

Characteristics:

General Description:

The single channel Relay Output, D5091S is a relay module suitable for the switching of safety related circuits, up to SIL 3 level according to IEC 61508:2010 Ed.2 for high risk industries. It provides isolation between input and output contacts.

Two mutually exclusive (by DIP-Switch programming) monitoring circuits are provided:

- 1) line input monitoring, to allow DCS/PLC line monitoring function: when enabled, the module permits a wide compatibility towards different DCS/PLC. Driving line pulse testing, executed by DCS/PLC, is permitted by a dedicated internal circuit, to prevent relay and LED flickering.
- 2) low voltage input monitoring: when enabled, the module reflects a high impedance state to the control unit when the driving voltage is below the specified threshold.

D5091S provides 1 SPDT contact for two different safety functions:

- 1) SIL 3 Safety Function for Normally De-Energized load (energized in fail safe state) is available at Terminal Blocks 7-8. The driving signal is normally low (0 Vdc), the relay is normally de-energized, contact is open and load is de-energized. The safety function is met when the driving signal is high (24 Vdc), the relay is energized, contact is closed and load is energized. At Terminal Blocks 9-10 is also available a service contact (for service load) with opposite (not SIL) function.
- 2) SIL 3 Safety Function for Normally De-Energized load (energized in fail safe state) is available at Terminal Blocks 9-10. The driving signal is normally high (24 Vdc), the relay is normally energized, contact is open and load is de-energized. The safety function is met when the driving signal is low (0 Vdc), the relay is de-energized, contact is closed and load is energized. At Terminal Blocks 7-8 is also available a service contact (for service load) with opposite (not SIL) function.

Mounting on standard DIN-Rail or on customized Termination Boards, in Safe Area / Non Hazardous Location or in Zone 2 / Class I, Division 2 or Class I, Zone 2

Functional Safety Management Certification:

G.M. International is certified by TUV to conform to IEC61508:2010 part 1 clauses 5-6 for safety related systems up to and included SIL3.



Front Panel and Features:



- SIL 3 according to IEC 61508:2010 Ed. 2 for Tproof = 6 / 20 yrs ($\leq 10\%$ / $> 10\%$ of total SIF) for ND load with ND relay (terminals 7-8).
- SIL 3 according to IEC 61508:2010 Ed. 2 for Tproof = 14 / 20 yrs ($\leq 10\%$ / $> 10\%$ of total SIF) for ND load with NE relay (terminals 9-10).
- PFDavg (1 year) 1.59 E-05, SFF 96.35 % for ND load with ND relay.
- PFDavg (1 year) 7.01 E-06, SFF 99.17 % for ND load with NE relay.
- Systematic capability SIL 3.
- Installation in Zone 2 / Division 2.
- 1 SPDT contact for 2 different Safety Functions:
 - 1) SIL 3 for ND load (energized in fail safe state) with ND relay condition (energized in fail safe state)
 - 2) SIL 3 for ND load (energized in fail safe state) with NE relay condition (de-energized in fail safe state).
- 6 A inrush current at 24 Vdc / 250 Vac.
- Line input monitoring in-field DIP Switch selectable.
- Driving input voltage monitoring.
- Input/Output isolation.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.
- ATEX, IECEx, UL & C-UL, FM & FM-C, INMETRO, EAC-EX, UKR TR n. 898, NEPSI, TÜV Certifications.
- Type Approval Certificate DNV and KR for maritime applications.
- Simplified installation using standard DIN-Rail and plug-in terminal blocks or customized Termination Boards.

Technical Data:

Input: 24 Vdc nom (21.6 to 27.6 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp.

The following monitoring circuits are mutually exclusive:

- 1) **Line input monitoring (DIP-Switch selectable):** to allow DCS/PLC line monitoring function (pulse test).
- 2) **Voltage monitoring (DIP-Switch selectable):** ≥ 21.6 Vdc for normal operation, ≤ 17 Vdc reflects a high impedance (≤ 10 mA consumption) to the control device.

Current consumption @ 24 V: 35 mA with relay energized and line input monitoring disabled, 45 mA with relay energized and line input monitoring enabled, typical.

Power dissipation: 0.85 W with 24 V input voltage, relay energized and line input monitoring disabled, 1.1 W with 24 V input voltage, relay energized and line input monitoring enabled, typical.

Isolation (Test Voltage): Input/Output 2.5 KV.

Output: voltage free SPDT relay contact.

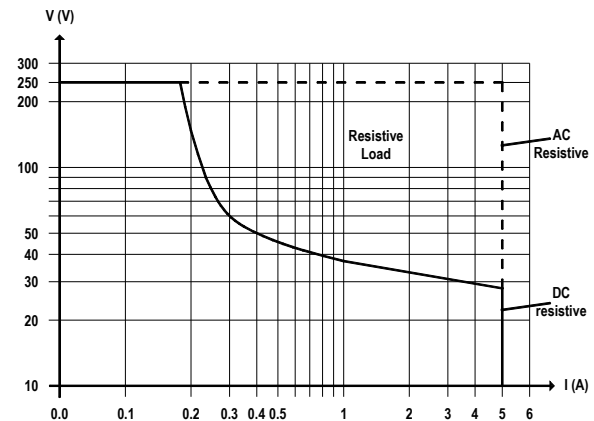
Terminals 7-8, open when relay de-energized, close in energized condition. Terminals 9-10, close when relay de-energized, open in energized condition.

Contact material: Ag Alloy (Cd free), gold plated.

Contact rating: 5 A 250 Vac 1250 VA, 5 A 250 Vdc 140 W
Min. Switching current 1 mA.

Contact inrush current: 6 A at 24 Vdc, 250 Vac.

AC / DC Load breaking capacity:



Mechanical / Electrical life: $5 * 10^6 / 3 * 10^4$ operation, typical.

Operate / Release time: 8 / 4 ms typical.

Bounce time NO / NC contact: 3 / 8 ms, typical.

Frequency response: 10 Hz maximum.

Compatibility:

CE mark compliant, conforms to Directive: 2014/34/EU ATEX, 2014/30/EU EMC, 2014/35/EU LVD, 2011/65/EU RoHS.

Environmental conditions:

Operating: temperature limits - 40 to + 70 °C, relative humidity 95 %, up to 55 °C.

Storage: temperature limits - 45 to + 80 °C.

Safety Description:



ATEX: II 3G Ex nA nC IIC T4 Gc

IECEx / INMETRO / NEPSI: Ex nA nC IIC T4 Gc

FM: NI / I / 2 / ABCD / T4, I / 2 / AEx nA nC / IIC / T4

FMC: NI / I / 2 / ABCD / T4, I / 2 / Ex nA nC / IIC / T4

EAC-EX: 2ExnAnCIIC T4 X.

UKR TR n. 898: 2ExnAnCIIC T4 X.

non-sparking electrical equipment.

-40 °C \leq Ta \leq 70 °C.

Approvals:

- BVS 10 ATEX E 114 conforms to EN60079-0, EN60079-15.
- IECEx BVS 10.0072 X conforms to IEC60079-0, IEC60079-15.
- INMETRO DNV 13.0109 X conforms to ABNT NBR IEC60079-0, ABNT NBR IEC60079-15.
- UL & C-UL E477485 conforms to ANSI/UL508
- FM 3046304 and FMC 3046304C conforms to Class 3600, 3611, 3810, ANSI/ISA-60079-0, ANSI/ISA-60079-15, C22.2 No.142, C22.2 No.213, C22.2 No. 60079-0, C22.2 No. 60079-15.
- C-IT.ME92.B.00206 conforms to GOST 30852.0, 30852.14.
- CL 16.0036 X conforms to DCTV 7113, DCTV IEC 60079-15.
- GYJ14.1406X conforms to GB3836.1, GB3836.8.
- TUV Certificate No. C-IS-236198-04, SIL 3 conforms to IEC61508:2010 Ed.2.
- TUV Certificate No. C-IS-236198-09, SIL 3 Functional Safety Certificate conforms to IEC61508:2010 Ed.2, for Management of Functional Safety.
- DNV Type Approval Certificate No.A-13625 and KR No.MIL20769-EL002 Certificates for maritime applications.

Mounting:

T35 DIN-Rail according to EN50022 or on customized Termination Board.

Weight: about 125 g.

Connection: by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm².

Location: installation in Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4 or Class I, Division 2, Group A,B,C,D, T4 or Class I, Zone 2, Group IIC, T4.

Protection class: IP 20.

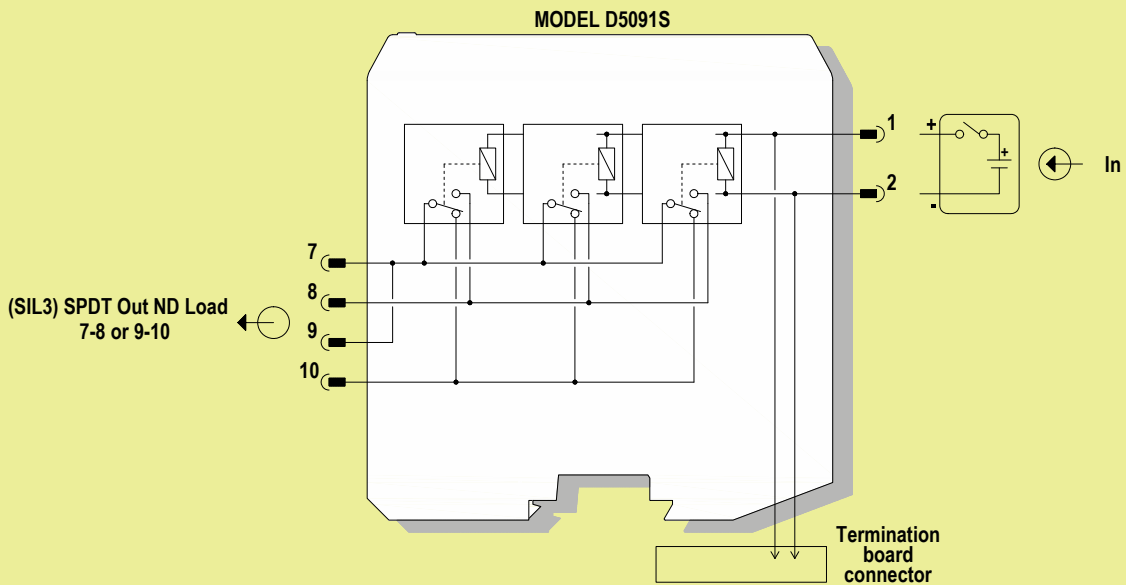
Dimensions: Width 12.5 mm, Depth 123 mm, Height 120 mm.

Image:



Function Diagram:

SAFE AREA, ZONE 2 GROUP IIC T4,
NON HAZARDOUS LOCATIONS, CLASS I, DIVISION 2,
GROUPS A, B, C, D T-Code T4, CLASS I, ZONE 2, GROUP IIC T4



Relay contact shown in de-energized position
Terminals 7-8 open, terminals 9-10 close.

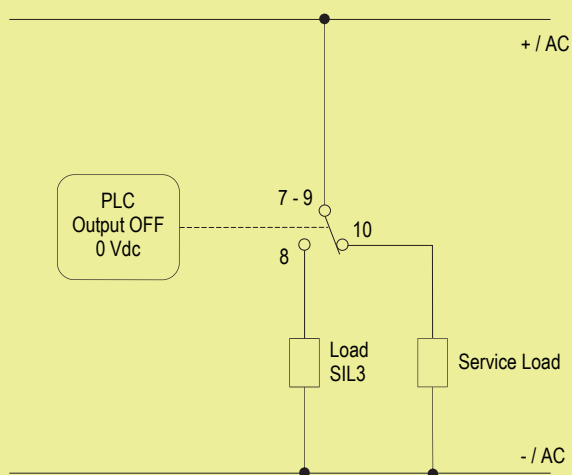
SIL3 Safety Function for ND load (energized in fail safe state) is available at terminal blocks 7-8;
In this case, the Safety Function is met when the relay is energized (closed contact).

SIL3 Safety Function for ND load (energized in fail safe state) is available at terminal blocks 9-10;
In this case, the Safety Function is met when the relay is de-energized (closed contact).

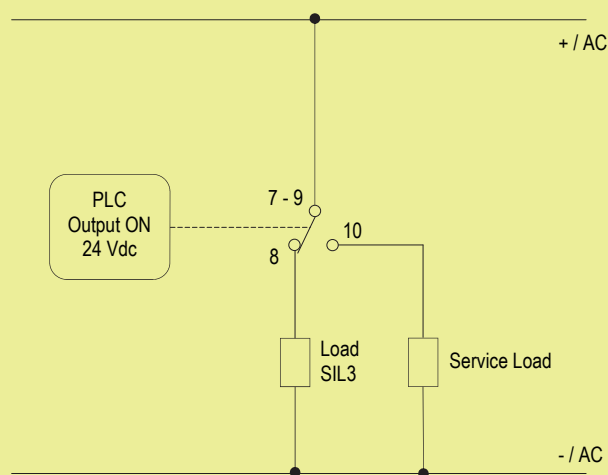
To prevent relay contacts from damaging, connect an external protection (fuse or similar),
chosen according to the relay breaking capacity diagram.

Application for D5091S - SIL Load Normally De-Energized Condition (ND) and Normally De-Energized Relay

Normal state operation



Energized to trip operation

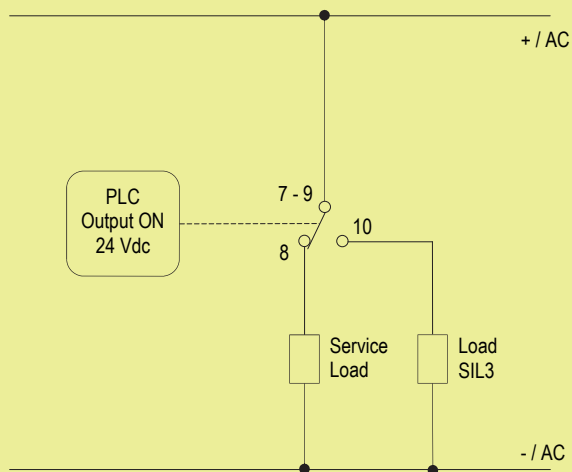


Contact 7-8: in normal operation the relay is de-energized, contact is open, load is de-energized
Contact 9-10: in normal operation the relay is de-energized, contact is closed, service load is energized.

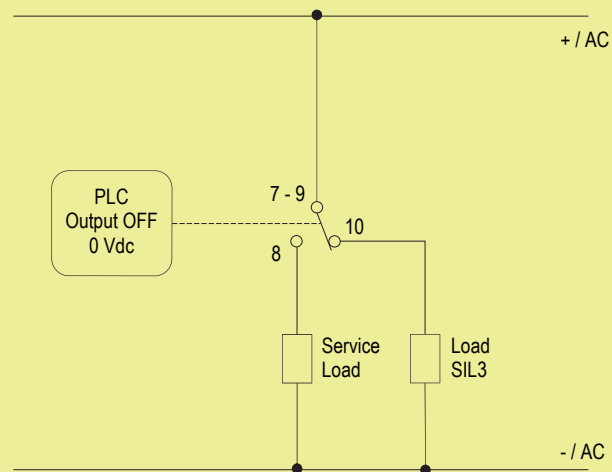
Contact 7-8: the SIL 3 Safety Function is met when the relay is energized, contact is closed, load is energized.
Contact 9-10: relay is energized, contact is open, service load is de-energized.

Application for D5091S - SIL Load Normally De-Energized Condition (ND) and Normally Energized Relay

Normal state operation



De-energized to trip operation



Contact 7-8: in normal operation the relay is energized, contact is closed, service load is energized
Contact 9-10: in normal operation the relay is energized, contact is open, load is de-energized.

Contact 7-8: relay is de-energized, contact is open, service load is de-energized.
Contact 9-10: the SIL 3 Safety Function is met when the relay is de-energized, contact is closed, load is energized.