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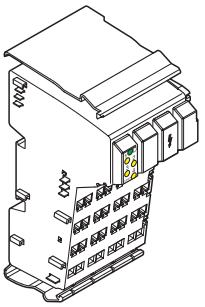
IB IL 24/230 DOR 4/W-PC
IB IL 24/230 DOR 4/W-PC-PAC

Inline Terminal
With Four Relay Changeover Contacts



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Data Sheet 6530B 03/2003

The IB IL 24/230 DOR 4/W-PC and IB IL 24/230 DOR 4/W-PC-PAC only differ in the scope of supply (see "Ordering Data" on page 17). Their function and technical data are identical.

For greater clarity, the Order Designation IB IL 24/230 DOR 4/W-PC is used throughout this document.

This data sheet is only valid in association with the IB IL SYS PRO UM E User Manual or the Inline System Manual for your bus system.

Function

The terminal is designed for use within an Inline station. It has four electrically isolated relay changeover contacts. The terminal is suitable for switching inductive and capacitive loads.

The terminal can be used in the SELV area and in the AC area. Observe the appropriate regulations and safety notes when using the terminal in the AC area.

Please use the IB IL 24/230 DOR 4/W terminal for switching voltages less than 12 V or currents less than 100 mA.

Features

- Safe isolation according to EN 50178
- Electrically isolated connection for four actuators
- Nominal current at the output: 3 A
- Total current of the terminal: 4 x 3 A = 12 A
- LED diagnostic and status indicators

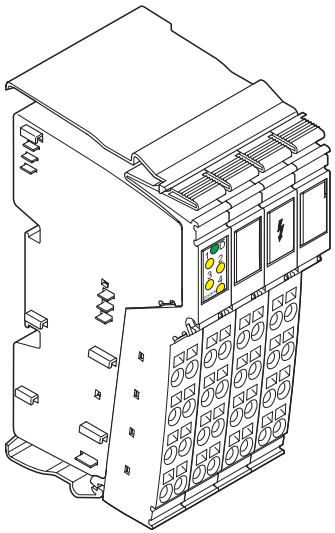

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Figure 1 IB IL 24/230 DOR 4/W-PC terminal with connectors

Safety Notes

Safety notes for Inline terminals for installation in voltage ranges outside the SELV (AC area)

Only qualified personnel may work on Inline terminals in the AC area.

Qualified personnel are people who, because of their education, experience, and instruction and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized by those responsible for the safety of the plant to carry out any required operations and who are able to recognize and avoid any possible dangers.
(Definitions for skilled workers according to EN 50110-1:1996.)

The instructions given in the IB IL SYS PRO UM E User Manual or the Inline System Manual for your bus system and in this data sheet must be followed during installation and startup.

Technical modifications reserved.

Correct Usage

The terminal is only to be used within an Inline station as specified in this data sheet and the IB IL SYS PRO UM E User Manual or the Inline System Manual for your bus system. Phoenix Contact accepts no liability if the device is used for anything other than its designated use.

Dangerous voltage

Please note that there are dangerous voltages when switching circuits that do not meet SELV requirements.

Only remove and insert the AC terminals when the power supply is disconnected. When working on terminals and wiring, always switch off the supply voltage and ensure it cannot be switched on again.

Installation Instructions and Notes

Install the system according to the requirements of EN 50178.

Please use grounded AC networks

Inline AC terminals must only be operated in grounded AC networks.

Read the user manual

Please observe the installation instructions and installation notes in the IB IL SYS PRO UM E User Manual or the Inline System Manual for your bus system, especially the information about the low voltage area.

Special Features of the IB IL 24/230 DOR 4/W-PC Terminal

Loads up to 230 V can be switched using the IB IL 24/230 DOR 4/W-PC terminal.

Please note that the IB IL 24/230 DOR 4/W-PC terminal interrupts the potential jumpers U_M, U_S, and GND (24 V area) as well as L and N (120 V/230 V areas). If required, these supply voltages must be reintroduced/ provided after the relay terminal using an appropriate power terminal.

Switching Loads in the 230 V Area

To switch voltages outside the SELV area, an AC area must be created corresponding to the installation instructions and notes given in the user manual.

Operation on an AC network

Operate the terminal from a single phase on an AC network.

Switching Voltages That Are Not Available in the Segment

A relay terminal can be used to switch voltages that are not available in the segment in which the terminal is located (e.g., switching 230 V AC within a 24 V DC segment).
In this case, place a distance terminal before and after the IB IL 24/230 DOR 4/W-PC terminal (see "Ordering Data" on page 17). The isolating distances between the individual areas are thus maintained.

See also "Connection Examples" on page 6.

General Description

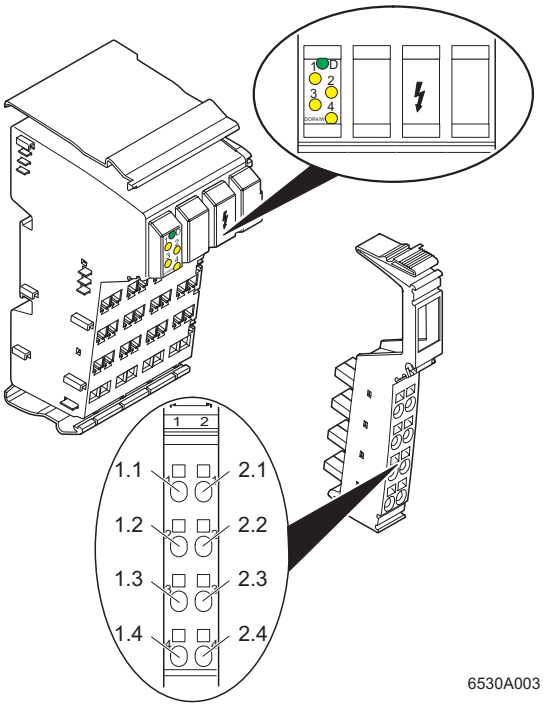


Figure 2 IB IL 24/230 DOR 4/W-PC with an appropriate connector

Function Identification

Red with lightning bolt

Housing/Connector Color

Gray housing

Gray connector

Local LED Diagnostic and Status Indicators

Des.	Color	Meaning
D	Green	Diagnostics
1, 2, 3, 4	Yellow	Output status indicator (relay has picked up)

Terminal Assignment for Each Connector

Terminal Points	Assignment
1.1, 2.1	Not used (no contact present)
1.2, 2.2	Relay N/C contact
1.3, 2.3	Relay main contact
1.4, 2.4	Relay N/O contact

In the corresponding connector IB IL SCN-8-AC-REL, the adjacent contacts 1.2/2.2, 1.3/2.3, and 1.4/2.4 are jumpered.

It is therefore possible to transmit the power to supply several relays of IB IL 24/230 DOR 4/W-PC terminals from one connector to the next via a jumper.

Please note that the current at one terminal point must not exceed 8 A.

Internal Circuit Diagram

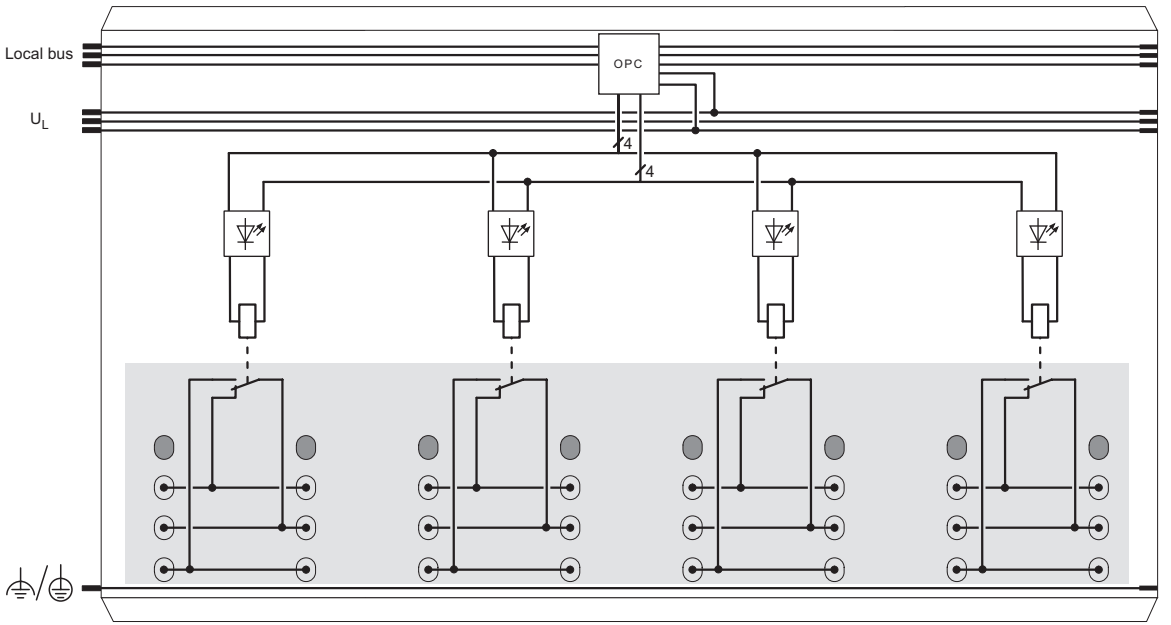


Figure 3 Internal wiring of the terminal points

Key:

OPC — Protocol chip (bus logic including voltage conditioning)

LED

Terminal point, without metal contact

Relay

FE or PE depending on the area in which the terminal is used

Electrically isolated area
I/O area including relay contact isolated from the logic area including the relay coil through "safe isolation" according to EN 50178.

Other symbols are explained in the IB IL SYS PRO UM E User Manual or in the Inline System Manual for your bus system.

Connection Examples

Connecting Actuators

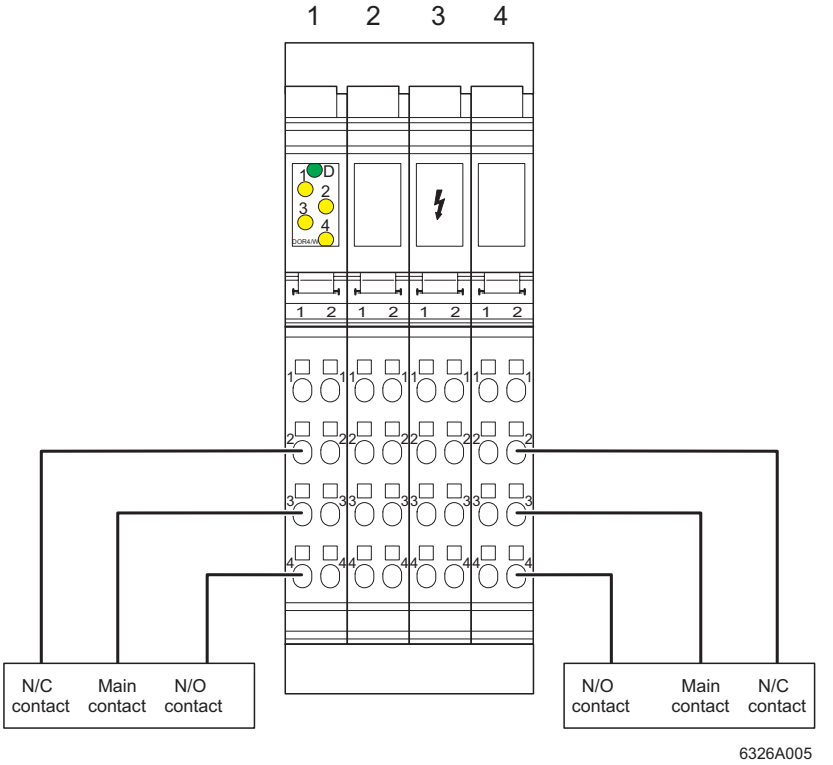


Figure 4 Typical connection of actuators

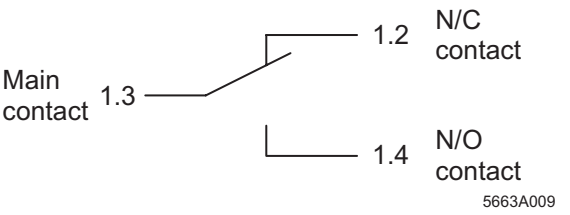


Figure 5 Output relay contacts

Switching Voltages That Are Not Available in the Segment

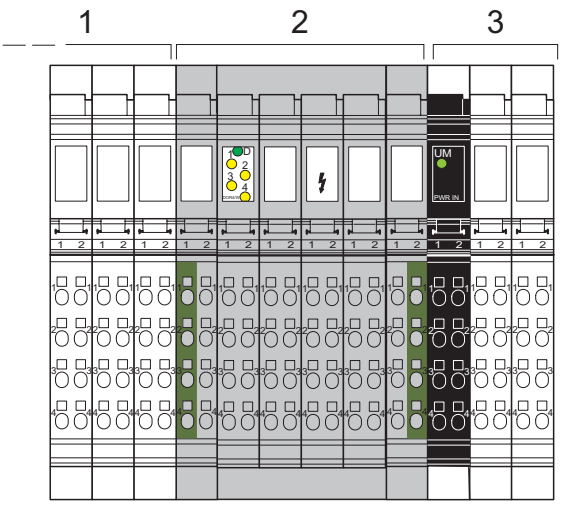


Figure 6 Example: Switching 230 V within a 24 V area

1 24 V area consisting of station head and I/O terminals

2 IB IL 24/230 DOR 4/W-PC terminal separated from the 24 V area by distance terminals

3 24 V area consisting of a power terminal and I/O terminals

See also "Special Features of the IB IL 24/230 DOR 4/W-PC Terminal" on page 3.

Distance terminals can also be used to switch a 24 V channel within a 230 V area.

Switching Voltages That Are Available in the Segment

The distance terminals are not required to switch a 24 V channel within a 24 V area or to switch a 230 V channel within a 230 V area.

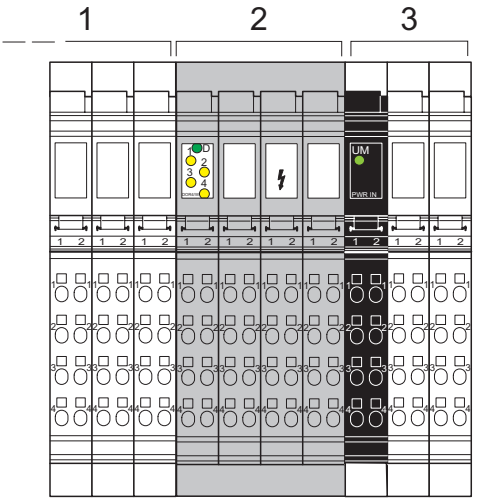


Figure 7 Switching 24 V within a 24 V area

1 24 V area consisting of station head and I/O terminals

2 IB IL 24/230 DOR 4/W-PC terminal

3 24 V area consisting of a power terminal and I/O terminals

Interference Suppression Measures on Inductive Loads/Switching Relay

Each electrical load is a mixture of ohmic, capacitive, and inductive elements. Depending on the proportion of the element, switching these loads results in a larger or smaller load on the switch contact.

In practice, loads are generally used with a large inductive element, such as contacts, solenoid valves, motors, etc. Due to the energy stored in the coils, voltage peaks of up to several thousand volts may occur when the system is switched off.
These high voltages cause an arc, which may destroy the controlling contact through material evaporation and material transfer.

This pulse, which is similar to a square wave pulse, emits electromagnetic pulses over a wide frequency range with a large amount of power and with spectral elements reaching several MHz.

To prevent such arcs from occurring it is necessary to fit the contacts/loads with protective circuits. The following protective circuits can be used:

– Contact protective circuit
– Load protective circuit
– Combination of both protective circuits

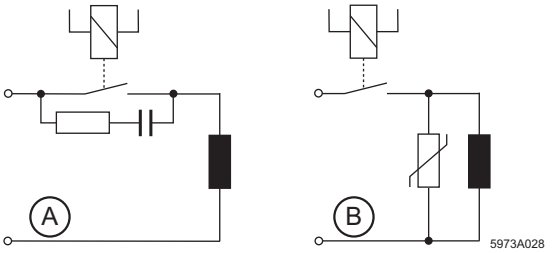


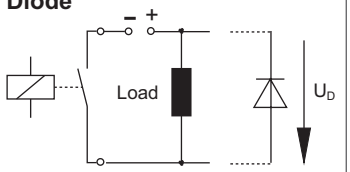
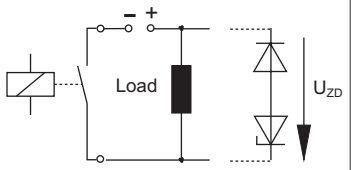
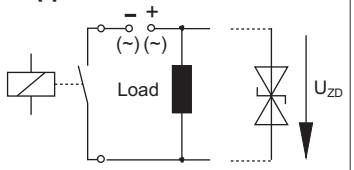
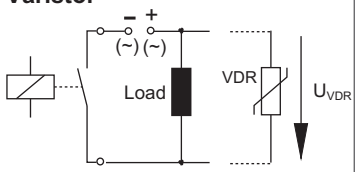
Figure 8 Contact protective circuit (A), load protective circuit (B)

If sized correctly, these circuit versions do not differ greatly in their effectiveness. In principle, a protective measure should be directly implemented at the source of the interference. In addition, the following points should be observed for a load protective circuit:

– When the contact is open, the load is electrically isolated from the operating voltage.
– It is not possible for the load to be activated or to "stick" due to undesired operating currents, e.g., from RC elements.
– Shutdown voltage peaks cannot be coupled in control lines that run in parallel.

Phoenix Contact provides protective circuit solutions in terminal format or in electronic housing (see the "CLIPLINE" catalog or "TRABTECH" catalog). Additional information is available on request. In addition to this, today the majority of contact manufacturers offer diode, RC or varistor elements that can be snapped on. For solenoid valves, connectors with an integrated protective circuit can be used.

Circuit Versions

Protecting the load	Additional delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/ Disadvantages
Diode 	Long	Yes (U_D)	No	Advantages: - Easy implementation - Cost-effective - Permitted - Uncritical sizing - Low induction voltage Disadvantages: - Attenuation only via load resistor - High delay
Series connection diode/ zener diode 	Medium to short	Yes (U_{ZD})	No	Advantages: - Uncritical sizing Disadvantages: - Attenuation only above U_{ZD}
Suppressor diode 	Medium to short	Yes (U_{ZD})	Yes	Advantages: - Cost-effective - Uncritical sizing - Limits positive peaks - Suitable for AC voltage Disadvantages: - Attenuation only above U_{ZD}
Varistor 	Medium to short	Yes (U_{VDR})	Yes	Advantages: - High power absorption - Uncritical sizing - Suitable for AC voltage Disadvantages: - Attenuation only above U_{VDR}

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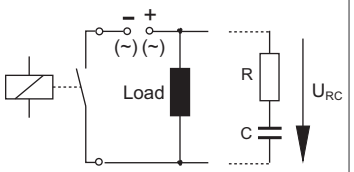
RC Circuit Versions

RC Connected in Series:

Protecitng the Load	Additional Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
R/C combination 	Medium to short	No	Yes	Advantages: - HF attenuation via power store - Suitable for A/C voltage - Level-independent attenuation - Reactive-current compensating Disadvantages: - Exact dimension required - High inrush current

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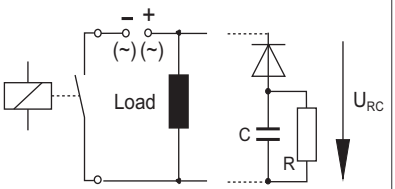
Sizing:

– Capacitor: $C \approx L_{Load}/4 \times R_{Load}^2$
– Resistor: $R \approx 0.2 \times R_{Load}$

RC Parallel Circuit With Series Diode

Protecting the load	Additional Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
R/C communication with diode 	Medium to short	No	Yes	Advantages: - HF attenuation via power store - Level-independant attenuation - Current inversion not possible Disadvantages: - Exact dimension required - Only suitable for DC voltage

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Sizing:

– Capacitor: $C \approx L_{Load}/4 \times R_{Load}^2$
– Resistor: $R \approx 0.2 \times R_{Load}$

Switching AC/DC Loads

Switching Large AC Loads

When switching large AC loads, the relay can be operated up to the corresponding maximum values for switching voltage, current, and power. The arc that occurs during shutdown depends on the current, voltage, and phase angle. This shutdown arc switches off automatically the next time the load current passes through zero.

In applications with an inductive load, an effective protective circuit must be provided, otherwise the life of the system will be reduced considerably.

To prolong the life of the IB IL 24/230 DOR 4/W-PC terminal as mush as possible when using lamp loads or capacitive loads, the current peak must not exceed 6 A when the load is switched on.

Switching Large DC Loads

In DC operation, a relay can only switch a relatively low current compared with the maximum permissible alternating current. This maximum direct current value is also highly dependent on the voltage and is determined in part by design conditions, such as the contact distance and contact opening speed.

The corresponding current and voltage values are shown in Figure 9.

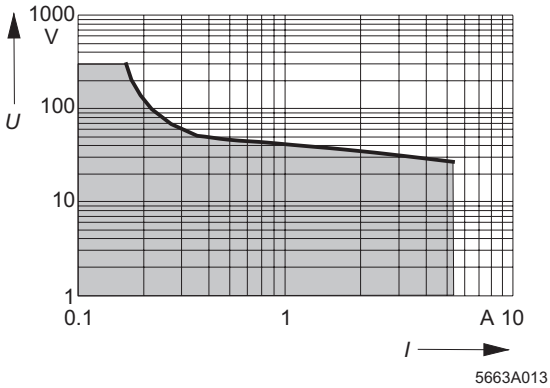


Figure 9 DC load limiting curve (REL-SNR-1XU/G 5 GOLD relay)

I Switching current in A

U Switching voltage in V

Definition of the load limiting curve: For 1000 cycles, no constant arc should occur with a burning life > 10 ms.

An unattenuated inductive load further reduces the values given here for switching currents. The energy stored in the inductivity can cause an arc to occur which forwards the current via the open contacts. Using an effective contact protective circuit in relay contacts with the same life enables you to switch currents that are virtually the same as with ohmic loads.

If it is permitted to switch higher DC loads, several relay contacts can be switched in parallel.

Additional technical data is available on request.

Programming Data/Configuration Data

INTERBUS

ID code	BD_{hex} (189_{dec})
Length code	41_{hex}
Process data channel	4 bits
Input address area	0 bits
Output address area	4 bits
Parameter channel (PCP)	0 bits
Register length (bus)	4 bits

Other Bus Systems

For the configuration data of other bus systems, please refer to the appropriate electronic device data sheet (GSD, EDS).

Process Data

Assignment of Terminal Points to OUT Process Data

(Byte.bit) view	Bit	0.3	0.2	0.1	0.0
Assignment	Slot	4	3	2	1
	N/C contact	1.2	1.2	1.2	1.2
	Main contact	1.3	1.3	1.3	1.3
	N/O contact	1.4	1.4	1.4	1.4
Status indicator	LED	4	3	2	1

If the bits are set to 1, the corresponding N/O contact is closed.

The LEDs light up, if the corresponding N/O contact is closed.

For the assignment of the illustrated (byte.bit) view for your **INTERBUS** control or computer system, please refer to data sheet DB GB IBS SYS ADDRESS, Part No. 90 00 99 9.

Technical Data

General Data	
Order Designation (Order No.)	IB IL 24/230 DOR 4/W-PC-PAC (28 62 18 1) IB IL 24/230 DOR 4/W-PC (28 60 41 3)
Housing dimensions (width x height x depth)	48.8 mm x 120 mm x 71.5 mm (1.921in. x 4.724 in. x 2.815 in.)
Weight	138 g (without connectors)
Operating mode	Process data mode with 4 bits
Type of actuator connection	To an electrically isolated relay changeover contact
Permissible temperature (operation)	-25°C to +55°C (-13°F to +131°F)
Permissible temperature (storage/transport)	-25°C to +85°C (-13°F to +185°F)
Permissible humidity (operation)	75% on average, 85% occasionally
In the range from -25°C to +55°C (-13°F to +131°F) appropriate measures against increased humidity (> 85%) must be taken.	
Permissible humidity (storage/transport)	75% on average, 85% occasionally
For a short period, slight condensation may appear on the outside of the housing if, for example, the terminal is brought into a closed room from a vehicle.	
Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2000 m [6562 ft.] above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m [9843 ft.] above sea level)
Degree of protection	IP 20 according to IEC 60529

Mechanical Requirements (Deviation From the Inline Specifications)	
Vibration test sinusoidal vibrations according to IEC 60068-2-6; EN 60068-2-6	2g load, 2 hours for each space direction
Shock test according to IEC 60068-2-27; EN 60068-2-27	2g load for 11 ms, half sinusoidal wave, three shocks in each space direction and orientation

Interface	
Local bus	Through data routing

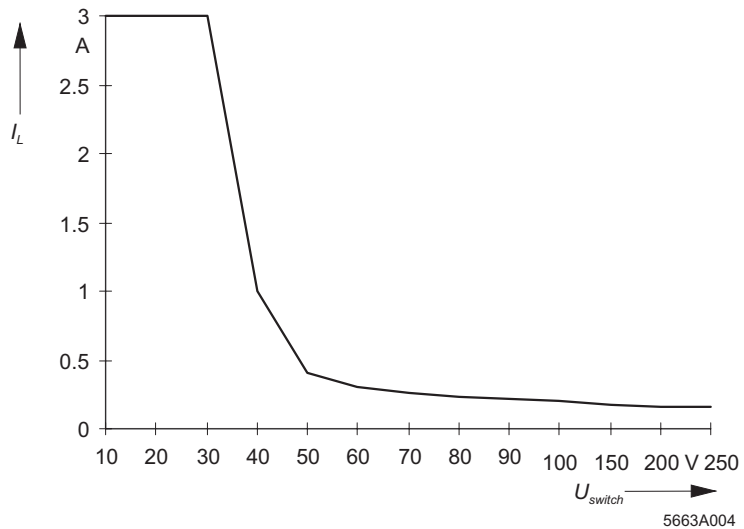
Power Consumption	
Communications power	7.5 V
Current consumption from the local bus off/on	22 mA/187 mA
Power consumption from the local bus	0.17 W/1.4 W

Supply of the Module Electronics and I/O Through Bus Terminal/Power Terminal	
Connection method	Through potential routing

Relay output	
Number	4
Contact material	$AgSnO_2$, hard gold-plated
Contact resistance	50 mΩ at 100 mA/6 V
Limiting continuous current (at maximum ambient temperature)	3 A
Maximum switching voltage	253 V AC, 250 V DC
Maximum switching power (AC/DC)	750 VA (see derating)
Minimum load	5 V; 10 mA
Switching current at 30 V DC	3 A
Switching current at 250 V DC	0.15 A
Maximum inrush current peak for lamp loads and capacitive loads	6 A for T = 200 µs
See also the Table entitled "Maximum Switching Current for Ohmic Load Depending on the Switching Voltage" on page 15.	
Nominal power consumption of the coil (at 20°C [68°F])	330 mW from the 7.5 V supply
Resistance of the coil (at 20°C [68°F])	119 Ω ±12 Ω
Maximum switching frequency (without load)	1200 cycles/minute
Maximum switching frequency (with nominal load)	6 cycles/minute
Response delay	5 ms, typical
Bouncing time	5 ms, typical
Release time	6 ms, typical
Mechanical life	2×10^7 cycles
Electrical life	10^5 cycles (at 20 cycles/minute)
Common potentials	All contacts electrically isolated

Maximum Switching Current for Ohmic Load Depending on the Switching Voltage (With Direct Voltage)	
Switching Voltage (V DC)	**Switching Current (A)**
5	3.0
10	3.0
20	3.0
30	3.0
40	1.0
50	0.4
60	0.3
70	0.26
80	0.23
90	0.215
100	0.2
150	0.18
200	0.165
250	0.155

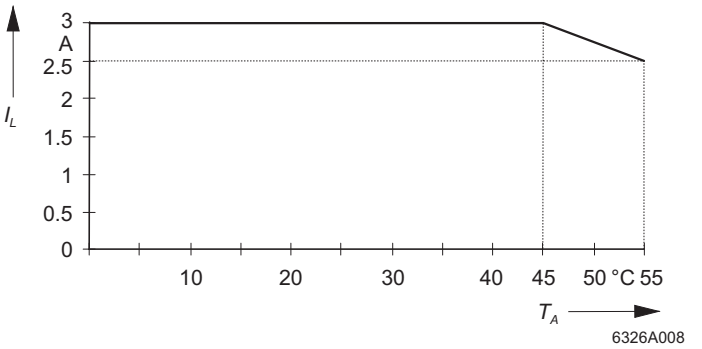
Load Current (I_L in A) as a Function of the Switching Voltage (U_{switch} in V)



Maximum Switching Current Depending on the Temperature (With Alternating Voltage)

With a switching current of 3 A, the switching voltage with alternating current must not exceed 253 V AC. Observe the derating.

Load Current (I_L in A) as a Function of the Ambient Temperature (T_A in °C)



Power Dissipation

Formula to Calculate the Power Dissipation in the Terminal

$P_{EL} = P_{BUS} + (P_{REL}) + P_L$

$P_{EL} = 0.17\ W + 4 \times ((0.31\ W) + I_L^2 \times 0.04\ \Omega)$

For N/C contacts, the term P_{REL} is omitted from the formula.

Where

P_{EL}	Total power dissipation in the terminal
P_{BUS}	Power dissipation through bus operation
P_{REL}	Power dissipation of the relay coil
P_L	Power dissipation through the load current via the contacts
I_L	Load current of the output

Power Dissipation of the Housing Depending on the Ambient Temperature

$P_{HOU} = 2.7\ W$	-25°C (-13°F) < $T_A \leq$ +25°C (+77°F)
$P_{HOU} = 2.7\ W - ((T_A - 25°C\ [77°F]) \times 0.02\ W/°C)$	+25°C (+77°F) < $T_A \leq$ +55°C (+131°F)

Where

P_{HOU}	Permissible power dissipation of the housing
T_A	Ambient temperature

Safety Measures	
None	

Error Messages to the Higher-Level Control or Computer System	
None	

Air and Creepance Distances (According to EN 50178, VDE 0109, VDE 0110)			
Isolating Distance	**Clearance**	**Creepance Distance**	**Test Voltage**
Relay contact/bus logic	≥ 5.5 mm (0.217 in.)	≥ 5.5 mm (0.217 in.)	4 kV, 50 Hz, 1 min.
Contact/contact	≥ 3.1 mm (0.122 in.)	≥ 3.1 mm (0.122 in.)	1 kV, 50 Hz, 1 min.
Contact/PE	≥ 3.1 mm (0.122 in.)	≥ 3.1 mm (0.122 in.)	1 kV, 50 Hz, 1 min.

Ordering Data

Description	Order Designation	Order No.
Terminal with four relay changeover contacts; including connectors and labeling fields	IB IL 24/230 DOR 4/W-PC-PAC	28 62 18 1
Terminal with four relay changeover contacts	IB IL 24/230 DOR 4/W-PC	28 60 41 3
Four connectors are required for the complete fitting of the IB IL 24/230 DOR 4/W-PC-PAC terminal.		
Connector with seven terminals, spring-cage connection (gray, w/o color print); pack of 10	IB IL SCN-8-AC-REL	27 40 29 0
Distance terminals (isolation of various voltage areas); pack of 1 set (2 pcs.)	IB IL DOR LV-SET	27 42 64 1
Connector for IB IL DOR LV-SET; pack of 1 set (2 pcs.)	IB IL DOR LV-PLSET	27 42 66 7
"Configuring and Installing the INTERBUS Inline Product Range" User Manual	IB IL SYS PRO UM E	27 43 04 8

Make sure you always use the latest documentation.
This is available on the Internet at www.phoenixcontact.com.

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