configuration, please note that connected digital I/O terminals also use parameter data in PROFIBUS. Please refer to the GSD file or the terminal-specific data sheets for the parameter data length.

10 Parameter data

11 Firmware functions

Function	R-IL PB BK DI8 DO4/CN-PAC	R-IL PB BK DI8 DO4-PAC	R-IL PB BK DP/V1-PAC	
MNR	R911172194	R911170402	R911170971	
			DP/V0 mode	DP/V1 mode
Process and parameter data				
Total amount of process data				
- IN and OUT	488 bytes, maximum	488 bytes, maximum	184 bytes, maximum	176 bytes, maximum
- IN	244 bytes, maximum	244 bytes, maximum	184 bytes, maximum	176 bytes, maximum
- OUT	244 bytes, maximum	244 bytes, maximum	184 bytes, maximum	176 bytes, maximum
Amount of process data for alignable I/O terminals				
- IN and OUT	486 bytes, maximum	486 bytes, maximum	184 bytes, maximum	176 bytes, maximum
- IN	243 bytes, maximum	243 bytes, maximum	184 bytes, maximum	176 bytes, maximum
- OUT	243 bytes, maximum	243 bytes, maximum	184 bytes, maximum	176 bytes, maximum
Amount of parameter data				
- Total	244 bytes, maximum	244 bytes, maximum	8 bytes, maximum	168 bytes, maximum
- For alignable I/O terminals	230 bytes, maximum	230 bytes, maximum	0 bytes	160 bytes, maximum
Amount of configuration data				
- Total	244 bytes, maximum	244 bytes, maximum	168 bytes, maximum	168 bytes, maximum
- For alignable I/O terminals	239 bytes, maximum	239 bytes, maximum	168 bytes, maximum	168 bytes, maximum
Other				
Number of PCP devices	max. 16	max. 16	8, maximum	8, maximum
Can be replaced with R-IL PB BK-PAC, MNR R911289283	No	No	Yes	No
Supports DP/V1 read and write (acyclic communication), Class 1 and Class 2 master	Yes	Yes	No	Yes
Communication with PCP modules via "normal" process data (DP/V0)	Yes	Yes	Yes	Yes
Transmission invoke ID	Yes	Yes	Yes	Yes
Parameterization of several I/Os via dialog boxes in the configuration tool	Yes	Yes	No	Yes
Dynamic configuration (reserving I/Os in the PLC)	Yes	Yes	No	Yes
Specification of fail-safe values via the configuration tool	Yes	Yes	No	Yes
Byte rotation for the R-IB IL 24 DI 16-PAC and R-IB IL 24 DO 16-PAC	Yes	Yes	Yes	Yes
Byte rotation for the R-IB IL 24 DI 32-PAC and R-IB IL 24 DO 32-PAC	Yes	Yes	Yes	Yes
Operation in the event of terminal failure on the local bus	Yes	Yes	No	No
Acknowledgment of local bus stops via the application program	Yes	Yes	Yes	Yes

Function	R-IL PB BK DI8 DO4/CN-PAC	R-IL PB BK DI8 DO4-PAC	R-IL PB BK DP/V1-PAC	
MNR	R911172194	R911170402	R911170971	
			DP/V0 mode	DP/V1 mode
Acknowledging bus stops either automatically or via the application program	Yes	Yes	Yes	Yes
Diagnostics in IL PB BK format	Yes	Yes	Yes	Yes
Channel-specific diagnostics	Yes	Yes	No	No
Diagnostics in identification format	Yes	Yes	No	Yes
Diagnostics as status PDU	Yes	Yes	No	Yes
Stop behavior can be set via parameter telegram	Yes	Yes	Yes	Yes
I & M functions	Yes	Yes	No	No
PROFIsafe support	Yes	No	No	No
IO-Link call	Yes	No	No	No
Selection of the diagnostic format in the configuration tool	Yes	No	No	No



For more detailed information on the specified bus coupler functions, please refer to application description DOK-CONTRL-ILPBBKDIOCN-AW...-EN-P.

12 IO-Link

In contrast to individual signal wiring, which was previously primarily used, IO-Link uses a 3-wire connection to sensors and actuators. This means that in addition to transmitting a simple switching signal, bidirectional serial communication is also possible. IO-Link is also suitable for mixed operation. If an interface does not support IO-Link, the device automatically switches to SIO mode (Standard Input/Output).

IO-Link call

IO-Link call refers to communication between the IO-Link client (PROFIBUS DP master) and the IO-Link server (R-IB IL IOL4 DI2-PAC Inline IO-Link master).

There can be multiple IO-Link masters in a station (depending on the amount of process data).

Read/write requests are used to access the IO-Link objects via PROFIBUS DP.



For additional information on IO-Link call communication, please refer to application description DOK-CONTRL-ILPBBKDIOCN-AW...-EN-P.

13 Notes on using the bus coupler in a PROFIsafe system



When using the bus coupler in a PROFIsafe system, please refer to the documentation for the safety terminals used.

It can be downloaded under www.boschrexroth.com/electrics.

The bus coupler supports Inline PROFIsafe modules. These PROFIsafe modules can also be operated together with standard I/O devices in an Inline station.

The following PROFIsafe modules are available at present:

- R-IB IL 24 PSDI 8-PAC
- R-IB IL 24 PSDI 16-PAC
- R-IB IL 24 PSDO 8-PAC
- R-IB IL 24 PSDO 4/4-PAC
- R-IB IL 24 PSDOR 4-PAC

The modules map their process data to the local bus and obtain the F-Parameters and iParameters from the parameter telegram via a parameter block. The settings are provided in the GSD file.

For more detailed information, please refer to the documents listed under the ordering data. Please refer to the documentation for the components used in your application.

The maximum number of Inline terminals that can be snapped onto the bus coupler depends on the following parameters:

- Maximum number of Inline bus devices that can be snapped on: 61
- Maximum length of the process data channel: 244 bytes
- Maximum length of the parameter channel: 244 bytes

Make sure that no parameters are overwritten.

When operating safety terminals on the bus coupler, it is recommended that status PDU diagnostics is activated. In this operating mode, the device and parameter errors are forwarded transparently by the safety terminals to the corresponding controller.



The GSD file (electronic device data sheet) is required to configure PROFIBUS devices. This file contains all the safety modules that are currently available.

Make sure you always use the latest GSD file. It is available on the Internet at www.boschrexroth.com.

14 Additional documentation



For additional information on the bus coupler, please refer to application description DOK-CTRL-ILPBBK-DIOCN-AW...-EN-P.