

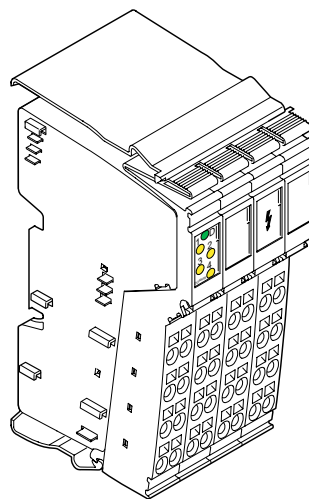
IB IL 24/230 DOR4/W ...

Inline digital output terminal with four SPDT relay contacts

AUTOMATION

Data sheet
6326_en_03

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1 Description

The terminal is designed for use within an Inline station. It has four floating SPDT relay contacts.



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.

Features

- Safe isolation according to EN 50178
- Floating connection for four actuators
- Nominal current at the output: 3 A
- Total current of the terminal: $4 \times 3 \text{ A} = 12 \text{ A}$
- Diagnostic and status indicators



This data sheet is only valid in association with the IL SYS INST 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 all products listed on the following page:

2 Ordering data

Products

Description	Type	Order No.	Pcs./Pkt.
Inline terminal with four digital relay outputs; complete with accessories (individually numbered connectors and labeling fields); transmission speed of 500 kbps	IB IL 24/230 DOR4/W-PAC	2861878	1
Inline terminal with four digital relay outputs; complete with accessories (consecutively numbered connectors and labeling fields); transmission speed of 500 kbps	IB IL 24/230 DOR4/W-PAC/CN	2692474	1
Inline terminal with four digital relay outputs; complete with accessories (connectors and labeling fields); transmission speed of 2 Mbps	IB IL 24/230 DOR4/W-2MBD-PAC	2862039	1
Inline terminal with four digital relay outputs; without accessories; transmission speed of 500 kbps	IB IL 24/230 DOR4/W	2836421	1
Inline terminal with four digital relay outputs; without accessories; transmission speed of 2 Mbps	IB IL 24/230 DOR4/W-2MBD	2855541	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
Connector for digital single-channel, two-channel or 8-channel Inline terminals with AC voltage (gray, without color print)	IB IL SCN-8-AC-REL	2740290	10
Inline distance terminal; complete with accessories (connectors and labeling fields)	IB IL DOR LV-SET-PAC	2861645	1 set (2 pcs.)

Documentation

Description	Type	Order No.	Pcs./Pkt.
"Automation terminals of the Inline product range" user manual	IL SYS INST UM E	2698737	1

3 Technical data

General data

Housing dimensions (width x height x depth)	48.8 mm x 120 mm x 71.5 mm
Weight	153 g (with connectors), 138 g (without connectors)
Operating mode	Process data mode with 4 bits
Connection method for actuators	At a floating SPDT relay contact
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)	80 kPa to 106 kPa (up to 2000 m above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Connection data for Inline connectors	
Connection method	Spring-cage terminals
Conductor cross-section	0.08 mm ² to 1.5 mm ² (solid or stranded), 28 - 16 AWG

Mechanical requirements (deviation from the Inline specifications)

Vibration test	2g load, 2 hours in each direction
Sinusoidal vibrations according to IEC 60068-2-6; EN 60068-2-6	
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
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Transmission speed

IB IL 24/230 DOR4/W	500 kbps
IB IL 24/230 DOR4/W-PAC	500 kbps
IB IL 24/230 DOR4/W-PAC/CN	500 kbps
IB IL 24/230 DOR4/W-2MBD	2 Mbps
IB IL 24/230 DOR4/W-2MBD-PAC	2 Mbps

Power consumption

	500 kbps	2 Mbps
Communications power	7.5 V DC	7.5 V DC
Current consumption at U_L off/on	22 mA/187 mA	45 mA/220 mA
Power consumption at U_L	0.17 W/1.4 W	0.34 W/1.65 W

Supply of the module electronics and I/O through bus coupler/power terminal

Connection method	Through potential routing
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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

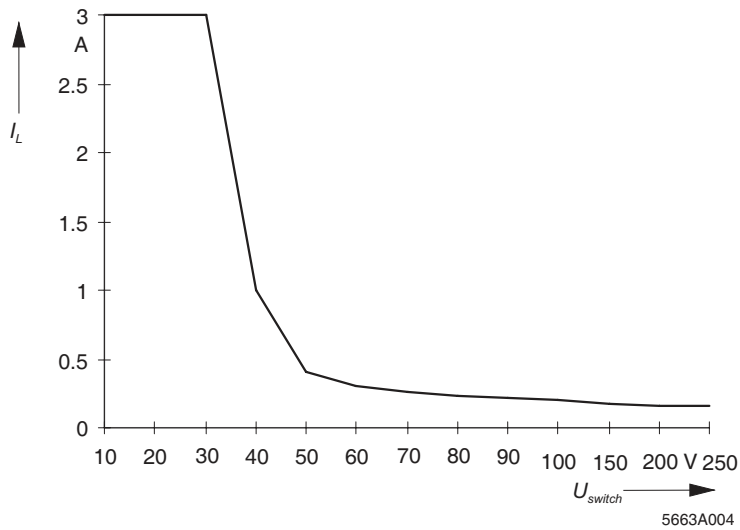


See also table "Maximum switching current for ohmic load depending on the switching voltage (with DC voltage)" on page 4.

Nominal power consumption of the coil (at 20°C)	330 mW from the 7.5 V supply
Resistance of the coil (at 20°C)	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 service life	2 x 10 ⁷ cycles
Electrical service life	10 ⁵ cycles (at 20 cycles/minute)
Common potentials	All contacts floating

Maximum switching current for ohmic load depending on the switching voltage (with DC 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)

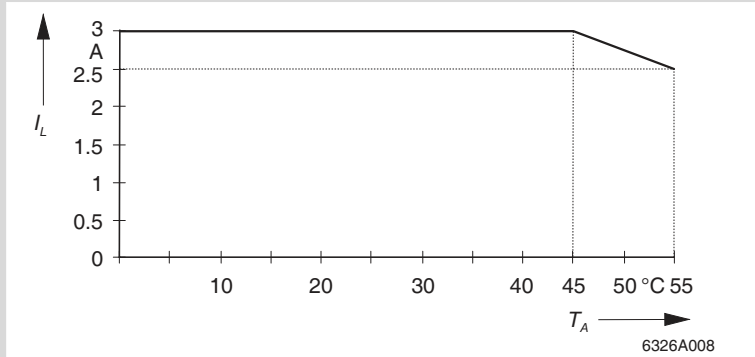


Maximum switching current depending on the temperature (with AC voltage)



With a switching current of 3 A, AC switching voltages 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 (500 kbps)

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

$$P_{TOT} = 0.17 \text{ W} + \sum_{i=1}^n (0.31 \text{ W} + I_L^2 \times 0.04 \Omega)$$

Formula to calculate the power dissipation in the terminal (2 Mbps)

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

$$P_{TOT} = 0.34 \text{ W} + \sum_{i=1}^n (0.31 \text{ W} + I_L^2 \times 0.04 \Omega)$$



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

Where:

- P_{TOT} 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
- n Number of set outputs ($n = 1$ to 4)
- i Index
- I_L Load current of the output

Power dissipation of the housing depending on the ambient temperature

$$P_{HOU} = 2.7 \text{ W} \quad -25^\circ\text{C} < T_A \leq +25^\circ\text{C}$$

$$P_{HOU} = 2.7 - ((T_A - 25^\circ\text{C}) \times 0.02 \text{ W}/^\circ\text{C}) \quad +25^\circ\text{C} < T_A \leq +55^\circ\text{C}$$

Where:

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

Safety equipment

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	Clearance	Creepage distance	Test voltage
Relay contact/bus logic	≥ 5.5 mm	≥ 5.5 mm	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	≥ 3.1 mm	1 kV, 50 Hz, 1 min.

Approvals

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

4 Safety notes for Inline terminals used in areas outside the SELV area (AC area)



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

Qualified personnel are persons 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.

(Definition of skilled workers according to EN 50110-1:1996).



The instructions given in this data sheet as well as the IL SYS INST UM E user manual must be strictly observed during installation and startup.

Technical modifications reserved.

5 Correct usage

The terminal is only to be used within an Inline station as specified in this data sheet as well as the IL SYS INST UM E user manual. Phoenix Contact accepts no liability if the device is used for anything other than its designated use.



WARNING: Dangerous contact voltage

Please note that there are dangerous contact 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 the terminals and wiring, always switch off the supply voltage and ensure it cannot be switched on again.

6 Installation instructions and notes



WARNING: Dangerous contact voltage

Install the system according to the requirements of EN 50178.



WARNING: Dangerous contact voltage in the event of ground faults

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



Read the user manual

Observe the installation instructions and notes in the IL SYS INST UM E user manual, especially the notes on the low voltage area.

7 Special features of the terminal

The terminal can be used to switch loads up to 230 V.

**NOTE: Malfunction**

Please note that the terminal interrupts the potential jumpers U_M , U_S , and GND (24 V area) or L and N (120 V/230 V areas). If required, these supply voltages must be resupplied/provided using an appropriate power terminal after the relay terminal.

Switching loads in the 230 V area

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

**WARNING:**

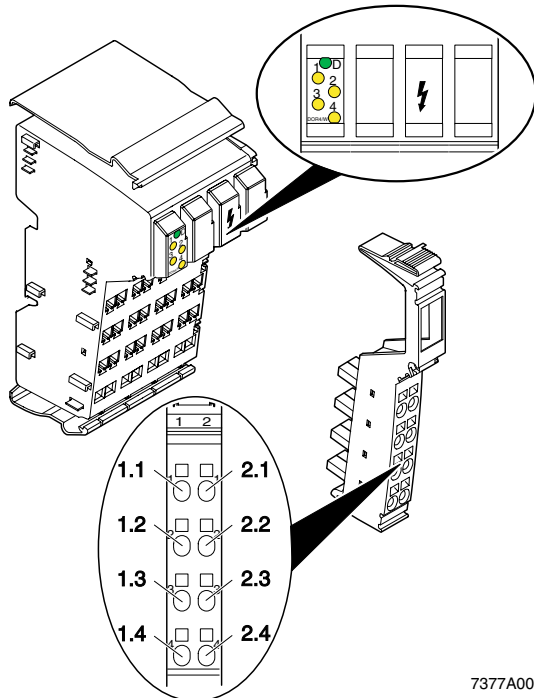
Operate the terminal from a single phase on an AC network.

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 terminal (see "Ordering data" on page 2). The isolating distances between the individual areas are thus maintained.

See also "Connection examples" on page 11.

8 Local diagnostic and status indicators and terminal point assignment



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Figure 1 Terminal with one of the appropriate connectors

Local diagnostic and status indicators

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

Function identification

Red with lightning bolt

2 Mbps: White stripe in the vicinity of the D LED

Housing/connector color

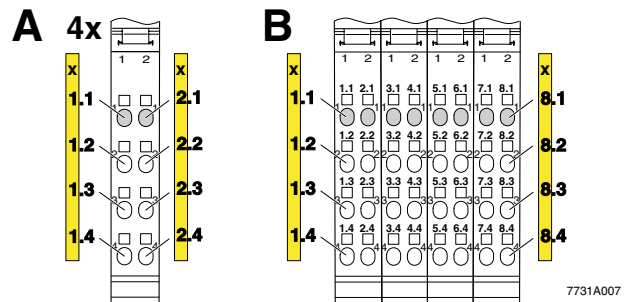
Dark gray housing

Dark gray connector

Terminal point assignment for each connector

Terminal points	Assignment
x.1, x.1	Not used (no contact present)
x.2, x.2	Relay N/C contact
x.3, x.3	Relay main contact
x.4, x.4	Relay N/O contact

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

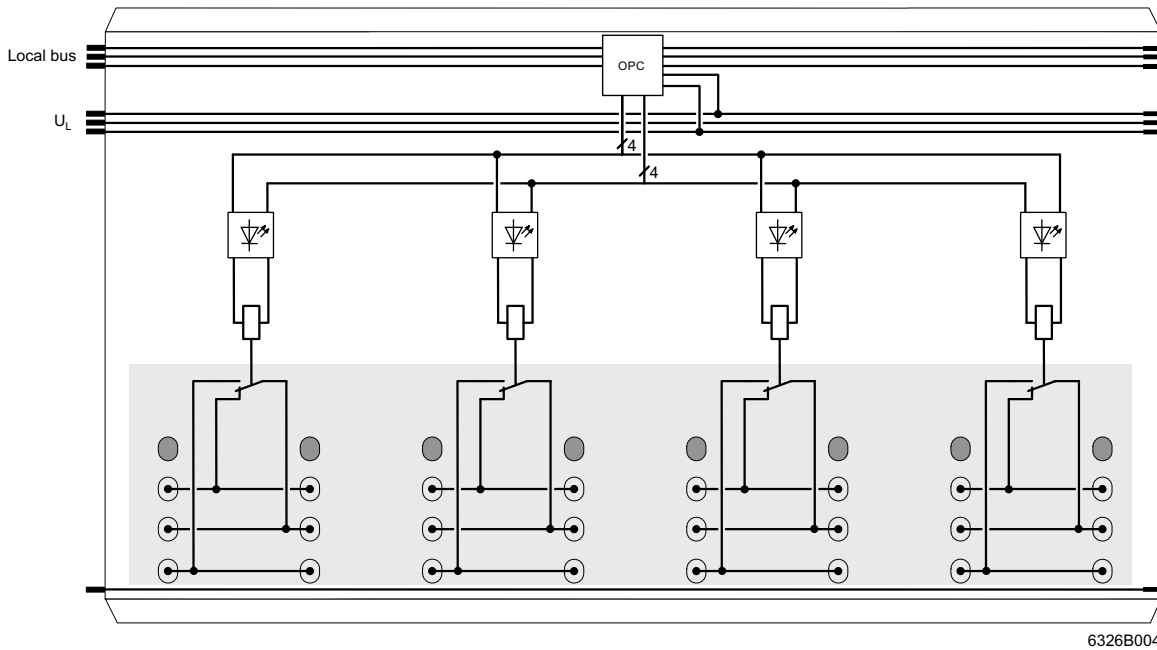


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Figure 2 Terminal point numbering: Individual connectors (A) and connector sets (B)

- A) Using the IB IL 24/230 DOR4/W-PAC and IB IL 24/230 DOR4/W-2MBD-PAC with the connectors provided. Using the IB IL SCN-8-AC-REL individual connectors.
- B) Using the IB IL 24/230 DOR4/W-PAC/CN with the original connector set


9 Internal basic circuit diagram




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
Figure 3 Internal wiring of the terminal points


Key:


 Protocol chip (bus logic including voltage conditioning)

 LED

 Terminal point, without metal contact

 Relay

 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 used are explained in the IL SYS INST UM E user manual.

10 Connection examples

Connecting actuators

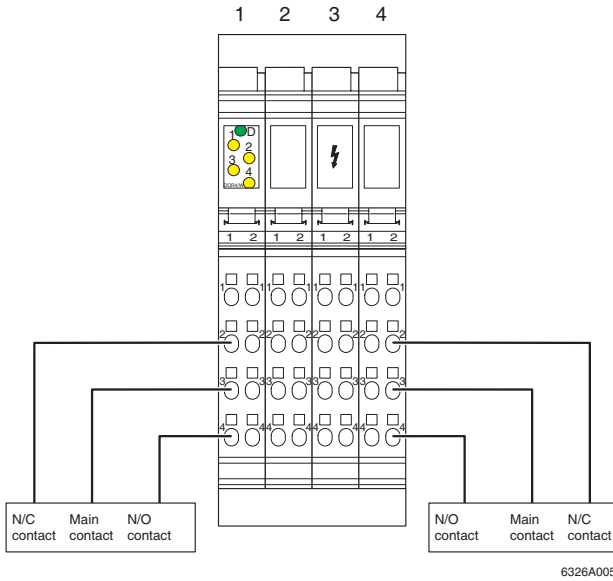


Figure 4 Typical connection of actuators

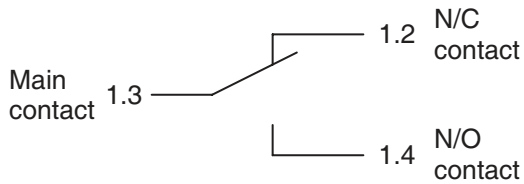


Figure 5 Output relay contacts

Switching voltages that are not available in the segment

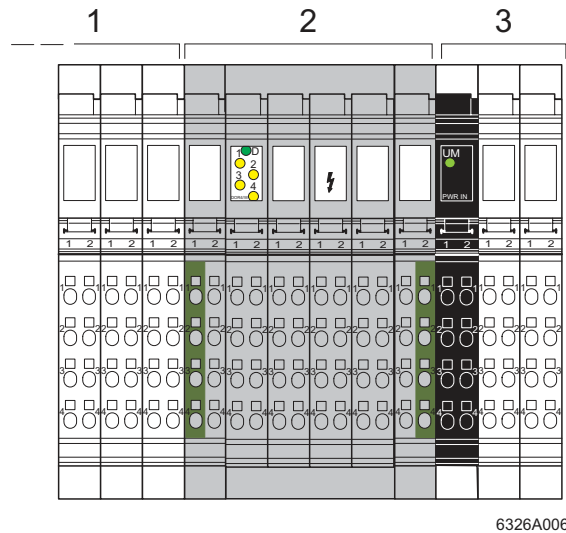


Figure 6 Example: Switching 230 V within a 24 V area

- 1 24 V area consisting of a station head and I/O terminals
- 2 Terminal with four SPDT relay contacts separated from the 24 V area by Inline distance terminals
- 3 24 V area consisting of a power terminal and I/O terminals

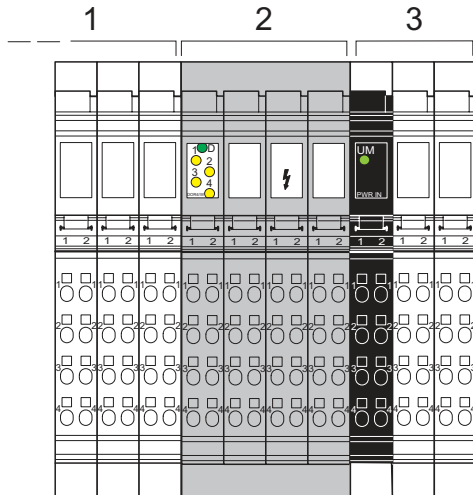
See also "Special features of the terminal" on page 8.

i Also insert Inline distance terminals if you want to switch a 24 V channel within a 230 V AC area.

Switching voltages that are available in the segment



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.



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Figure 7 Switching 24 V within a 24 V area

- 1 24 V area consisting of a station head and I/O terminals
- 2 Terminal with four SPDT relay contacts
- 3 24 V area consisting of a power terminal and I/O terminals

11 Interference suppression measures for inductive loads/switching relays

Each electrical load is a mix of ohmic, capacitive, and inductive elements. Depending on the proportion of the elements, 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 contactors, solenoid valves, motors, etc. Due to the energy stored in the coils, voltage peaks of up to a few thousand volts may occur when the system is switched off. These high voltages cause an arc on the controlling contact, which may destroy the contact through material vaporization and material migration.

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

To prevent such arcs from occurring, the contacts/loads must be fitted with protective circuits. In general, the following protective circuits can be used:

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

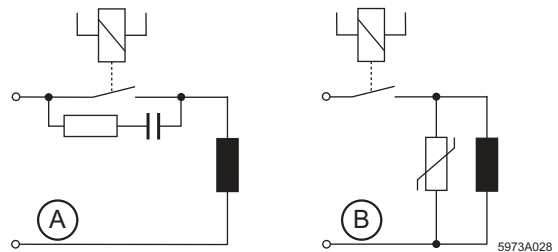


Figure 8 Contact protective circuit (A), load protective circuit (B)

If sized correctly, these circuit versions do not differ greatly in their effectiveness. In principle, safety equipment should intervene directly at the source of the interference. The following points speak in favor of 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 the form of terminals or electronic housing (see "CLIPLINE" or "TRABTECH" catalogs). Other versions are available on request. In addition to this, today the majority of contactor manufacturers offer diode, RC or varistor elements that can be snapped on. For solenoid valves, connectors with an integrated protective circuit can be used.

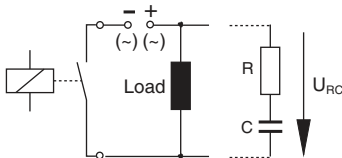
Circuit versions

Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/disadvantage
<p>Diode</p>	Large	Yes (U_D)	No	<p>Advantages:</p> <ul style="list-style-type: none"> - Easy implementation - Cost-effective - Reliable - Uncritical sizing - Low induction voltage <p>Disadvantages:</p> <ul style="list-style-type: none"> - Attenuation only via load resistance - High dropout delay
<p>Diode/Zener diode series circuit</p>	Medium to small	Yes (U_{ZD})	No	<p>Advantages:</p> <ul style="list-style-type: none"> - Uncritical sizing <p>Disadvantages:</p> <ul style="list-style-type: none"> - Attenuation only above U_{ZD}
<p>Suppressor diode</p>	Medium to small	Yes (U_{ZD})	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> - Cost-effective - Uncritical sizing - Limitation of positive peaks - Suitable for AC voltages <p>Disadvantages:</p> <ul style="list-style-type: none"> - Attenuation only above U_{ZD}
<p>Varistor</p>	Medium to small	Yes (U_{VDR})	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> - High energy absorption - Uncritical sizing - Suitable for AC voltages <p>Disadvantages:</p> <ul style="list-style-type: none"> - Attenuation only above U_{VDR}

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RC circuit versions

RC series circuit:

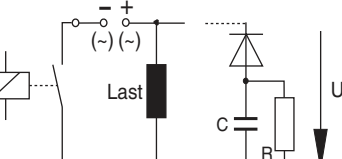
Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/Disadvantages
<p>R/C combination</p> 	Medium to small	No	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> - HF attenuation due to energy absorption - Suitable for AC voltages - Level-independent attenuation - Reactive-current compensation <p>Disadvantages:</p> <ul style="list-style-type: none"> - Precise sizing required - High inrush current flow

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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

Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/Disadvantages
<p>R/C combination with diode</p> 	Medium to small	No	Yes	<p>Advantages:</p> <ul style="list-style-type: none"> - HF attenuation due to energy absorption - Level-independent attenuation - Current reversal not possible <p>Disadvantages:</p> <ul style="list-style-type: none"> - Precise sizing required - Only suitable for DC voltages

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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 the switching voltage, current, and power. The arc that occurs during shutdown depends on the current, voltage, and phase relation. 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 service life of the system will be reduced considerably.

To prolong the life of the terminal as much 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 DC 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 using the example in Figure 9.

A non-attenuated inductive load further reduces the values for switching currents given here. The energy stored in the inductance can cause an arc to occur, which forwards the current via the open contacts. Using an effective contact protection circuit, virtually the same currents can be switched as for an ohmic load and the service life of the relay contacts is the same.

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

The technical data for this is available on request.

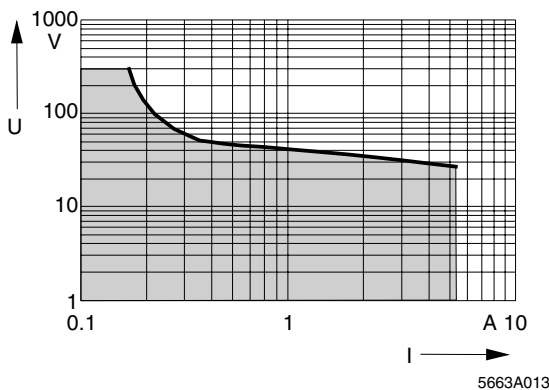


Figure 9 DC load limit curve (REL-SNR-1XU/G 5 GOLD relay)

I Switching current in A

U Switching voltage in V

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

12 Programming data/ configuration data

Local bus

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 programming data/configuration data of other bus systems, please refer to the corresponding electronic device data sheet (e.g., GSD, EDS).

13 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 indicators	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 the DB GB IBS SYS ADDRESS data sheet, Order No. 9000990.