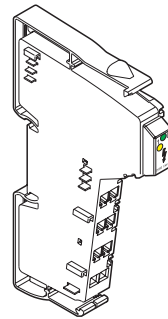


# IB IL 24/230 DOR 1/W-PC

## INTERBUS Inline Terminal With One Relay Changeover Contact

Data Sheet 6485A

09/2002



5663A001



This data sheet is only valid in association with the "Configuring and Installing the INTERBUS Inline Product Range" User Manual IB IL SYS PRO UM E.

## Function

The terminal is designed for use within an INTERBUS Inline station. It has a relay changeover contact that is electrically isolated. The terminal is suitable for switching inductive and capacitive loads.



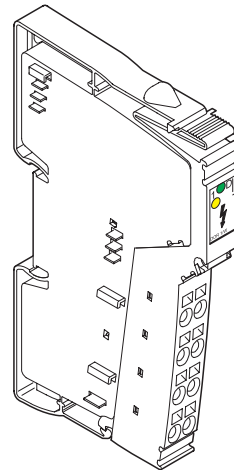
The terminals can be used in the SELV (low voltage) area and in the AC area. Observe the appropriate conditions and safety notes when using the terminal in the AC area.



Please use the IB IL 24/230 DOR 1/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 an actuator
- Nominal current of the output: 2.2 A
- Total current of the terminal: 2.6 A
- Diagnostic and status indicators



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



Please note that the connector is not supplied as standard with the terminal. Refer to the Ordering Data on page 17 to order the appropriate connector for your application.



## Safety Notes for Inline Terminals Used in Areas Outside the SELV (AC Area)

Only qualified personnel may carry out work on the Inline terminals of 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 recog-

nize 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 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 in the "Configuring and Installing the INTERBUS Inline Product Range" User Manual. 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.

Connecting and disconnecting the AC terminals is only allowed if 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.



### Use Grounded AC networks

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



### Read the User Manual

Please observe the installation guidelines in the IB IL SYS PRO UME User Manual, in particular the notes for the low voltage area.

## Special Features of the IB IL 24/230 DOR 1/W-PC Terminal

Up to 230 V can be switched using the IB IL 24/230 DOR 1/W-PC terminal.



Please note that the IB IL 24/230 DOR 1/W-PC terminal interrupts the potential jumpers  $U_M$ ,  $U_S$  and GND (24 V area) and L and N (120 V/230 V areas). These supply voltages must be fed in/provided using a power terminal after the relay terminal, if required.

### 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 in an AC network:

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

### Switching Loads that are not Available in the Segment

With the relay terminal it is possible to switch voltages that are not available in the segment in which the terminal is used (e.g., switching 230 V AC within a 24 V DC segment). In this case, place a terminal before and after the IB IL 24/230 DOR 1/W-PC terminal to separate the relay terminal (see "Ordering Data" on page 17). Thus, the isolating distances between the individual areas are maintained.

See also "Connection Examples" on page 6.

## General Description

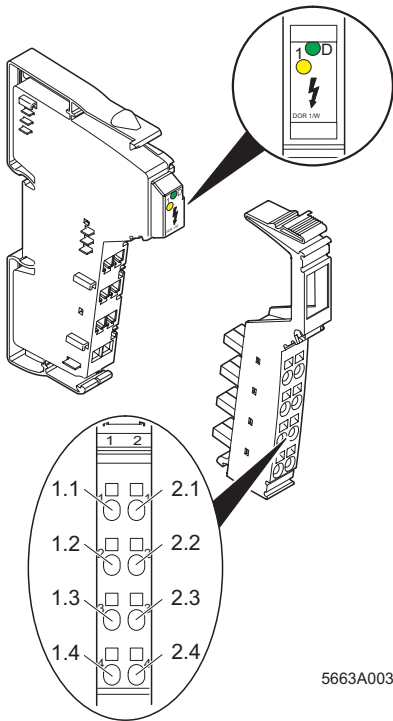


Figure 2 IB IL 24/230 DOR 1/W-PC with appropriate connector

### Function Identification

Red with lightning bolt

### Housing/Connector Color

Gray housing

Gray connector, without color print

### Local diagnostic and status indicators

Des.	Color	Meaning
D	Green	Bus diagnostics
1	Yellow	Output status indication (relay energized)

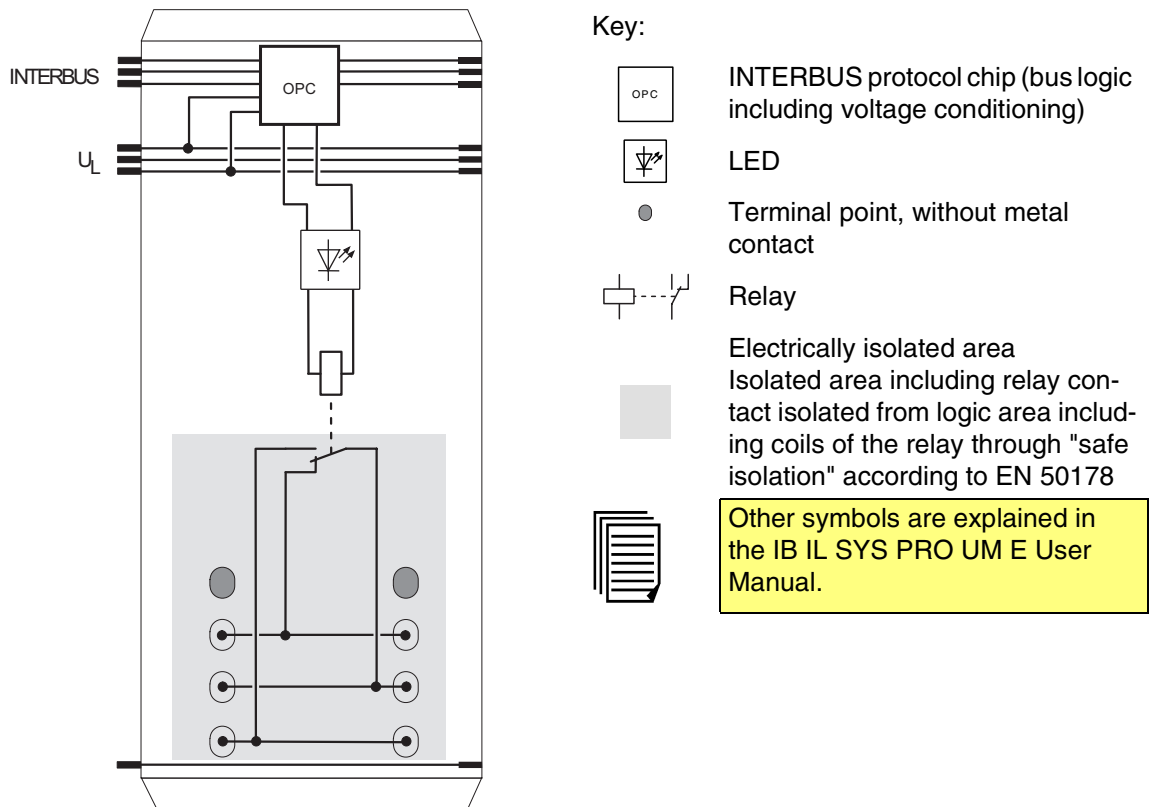
### Terminal assignment

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

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

If required, it is possible to supply several relays of the IB IL 24/230 DOR 1/W-PC terminals by using a jumper to send the voltage from one terminal to the next.

## Internal Circuit Diagram



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Figure 3 Internal wiring of the terminal points

# Connection Examples

## Connection of an Actuator

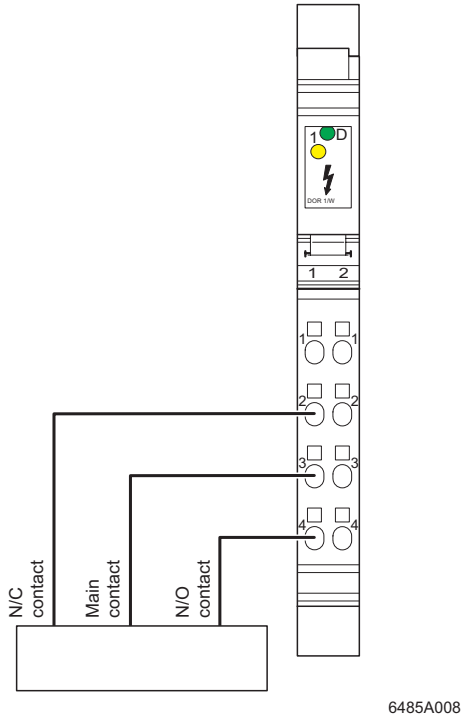


Figure 4 Connection example of an actuator

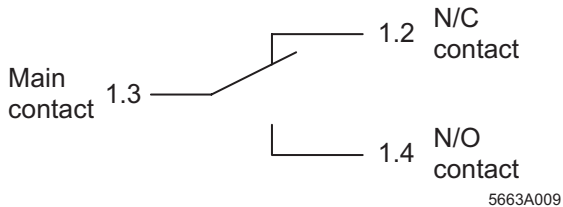


Figure 5 Relay contacts for the output

## Switching Loads that are not Available in the Segment

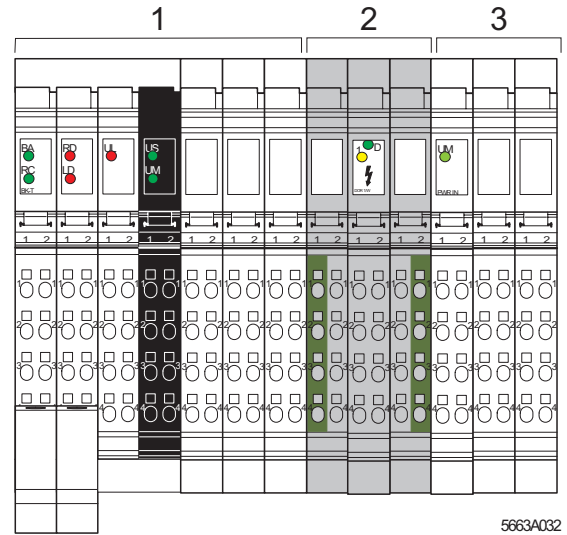


Figure 6 Example: Switching 230 V within a 24 V area

- 1 24 V area consisting of bus terminal and I/O terminals
- 2 IB IL 24/230 DOR 1/W-PC terminal, separated from the 24 V area by the appropriate terminals
- 3 24 V area consisting of power terminal and I/O terminals

See also "Special Features of the IB IL 24/230 DOR 1/W-PC Terminal" on page 3.



Also use the appropriate separating terminals to switch a 24 V channel within a 230 V area.

### Switching Loads that are Available in the Segment



The separating terminals are not required when switching a 24 V channel within a 24 V area or when switching a 230 V channel within a 230 V area.

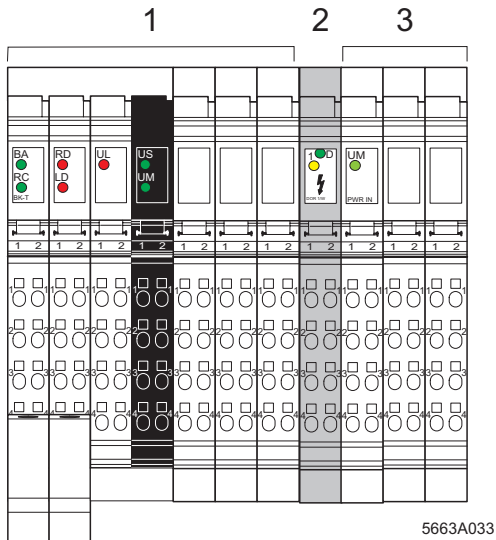


Figure 7 Switching 24 V within a 24 V area

- 1 24 V area consisting of bus terminal and I/O terminals
- 2 IB IL 24/230 DOR 1/W-PC terminal
- 3 24 V area consisting of power terminal and I/O terminals

## Interference Suppression Measures for Inductive Loads/Switching Relays

Each electrical load is a combination of ohmic, capacitive and inductive elements. When switching these loads a larger or smaller load is provided for the switching contact depending on the weighting of the elements.

In practice, mainly loads with large inductive portions, such as contactors, solenoid valves or motors are used. 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 rectangular type pulse beams electromagnetic pulses via a wide frequency area. Spectral parts reach the MHz area with a great deal of power.

To prevent such arcs from occurring protective circuits must be provided for contacts/loads. In general, different protection options are available:

- Protecting the contact
- Protecting the load
- Combination of both protection methods

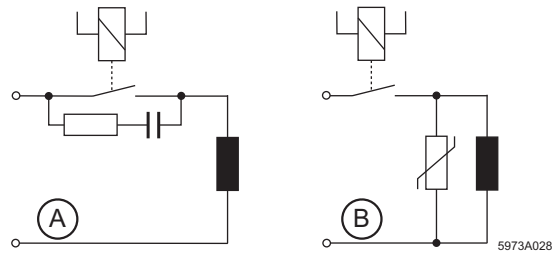


Figure 8 Contact protection (A), Load protection (B)

If sized correctly, these circuit versions do not differ greatly in their effectiveness. In general, a protective measure should be implemented directly at the source of the interference. The following points indicate the advantages of load protection:

- 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 induced in control lines that run in parallel.

Phoenix Contact provide various solutions for the protective circuit in terminal format or in electronic housing (see "CLIPLINE" catalog or "TRABTECH" catalog). Additional information is available on request. Today most contact manufacturers also offer diode, RC or varistor elements, which can be snapped on. For solenoid valves, it is possible to insert connectors with an integrated protective circuit.



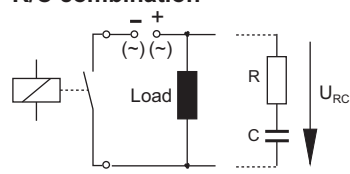
Circuit Versions

Load Protection	Additional Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
<p><b>Diode</b></p>	Long	Yes ( $U_D$ )	No	<p>Advantages:</p> <ul style="list-style-type: none"> <li>- easy implementation</li> <li>- cost-effective</li> <li>- reliable</li> <li>- uncritical dimensioning</li> <li>- low induction voltage</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>- attenuation only via load resistor</li> <li>- long off delay</li> </ul>
<p><b>Series connection diode/zener diode</b></p>	Medium to short	Yes ( $U_{ZD}$ )	No	<p>Advantages:</p> <ul style="list-style-type: none"> <li>- uncritical dimensioning</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>- attenuation only above <math>U_{ZD}</math></li> </ul>
<p><b>Suppressor diode</b></p>	Medium to short	Yes ( $U_{ZD}$ )	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> <li>- cost-effective</li> <li>- uncritical dimensioning</li> <li>- limitation of positive peaks</li> <li>- suitable for A.C. voltage</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>- attenuation only above <math>U_{ZD}</math></li> </ul>
<p><b>Varistor</b></p>	Medium to short	Yes ( $U_{VDR}$ )	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> <li>- high power absorption</li> <li>- uncritical dimensioning</li> <li>- suitable for A.C. voltage</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>- attenuation only above <math>U_{VDR}</math></li> </ul>

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RC Circuit Versions

RC Series Connection:

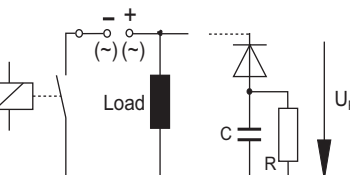
Load Protection	Additional Off Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
<p><b>R/C combination</b></p> 	Medium to small	No	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> <li>- HF attenuation via power storage</li> <li>- suitable for A.C. voltage</li> <li>- level-independent attenuation</li> <li>- reactive-current compensating</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>- exact dimensioning required</li> <li>- high inrush current</li> </ul>

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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 Connection With Series Diode

Load Protection	Additional Off Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
<p><b>R/C combination with diode</b></p> 	Medium to small	No	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> <li>- HF attenuation via power storage</li> <li>- level-independent attenuation</li> <li>- Current inversion not possible</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>- exact dimensioning required</li> <li>- only suitable for D.C. voltage</li> </ul>

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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 specified maximum values for switching voltage, current and power. The arc, which occurs during shutdown, depends on the current, voltage and phase angle. This shut-down 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.

In order to achieve as long an electrical service life as possible for the terminal when using lamp loads or capacitive loads the current peak should not exceed 6 A when switching on the load.

### Switching Large DC Loads

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

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

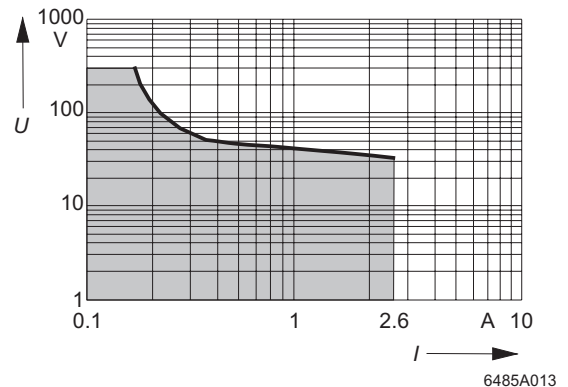


Figure 9 DC load limiting curve, ohmic load (REL-SNR-1XU/G 5 LIEG relay)

$I$  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 of > 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 appear which passes on the current via the open contacts. Using an effective contact protective circuit, the same currents can be switched as for an ohmic load and the life of the relay contacts is the same.

If higher DC loads than permitted are to be switched, several contacts can be switched in parallel.

Additional technical data is available on request.

## Programming Data

ID code	BD <sub>hex</sub> (189 <sub>dec</sub> )
Length code	C2 <sub>hex</sub>
Process data channel	2 bits
Input address area	0 bits
Output address area	2 bits (only bit 0 is occupied)
Parameter channel (PCP)	0 bits
Register length (bus)	2 bits

## INTERBUS Process Data

### Assignment of the Terminal Points to the OUT Process Data

Bit View	Bit	1	0
Terminal	N/C contact	–	1.2
	Main contact	–	1.3
	N/O contact	–	1.4
Status indicator	LED		1



If bit 0 is set to 1, the N/O contact is closed.


The LED lights up if the N/O contact is closed.



For the assignment of the illustrated bit view for your control or computer system, please refer to data sheet [DB GB IBS SYS ADDRESS](#), Part-No. 90 00 99 0.

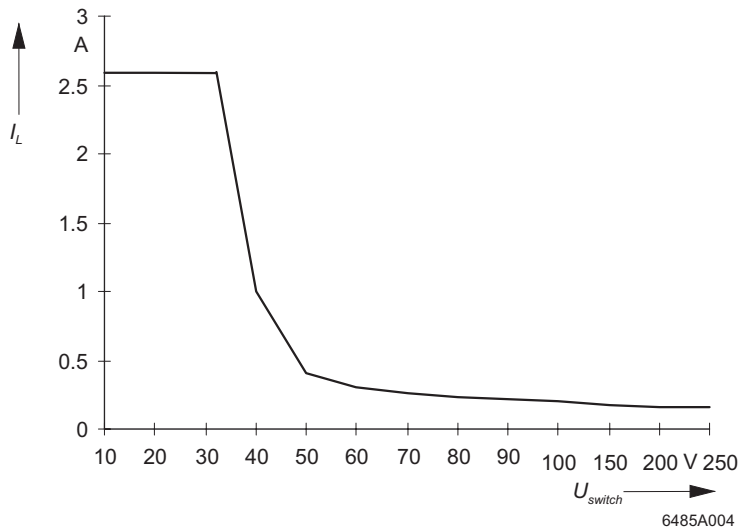
## Technical Data

General Data	
Order Designation	IB IL 24/230 DOR 1/W-PC
Order No.	28 60 40 0
Housing dimensions (width x height x depth)	12.2 mm x 120 mm x 71.5 mm (0.480 x 4.724 x 2.815 in.)
Weight	46 g (without connectors)
Operating mode	Process data operation with 2 bits
Connection method for actuators	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°C to +185°C)
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 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
Interface	
INTERBUS local bus	Through data routing
Power Consumption	
Communications power	7.5 V
Current consumption from the local bus	60 mA, maximum
Power consumption from the local bus	0.45 W, maximum

<b>Supply of the Module Electronics and I/O Through Bus Terminal/Power Terminal</b>	
Connection method	Through potential routing
<b>Relay Output</b>	
Number	1
Contact material	AgSnO <sub>2</sub>
Contact resistance	≤ 150 mΩ at 1 A / 24 V
Limiting continuous current	2.6 A
Maximum switching voltage	253 V AC, 250 V DC
Maximum switching power (AC/DC)	750 VA (see derating)
Minimum load	12 V; 100 mA
Switching current at 30 V DC	2.6 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
 <span style="background-color: yellow; padding: 5px;">See also table "Maximum Switching Current for Ohmic Load Depending on the Switching Voltage" on page 15.</span>	
Nominal power consumption of the coil (at 20 °C [68°F])	210 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 (at nominal load)	6 cycles/minute
Response delay	5 ms, typical
Chatter time	5 ms, typical
Release time	6 ms, typical
Mechanical life	2 x 10 <sup>7</sup> cycles
Electrical life	10 <sup>5</sup> cycles (at 20 cycles/minute)
Common Potentials	All contacts electrically isolated

Maximum Switching Current for Ohmic Load Depending on the Switching Voltage (DC)	
Switching Voltage (V DC)	Switching Current (A)
10	2.6
20	2.6
30	2.6
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 DC)



**Power Dissipation**

**Formula to Calculate the Power Dissipation in the Terminal**

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

$$P_{TOT} = 0.19 \text{ W} + (0.26 \text{ W}) + I_L^2 \times 0.15 \Omega$$



For a N/C contact, the term  $P_{REL}$  in the formula does not apply.

Where

- $P_{TOT}$  Total power dissipation of the terminal
- $P_{BUS}$  Power dissipation through the 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**

$$P_{HOU} = 1.2 \text{ W} \quad -25^\circ\text{C} < T_A \leq +25^\circ\text{C}$$

$$P_{HOU} = 1.2 \text{ W} - ((T_A - 25^\circ\text{C}) \times 0.02 \text{ W}/^\circ\text{C}) \quad +25^\circ\text{C} < T_A \leq +55^\circ\text{C}$$

Where

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

**Derating**

Ambient temperature $T_A$	Power Dissipation of the Housing	Maximum Load Current	
		N/C contact	N/O contact
25°C (77°F)	1.2 W	2.6 A	2.2 A
30°C (86°F)	1.1 W	2.5 A	2.1 A
35°C (95°F)	1.0 W	2.3 A	1.9 A
40°C (104°F)	0.9 W	2.2 A	1.7 A
45°C (113°F)	0.8 W	2.0 A	1.5 A
50°C (122°F)	0.7 W	1.8 A	1.3 A
55°C (131°F)	0.6 W	1.7 A	1.0 A



Safety Measures	
None	

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

Air and Creepage Distances (According to EN 50178, VDE 0109, VDE 0110)			
Isolating Distance	Air Distance	Creepage 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*	≥ 3.1 mm*	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

\*on the printed circuit board

## Ordering Data

Description	Order Designation	Order No.
Terminal with a digital relay output	IB IL 24/230 DOR 1/W-PC	28 60 40 0
Connector with six connections using the spring-cage method (gray, w/o color print); pack of 10	IB IL SCN-8-AC-REL	27 40 29 0
Terminals for separating the relay terminal (separating different 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

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