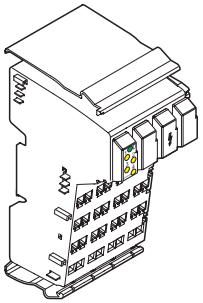
IB IL 24/230 DOR 4/W

INTERBUS Inline Terminal
With 4 Relay Changeover Contacts



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Data Sheet 6326A 01/2002

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 4 relay changeover contacts that are electrically isolated.

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.

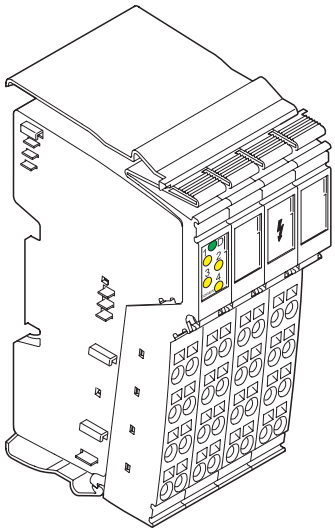

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Figure 1 IB IL 24/230 DOR 4/W terminal with connector

Please note that the connectors are not supplied with the terminal. Please refer to ordering data on page 18 to order the appropriate connectors for your application.

Features

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

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 recognize and avoid any possible dangers.
(Definitions for skilled workers according to EN 50110-1:1996).

The instructions given in this data sheet and in the IB IL SYS PRO UM E User Manual 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 INTERBUS Inline System Manual. Phoenix Contact accepts no liability if the device is used for anything other than its designated use.

Dangerous voltage!

Dangerous voltage when switching current circuits that do not meet the requirements of the SELV.

Connecting and disconnecting the AC terminals is only allowed if the power supply is disconnected.
When working on the terminals and wiring, always switch off the supply voltage and ensure it cannot be switched on again.

For general information on the INTERBUS Inline product range, please refer to the “Configuring and Installing the INTERBUS Inline Product Range” User Manual
IB IL SYS PRO UM E.

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 UM E User Manual, in particular the notes for the low voltage area.

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

Up to 230 V can be switched using the IB IL 24/230 DOR 4/W terminal.

Please note that the IB IL 24/230 DOR 4/W terminal interrupts the voltage jumpers U_M, U_S and GND (24 V area) and L and N (120 V/ 230 V areas). The main power must be supplied using a power terminal after the IB IL 24/230 DOR 4/W, 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 in the User Manual.

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

Switching Voltages 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 of 230 V AC in a 24 V DC segment). In this case, place a terminal (see “Ordering Data” on page 18) before and after the IB IL 24/230 DOR 4/W relay terminal.

See also "Connection Examples" on page 6.

General Description

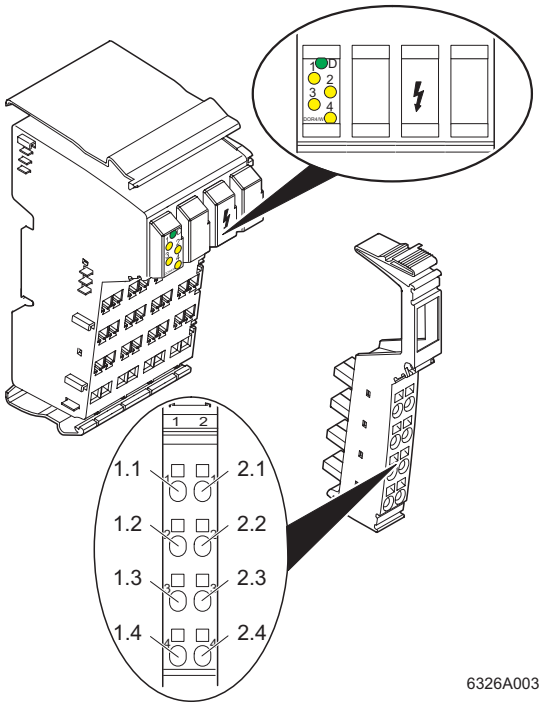


Figure 2 IB IL 24/230 DOR 4/W with appropriate connectors

Function Identification

Red with lightning bolt

Housing/Connector Color

Gray housing

Gray connectors

Local Diagnostic and Status Indicators

Des.	Color	Meaning
D	Green	Bus diagnostics
1,2, 3,4	Yellow	Output status indication (relay energized)

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

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-REL.

Internal Circuit Diagram

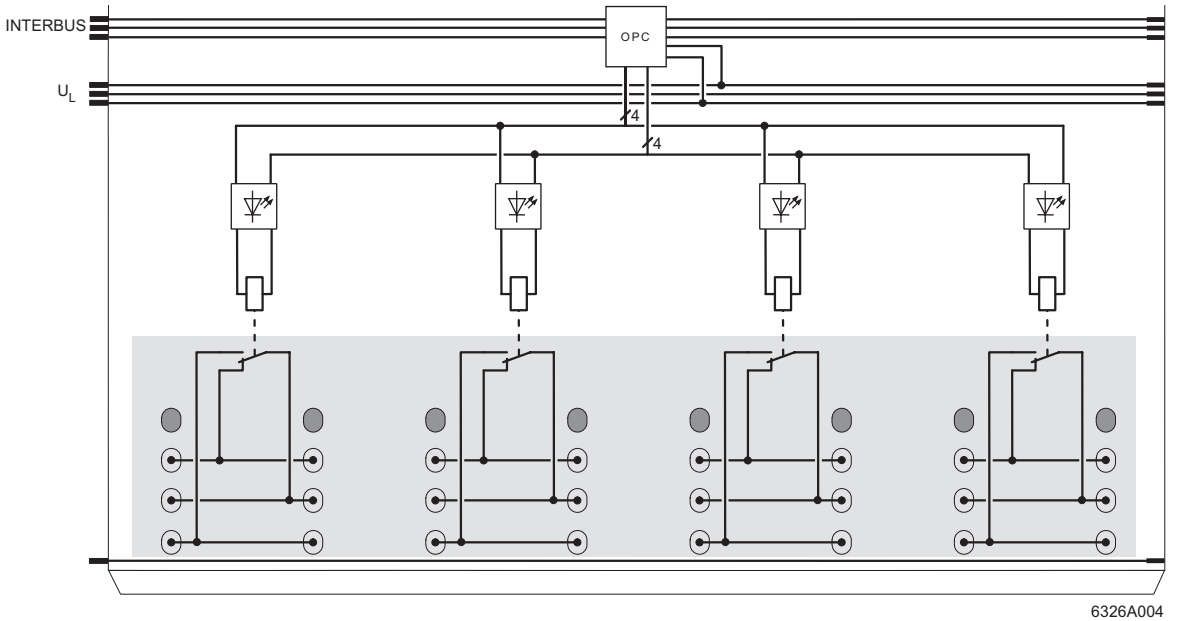


Figure 3 Internal wiring of the terminal points

Key:

OPC — INTERBUS protocol chip (bus logic incl. voltage conditioning)

LED

Terminal point, without metal contact

Relay

Isolated area
I/O area including relay contact isolated from logic area including coils of the relay through "safe isolation" according to EN 50178

Other symbols are explained in the IB IL SYS PRO UM E User Manual.

Connection Examples

Connecting Actuators

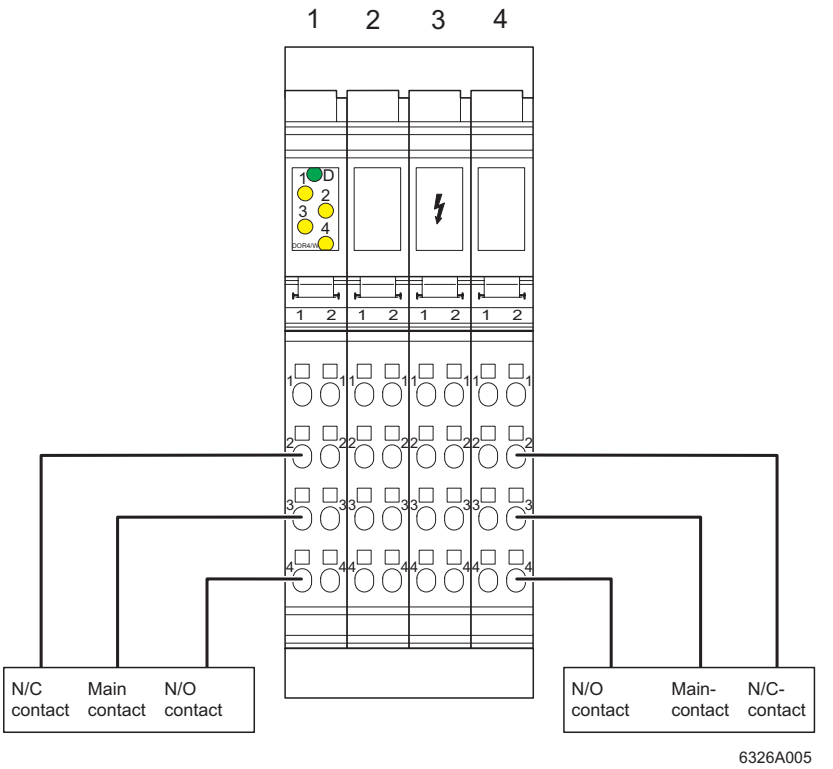


Figure 4 Connection example of actuators

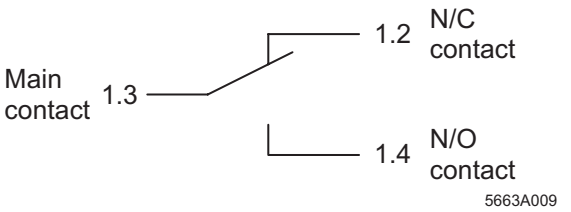


Figure 5 Relay contacts for the output

Switching Voltages That are not Available in the Segment

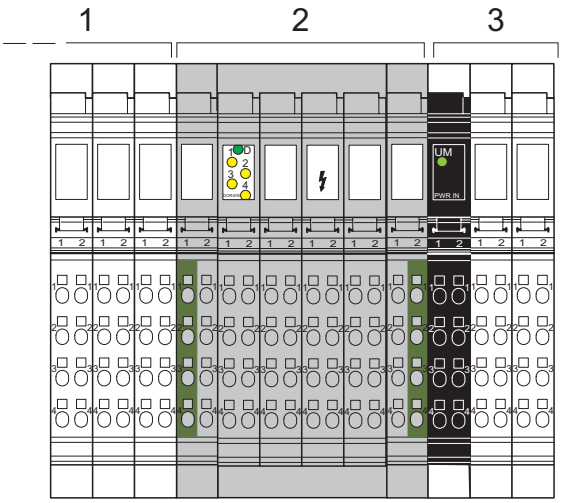


Figure 6 Switching 230 V within a 24 V area

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

2 IB IL 24/230 DOR 4/W terminal separated from the 24 V area using the according terminals

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

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

Use the separating terminals, too, if you want to switch a 24 V channel within a 230 V area.

Switching Voltages That are Available in the Segment

When switching a 24 V channel in a 24 V area or a 230 V channel in a 230 V area the separating terminals are not required.

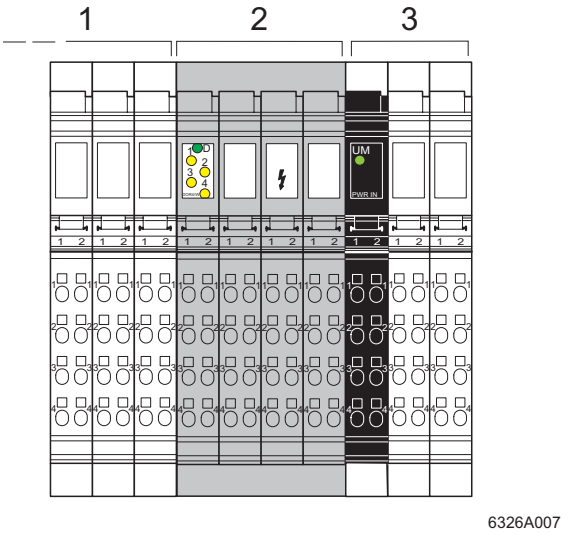


Figure 7 Switching 24 V within a 24 V area

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

2 IB IL 24/230 DOR 4/W 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 wiring options are available:

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

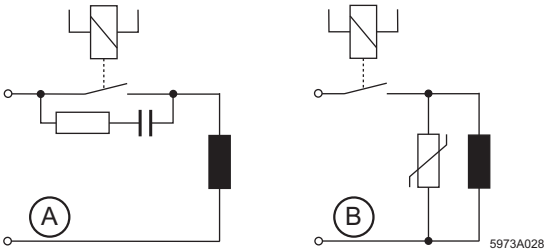


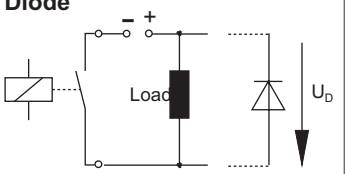
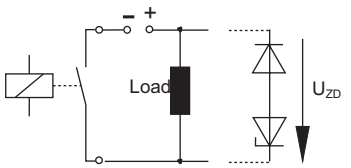
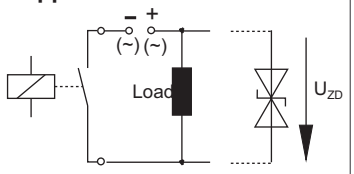
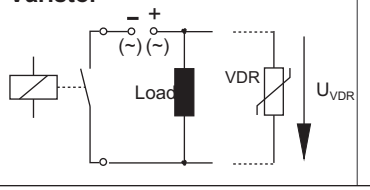
Figure 8 Contact protection (A), load protection (B)

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	Addtional Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadavantages
Diode 	Long	Yes (U_D)	No	Advantages: - easy implementation - cost-effective - reliable - uncritical dimensioning - low induction voltage Disadvantages: - attenuation only via load resistor - long off delay
Series connection diode/zener diode 	Medium to short	Yes (U_{ZD})	No	Advantages: - uncritical dimensioning Disadvantages: - attenuation only above U_{ZD}
Suppressor diode 	Medium to short	Yes (U_{ZD})	Yes	Advantages: - cost-effective - uncritical dimensioning - limitation of positive peaks - suitable for A.C. voltage Disadvantages: - attenuation only above U_{ZD}
Varistor 	Medium to short	Yes (U_{VDR})	Yes	Advantages: - high power absorption - uncritical dimensioning - suitable for A.C. voltage Disadvantages: - attenuation only above U_{VDR}

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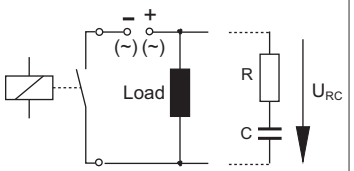
RC Circuit Versions

RC Series Connection:

Load Protection	Additional Off Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
R/C combination  	Medium to small	No	Yes	Advantages: - HF attenuation via power storage - suitable for A.C. voltage - level-independent attenuation - reactive-current compensating Disadvantages: - exact dimensioning required - high inrush current

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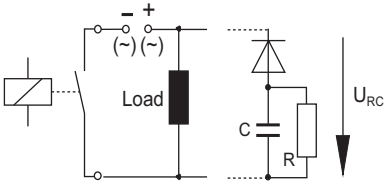
Sizing:

– Capacitor: $C \approx L_{load} / 4 \times R_{load}^2$

– Resistor: $R \approx 0.2 \times R_{load}$

RC Parallel Connection With Series Diode

Load Protection	Additional Off Delay	Defined Induction Voltage Limitation	Bipolar Effective Attenuation	Advantages/Disadvantages
R/C combination with diode  	Medium to small	No	Yes	Advantages: - HFattenuation via power storage - level-independent attenuation - Current inversion not possible Disadvantages: - exact dimensioning required - only suitable for D.C. 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 specified maximum values for switching voltage, current and power. The arc, which 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.

In applications with lamp loads or capacitive loads the current peak should not exceed 6 A when switching on the load. This guarantees a lifetime of the IB IL 24/230 DOR 4/W terminal as high as possible.

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.

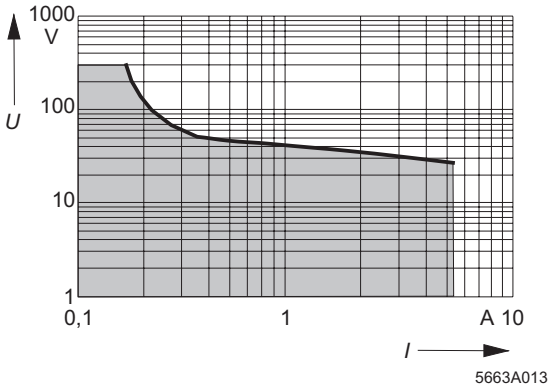


Figure 9 DC load limiting curve (relay REL-SNR-1XU/G 5 GOLD LIEG)

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_{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

INTERBUS Process Data

Assignment of the Terminal Points for the OUT Process Data

(Byte.bit)-view	Bit	0.3	0.2	0.1	0.0
Assign-ment	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 appropriate connector is closed.

The LEDs light up if the appropriate connector is closed.

For the assignment of the bit view to your control or computer system, please refer to the data sheet DB GB IBS SYS ADDRESS, Part No. 90 00 99 0.

Technical Data

General Data	
Order Designation	IB IL 24/230 DOR 4/W
Order No.	28 36 42 1
Housing dimensions (width x height x depth)	48.8.2 mm x 120 mm x 71.5 mm (1.921 in. x 4.724 in. x 2.815 in.)
Weight	138 g (without connector)
Operating mode	Process data operation with 4 bits
Connection method for actuators	To an electrically isolated relay changeover contact
Permissible temperature (operation)	-25°C to +55 °C (-13°F to +131°C)
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 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 [6561.680 ft.] above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m [9842.520 ft.] above sea level)
Degree of protection	IP 20 according to IEC 60529

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

Interface	
INTERBUS local bus	Through data routing

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

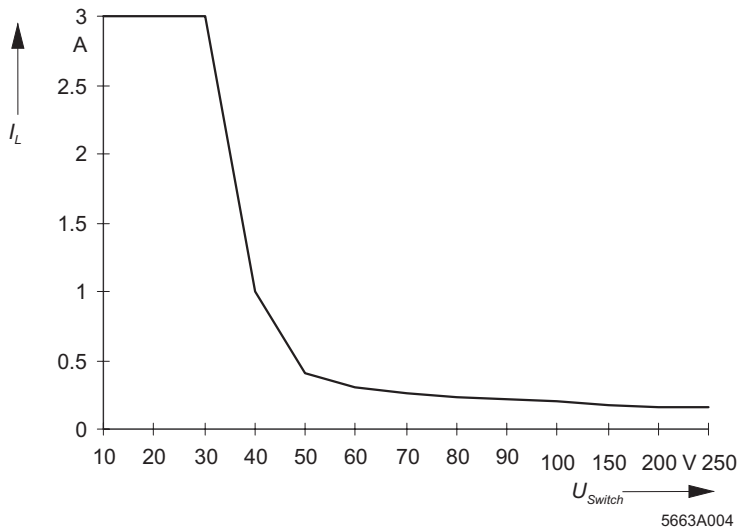
Supply of the Module Electronics and I/O Through Bus Terminal/Power Terminal	
Connection method	Through potential routing

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 table "Maximum Switching Current for Ohmic Load Depending on the Switching Voltage" on page 16.	
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 (at nominal load)	6 cycles/minute
Response delay	5 ms, typical
Chatter time	5 ms, typical
Release time	6 ms, typical

Relay Output (Continued)	
Mechanical life	2 x 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	
Switching Voltage (V DC)	**Switching Current (A)**
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

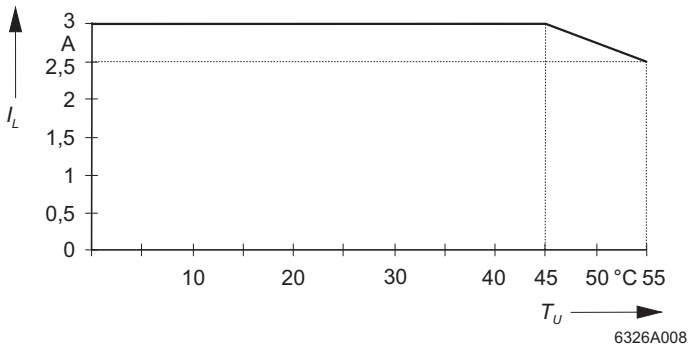
Load Current (I_L in A) as a Function of the Switching Voltage (U_{switch} in V)



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

At a switching current of 3 A the switching voltage for alternating voltage can be up to 253 V AC. Observe the derating.

Load Current (I_L in A) as Function of Ambient Temperature (T_U in °C)



Power Dissipation

Formula to Calculate the Power Dissipation in the Terminal

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

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

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

$P_{GEH} = 2.7\ W$ $\quad -25\ °C < T_U \leq +25\ °C$

$P_{GEH} = 2.7\ W - ((T_U - 25\ °C) \times 0.02\ W/°C)$ $\quad +25\ °C < T_U \leq +55\ °C$

Where

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

Safety Devices	
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	**Air Distance**	**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 4 digital relay outputs	IB IL 24/230 DOR 4/W	28 36 42 1
Connector with six connections using the spring-clamp method (gray, w/o color print); Package unit: 10 pieces	IB IL SCN-8-AC	27 40 29 0
Terminals for separating the relay terminal (separating different voltage areas); Package unit: 1 set (2 pieces)	IB IL DOR LV-SET	27 42 64 1
Connector for IB IL DOR LV-SET; Package unit: 1 set (2 pieces)	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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