Inline digital output terminal with one SPDT relay contact: ILT 24/230 DOR1/W

Device description

This manual is intended to provide support for installation and usage of the device. The information is believed to be accurate and reliable. However, SysMik GmbH Dresden assumes no responsibility for possible mistakes and deviations in the technical specifications. SysMik GmbH Dresden reserves the right to make modifications in the interest of technical progress to improve our modules and software or to correct mistakes.

We are grateful to you for criticism and suggestions. Further information (device description, available software) can be found on our homepage www.sysmik.de. Please ask for latest information.

SysMik disclaims all warranties in case of improper use or disassembly and software modifications not described in this document or when using improper or faulty tools. Commissioning and operation of the device by qualified personnel only. All applicable regulations have to be observed.

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Contents

1 Description

Note: This device description is only valid in association with the IL SYS INST UM user manual or the Inline system manual of the specifically used bus system.
Make sure you always use the latest documentation – it can be downloaded at www.sysmik.de.

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

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 one actuator
- Nominal current at the output: 3 A
- Total current of the terminal: 3 A
- Diagnostic and status indicators

2 Order information

Description	Type	Part-No.	Pcs./Pkt.
Inline terminal with one digital relay output; complete with accessories (connector and labeling field); transmission speed of 500 kbps	ILT 24/230 DOR1/W	1225-100503-01-8	1

Optional Add-Ons (Purchase via Phoenix Contact):

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

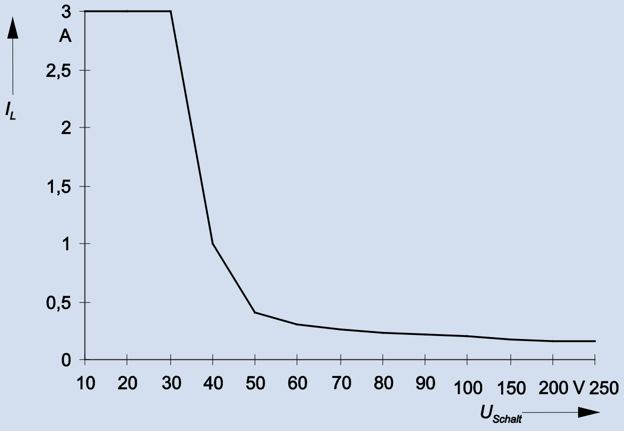
3 Technical data

General data	
Housing dimensions (width x height x depth)	12,2 mm x 120 mm x 71,5 mm
Weight	46 g (without connector), 61 g (with connector)
Operating mode	Process data mode with 2 bits
Connection method for actuators	At a floating SPDT relay contact
Ambient temperature (operation)	-25 °C bis +55 °C
Ambient temperature (storage/transport)	-25 °C bis +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	0.2 mm² to 1.5 mm² (solid or stranded), 28 – 16 AWG

Power consumption	500 kBit/s
Communications power	7,5 V DC
Current consumption at U_L off/on	60 mA maximum
Power consumption at U_L	0.45 W maximum

Relay output	
Number	1
Contact material	$AgSnO_2$, hard gold-plated
Contact resistance	50 mW 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
Switching current at 253 V AC	3 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)".	
Nominal power consumption of the coil (at 20 °C)	210 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

Load current (I_L in A) as a function of the switching voltage (U_{switch} in V)



Load current (I_L in A) as a function of the switching voltage (U_{switch} in V)

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

Power dissipation

Formula to calculate the power dissipation in the terminal

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

$P_{EL} = 0{,}19\ W + (0{,}26\ W) + I_L^2 \times 0{,}05\ \Omega$

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
I_L	Load current of the output

Power dissipation of the housing depending on the ambient temperature

P_{HOU} = 1.2 W	-25 °C < T_A ≤ +25 °C [-13 °F < T_A ≤ +77 °F]
P_{HOU} = 1.2 W- ((T_A -25 °C) x 0.02 W/°C)	+25 °C < T_A ≤ +55 °C [+77 °F < T_A ≤ +131 °F]

Dabei sind:

P_{Hou}	Permissible power dissipation of the housing
T_A	Ambient Temperature

Derating When Using the N/O Contact (500 kBit/s)

Ambient temperature T_A	Power dissipation of the housing	Maximum load current
40 °C	0.9 W	3.0 A
45 °C	0.8 W	2.6 A
50 °C	0.7 W	2.2 A
55 °C	0.6 W	1.7 A

With an ambient temperature of up to 40 °C, a maximum permissible load current of 3.0 A can flow via the N/O contact. Observe the derating at higher temperatures.

Safety equipment

none

Error messages to the higher-level control or computer system

none

Air and creepage distances (according to EN 50178, VEDE 0109, VDE 0110)			
Isolating distance	**Clearance**	**Creepage dist.**	**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
Fort he latest approvals, please visit www.sysmik.de.

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.

WARNUNG: 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‘!

8 Local diagnostic and status indicators and terminal point assignment

Local diagnostic and status indicators

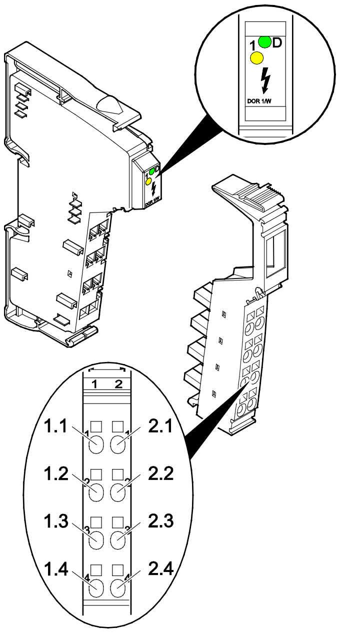


Fig. 1: Terminal with one appropriate connector

Local diagnostic and status indicators

Designation	Color	Meaning
D	green	Diagnostics
1	yellow	Output status indicator (relay has picked up)

Terminal point assignment per 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

Function identification

- Red with lightning bolt

Housing/connector color

- Dark gray housing
- Dark gray connector

9 Internal basic circuit diagram

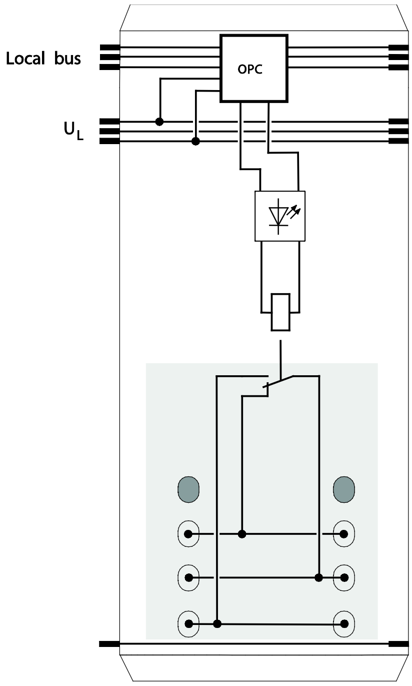


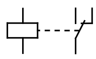
Fig. 2: Internal wiring oft the terminal points

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

Note: Other symbols used are explained in the IL SYS INST UM E user manual.

10 Connection examples

Connecting actuators

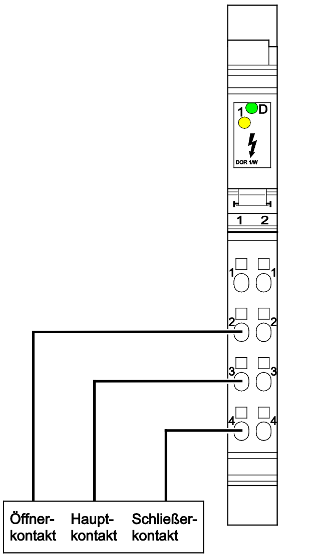


Fig. 3: Typical connection of an actuator

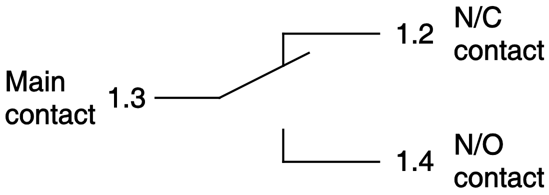


Fig. 4: Output relay contacts

Switching voltages that are not available in the segment

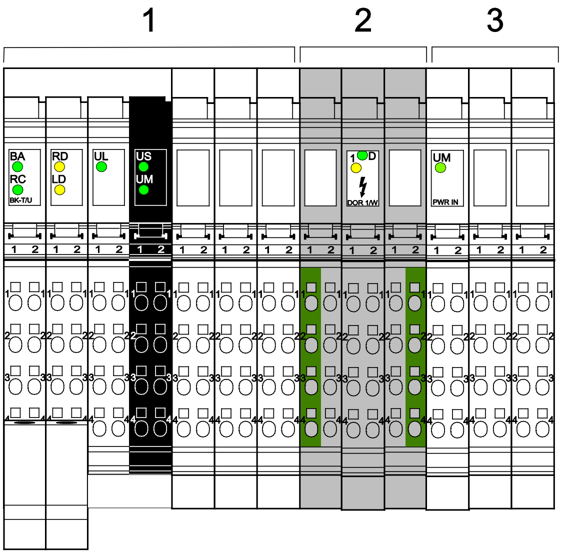


Fig. 5: Switching of 230 V within a 24 V area

1 24 V area consisting of bus coupler and I/O terminals

2 Terminal 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 oft the terminal‘!

> ⚠ 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

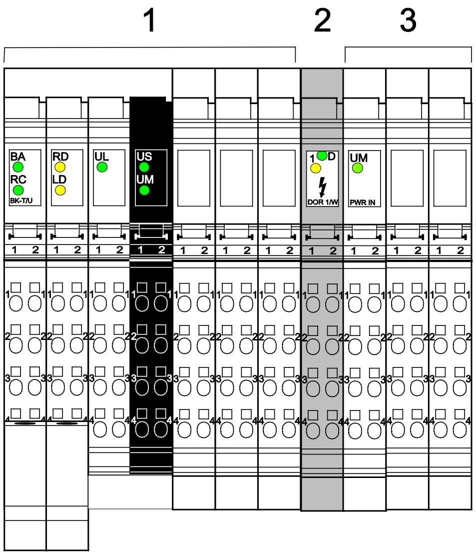


Fig. 6: Switching oft 24 V within a 24 Varea

1 24 V area consisting of bus coupler and I/O terminals

2 Terminal

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

> ⚠ 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!

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

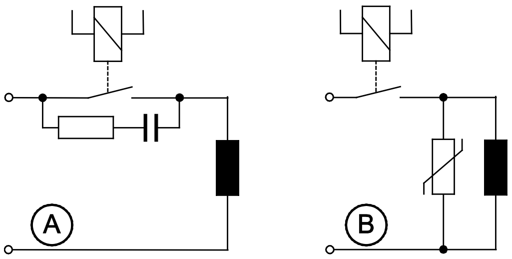


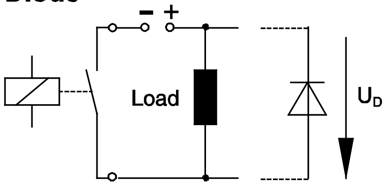
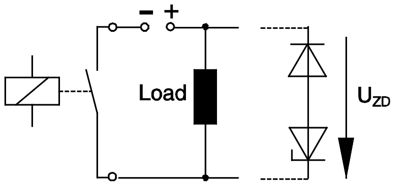
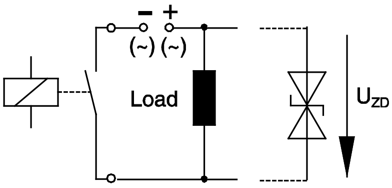
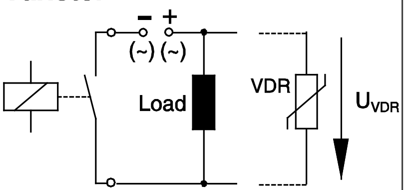
Fig. 7: Contact protective circuit (A), -load protective circuit (B)

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.

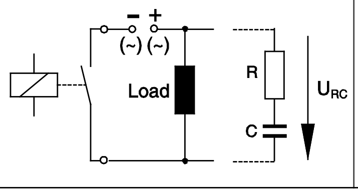
Today, the majority of contactor manufacturers offer diode, RC or varistor elements that can be snapped on. For solenoid valves, connectors with an integrated protective circuit can be used.

Circuit versions:

Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/disadvantage
Diode 	Large	Yes (U_D)	No	Advantages: - Easy implementation - Cost-effective - Reliable - Uncritical sizing - Low induction voltage Disadvantages: - Attenuation only via load resistance - High dropout delay
Diode/Zener diode series circuit 	Medium to small	Yes (U_{ZD})	No	Advantages: - Uncritical sizing Disadvantages: - Attenuation only above U_{ZD}
Suppressor diode 	Medium to small	Yes (U_{ZD})	Yes	Advantages: - Cost-effective - Uncritical sizing - Limitation of positive peaks - Suitable for AC voltages Disadvantages: - Attenuation only above U_{ZD}
Varistor 	Medium to small	Yes (U_{VDR})	Yes	Advantages: - High energy absorption - Uncritical sizing - Suitable for AC voltages Disadvantages: - Attenuation only above U_{VDR}

RC circuit versions:

RC series circuit

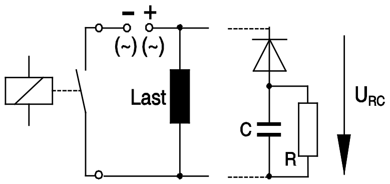
Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/Disadvantages
R/C combination  	Medium to small	No	Yes	Advantages: - HF attenuation due to energy absorption - Suitable for AC voltages - Level-independent attenuation - Reactive-current compensation Disadvantages: - Precise sizing required - High inrush current flow

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
R/C combination with diode  	Medium to small	No	Yes	Advantages: - HF attenuation due to energy absorption - Level-independent attenuation - Current reversal not possible Disadvantages: - Precise sizing required - Only suitable for DC voltages

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.

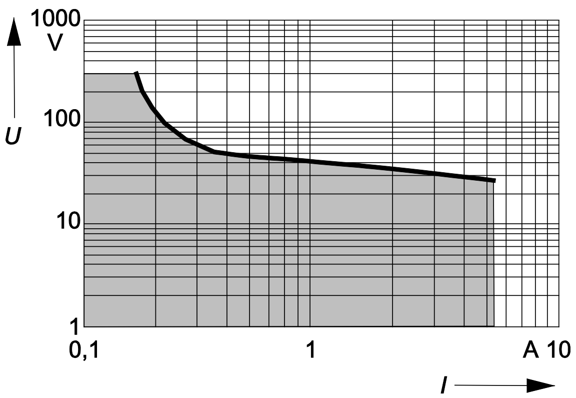
To prolong the life of the terminal as much as possible when using lamp loads or capacitive loads, the current peak must not exceed 6 A when the load is switched on.

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

The corresponding current and voltage values are shown using the example in Figure 8.



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.

Fig. 8: DC loadn limit curve
(REL-SNR-1XU/G 5 GOLD relay)

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.