INSTRUCTION & SAFETY MANUAL

SIL 2 - SIL 3 Digital Relay Output
Loop Powered
DIN-Rail and Termination Board
Models D5244S, D5244D

gmi technology for safety

Characteristics

General Description:
The single and dual channel DIN Rail and Termination Boards Digital Relay Output, models D5244S and D5244D, are loop powered digital output modules enabling a Safe Area loop voltage signal, to control a device in Hazardous Area, providing 2 port isolation (input/output). Outputs are galvanically isolated.
Typical applications include switching of Hazardous Area circuits, changing of polarities and sounder tones, calibrating of strain gauge bridges, resetting of field devices, testing of fire detectors. Each output channel provides a SPDT relay, with two contacts defined NO (Normally Open) and NC (Normally Close) when the output relay is de-energized. Considering each channel NE (Normally Energized), the output relay is energized,so that NO contact is closed (useful for NE loads or Hazardous Area circuits) and NC contact is open (useful for ND loads or Hazardous Area circuits). The safe state is reached when the channel and the output relay are de-energized, so that NO contact is open (de-energizing loads or Hazardous Area circuits) and NC contact is closed (energizing loads or Hazardous Area circuits).

Function:
1 or 2 channels I.S. relay output, provides 2 port isolation (input/output).
D5244S (Loop Powered mode) or **D5244D (Loop Powered mode with independent channels)**, as shown in function diagrams:
SIL 2 Safety Function for NE load (de-energized in safe state) is available at Terminal Blocks 14-15/16 and Terminal Blocks 18-19/20.
SIL 2 Safety Function for ND load (energized in safe state) is available at Terminal Blocks 13-15/16 and Terminal Blocks 17-19/20.
D5244D (Loop Powered mode with 1oo2 channel architecture),as shown in function diagram:
SIL 3 Safety Function for NE load (de-energized in safe state) is available at Terminal Blocks 14-19/20.
SIL 3 Safety Function for ND load (energized in safe state) is available at Terminal Blocks 13-15/16 (or 17-19/20 because externally connected in parallel).

Signalling LEDs: Output status (yellow).

EMC: Fully compliant with CE marking applicable requirements.

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.

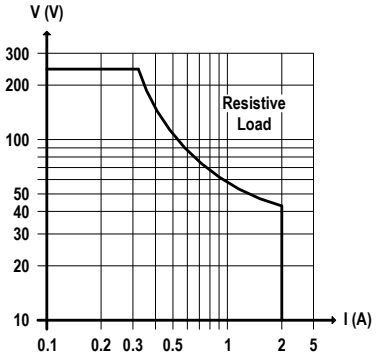
FSM SIL 3

Technical Data

Input: 24 Vdc nom (18 to 30 Vdc) reverse polarity protected,
ripple within voltage limits ≤ 5 Vpp.
Current consumption @ 24 V: 20 mA / channel with relay energized.
Power dissipation: 0.4 W / channel with 24 V loop voltage and relays energized.
Trip voltage levels: OFF status ≤ 15 V, ON status ≥ 18 V (maximum 30 V).

Isolation (Test Voltage): I.S. Out/In 1.5 KV; I.S. Out/I.S. Out 1.5 KV; In/In 500 V.

Output I.S.: voltage free SPDT relay contact.
Contact material: AgNi90/10.
Contact rating: 40 Vdc, 2 A for use in Intrinsic Safety applications, 2 A 250 Vac 500 VA, 2 A 250 Vdc 80 W (resistive load) for non Intrinsic Safety applications.
DC Load breaking capacity:



Mechanical / Electrical life: 15 * 10^6 / 1 * 10^5 operations, typical.
Operate / Release time: 5 / 2 ms typical.
Bounce time NO / NC contact: 1 / 5 ms.
Response time In / Out: 50 ms.
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 3(1)G Ex nA nC [Ex ia Ga] IIC T4 Gc, I (M1) [Ex ia Ma] I, II (1)D [Ex ia Da] IIIC
IECEx: Ex nA nC [Ex ia Ga] IIC, [Ex ia Ma] I, [Ex ia Da] IIIC
associated apparatus and non-sparking electrical equipment.
Uo/Voc = 0 V, Io/Isc = 0 mA, Po/Po = 0 mW at terminals 13-14-15/16, 17-18-19/20
(Uo, Io, Po equal to the connected Intrinsic Safety circuit).
Ui/Vmax = 40 V, Ii/Imax = 2 A, Ci = 0 nF, Li = 0 nH at term. 13-14-15/16, 17-18-19/20.
Um = 250 Vrms, -40 °C ≤ Ta ≤ 70 °C.
Approvals:
BVS 16 ATEX E 109 X conforms to EN60079-0, EN60079-11, EN60079-15.
IECEx BVS 16.0071X conforms to IEC60079-0, IEC60079-11, IEC60079-15.
TÜV Certificate No. C-IS-236198-04 SIL 2 / SIL 3 conforms to IEC61508:2010 Ed.2.
TÜV Certificate No. C-IS-236198-09, SIL 3 Functional Safety Certificate conforms to IEC61508:2010 Ed.2, for Management of Functional Safety.

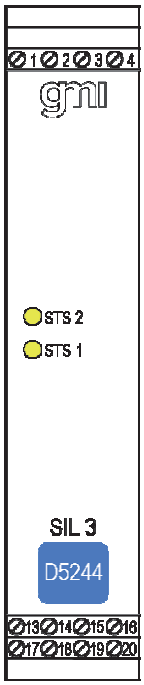
Mounting: T35 DIN Rail according to EN50022 or on customized Termination Board.
Weight: about 175 g D5244D, 165 g D5244S.
Connection: by polarized plug-in disconnect screw terminal blocks to accomodate terminations up to 2.5 mm^2.
Location: Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4.
Protection class: IP 20.
Dimensions: Width 22.5 mm, Depth 123 mm, Height 120 mm.

Ordering Information

Model:	D5244	
1 channel		S
2 channels		D

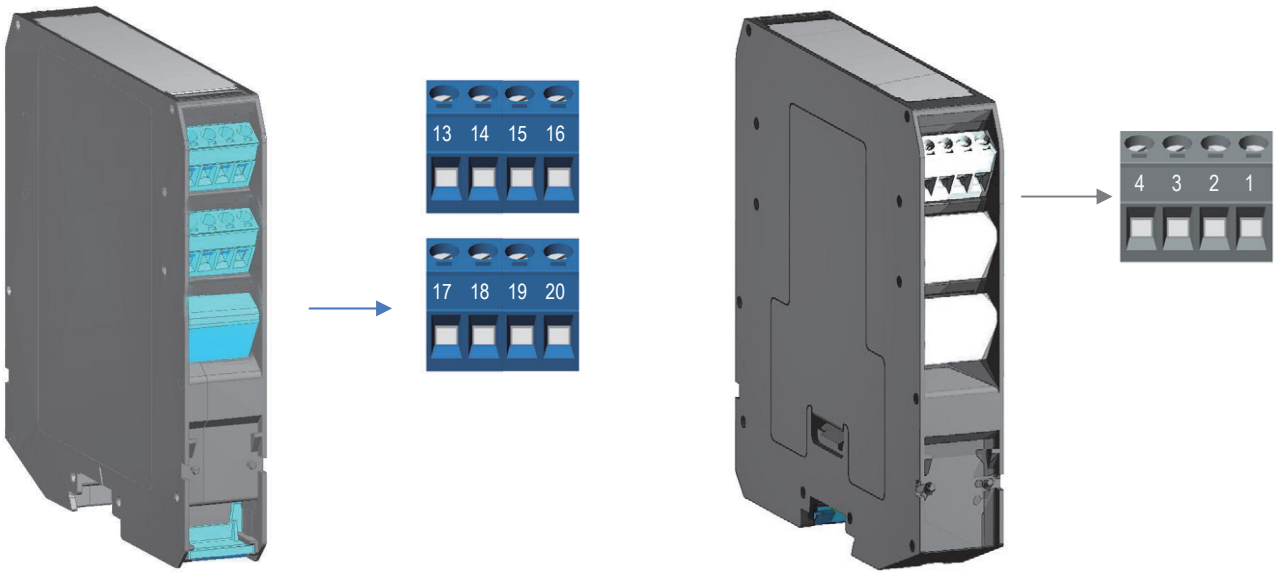
DIN-Rail accessories: Cover and fix MCHP196

Front Panel and Features



- SIL 2 according to IEC 61508:2010 Ed. 2 for Tproof = 6 / 20 yrs (≤10% / >10 % of total SIF), for each channel of D5244S / D.
- SIL 3 according to IEC 61508:2010 Ed. 2 for Tproof = 12 / 20 yrs (≤10% / >10 % of total SIF), D5244D with 1oo2 channel architecture.
- PFDavg (1 year) 1.55 E-04, SFF 75.70 % with independent channel architecture.
- PFDavg (1 year) 7.73 E-06, SFF 99.20 % with 1oo2 channel architecture.
- SIL 3 Systematic capability.
- Output to Zone 0 (Zone 20), installation in Zone 2.
- Voltage level input.
- Two SPDT Relay Output Signals.
- Two port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety systems.
- ATEX, IECEx, TÜV Certification.
- TÜV Functional Safety Certification.
- High Reliability, SMD components.
- High Density, two channels per unit.
- Simplified installation using standard DIN Rail and plug-in terminal blocks or customized Termination Boards.
- 250 Vrms (Um) max. voltage allowed to the instruments associated with the barrier.

Terminal block connections



HAZARDOUS AREA	
13	Output Ch 1 NC (Normally Closed)
14	Output Ch 1 NO (Normally Open)
15	Output Ch 1 COM (Common)
16	Output Ch 1 COM (Common)
17	Output Ch 2 NC (Normally Closed)
18	Output Ch 2 NO (Normally Open)
19	Output Ch 2 COM (Common)
20	Output Ch 2 COM (Common)

SAFE AREA	
1	Input Ch 1 for Control
2	Input Ch 1 for Control
3	Input Ch 2 for Control
4	Input Ch 2 for Control

Parameters Table

In the system safety analysis, always check the Hazardous Area/Hazardous Locations devices to conform with the related system documentation, if the device is Intrinsically Safe check its suitability for the Hazardous Area/Hazardous Locations and gas group encountered and that its maximum allowable voltage, current, power (Ui/Vmax, Ii/Imax, Pi/Pi) are not exceeded by the safety parameters (Uo/Voc, Io/Isc, Po/Po) of the D5244 series Associated Apparatus connected to it. Also consider the maximum operating temperature of the field device, check that added connecting cable and field device capacitance and inductance do not exceed the limits (Co/Ca, Lo/La, Lo/Ro) given in the Associated Apparatus parameters for the effective gas group. See parameters on enclosure side and the ones indicated in the table below:

D5244 Terminals		D5244 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	13 - 14 - 15/16	Uo / Voc = 0 V (Uo equal to the connected I.S. circuit)	≤	Ui / Vmax
Ch2	17 - 18 - 19/20			
Ch1	13 - 14 - 15/16	Io / Isc = 0 mA (Io equal to the connected I.S. circuit)	≤	Ii/ Imax
Ch2	17 - 18 - 19/20			
Ch1	13 - 14 - 15/16	Po / Po = 0 mW (Po equal to the connected I.S. circuit)	≤	Pi / Pi
Ch2	17 - 18 - 19/20			

When connected to other intrinsically safe devices or associated apparatus, check that maximum allowable voltage, current (Ui/Vmax, Ii/Imax) of the D5244 Associated Apparatus are not exceeded by the safety parameters (Uo/Voc, Io/Isc) of the Intrinsically Safe device, indicated in the table below:

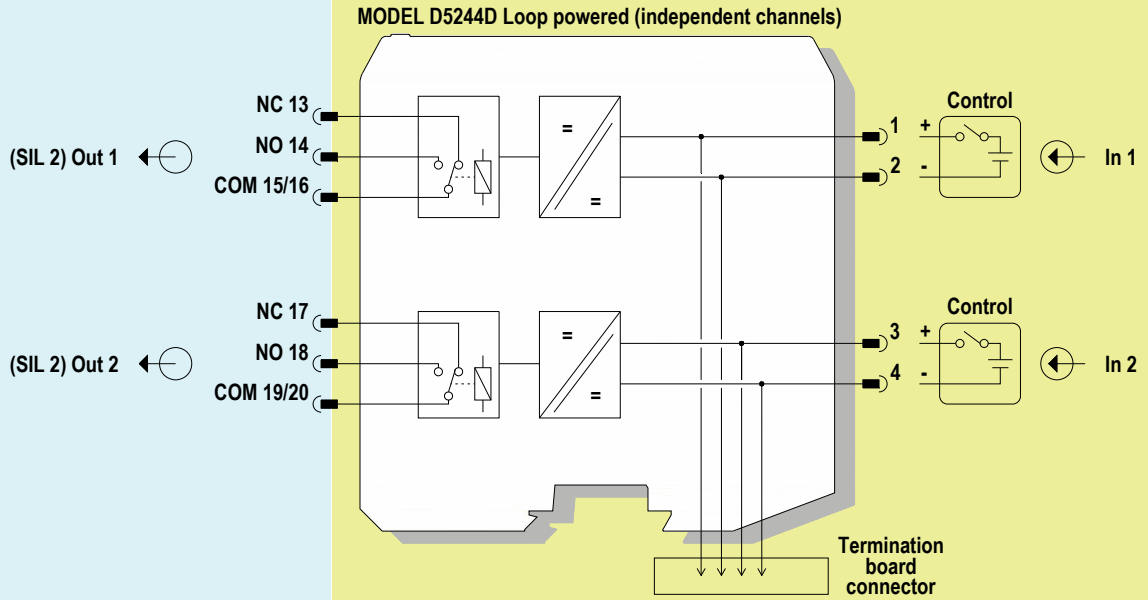
D5244 Terminals		D5244 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	13 - 14 - 15/16	Ui / Vmax = 40V	≥	Uo / Voc
Ch2	17 - 18 - 19/20			
Ch1	13 - 14 - 15/16	Ii / Imax = 2 A	≥	Io / Isc
Ch2	17 - 18 - 19/20			
Ch1	13 - 14 - 15/16	Ci = 0 nF, Li= 0 nH		
Ch2	17 - 18 - 19/20			

For installations in which both the Ci and Li of the Intrinsically Safe apparatus exceed 1 % of the Co and Lo parameters of the Associated Apparatus (excluding the cable), then 50 % of Co and Lo parameters are applicable and shall not be exceeded (50 % of the Co and Lo become the limits which must include the cable such that Ci device + C cable ≤ 50 % of Co and Li device + L cable ≤ 50 % of Lo).
If the cable parameters are unknown, the following value may be used: Capacitance 60pF per foot (180pF per meter), Inductance 0.20µH per foot (0.60µH per meter).
The Intrinsic Safety Entity Concept allows the interconnection of Intrinsically Safe devices approved with entity parameters not specifically examined in combination as a system when the above conditions are respected.
For Division 1 and Zone 0 installations, the configuration of Intrinsically Safe Equipment must be FM approved under Entity Concept (or third party approved);
for Division 2 installations, the configuration of Intrinsically Safe Equipment must be FM approved under non-incendive field wiring or Entity Concept (or third party approved).

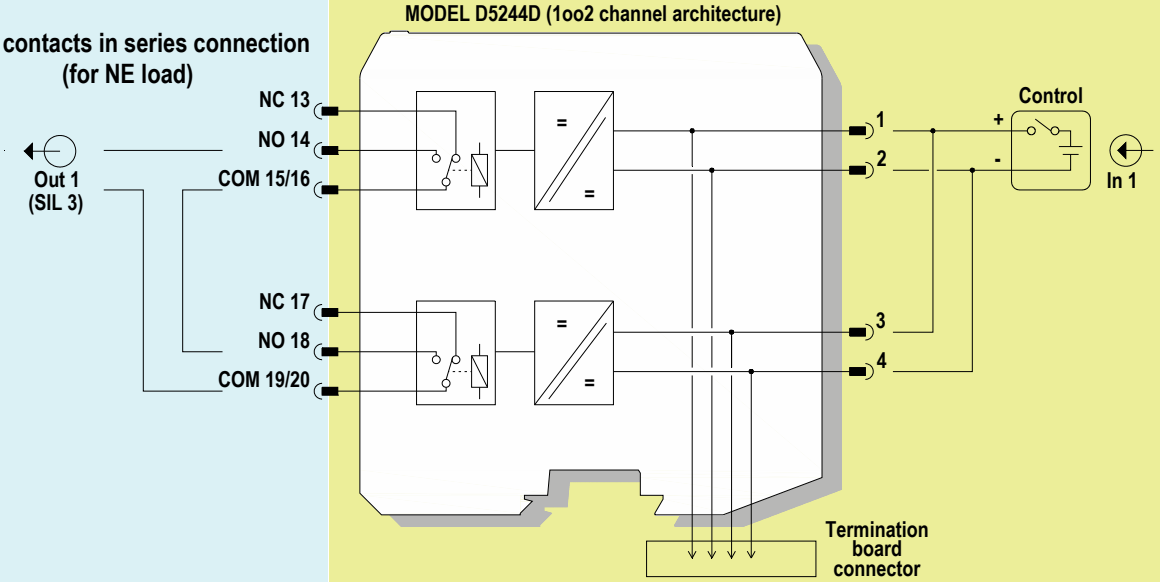
Function Diagram

HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC

SAFE AREA, ZONE 2 GROUP IIC T4



2 NO contacts in series connection (for NE load)



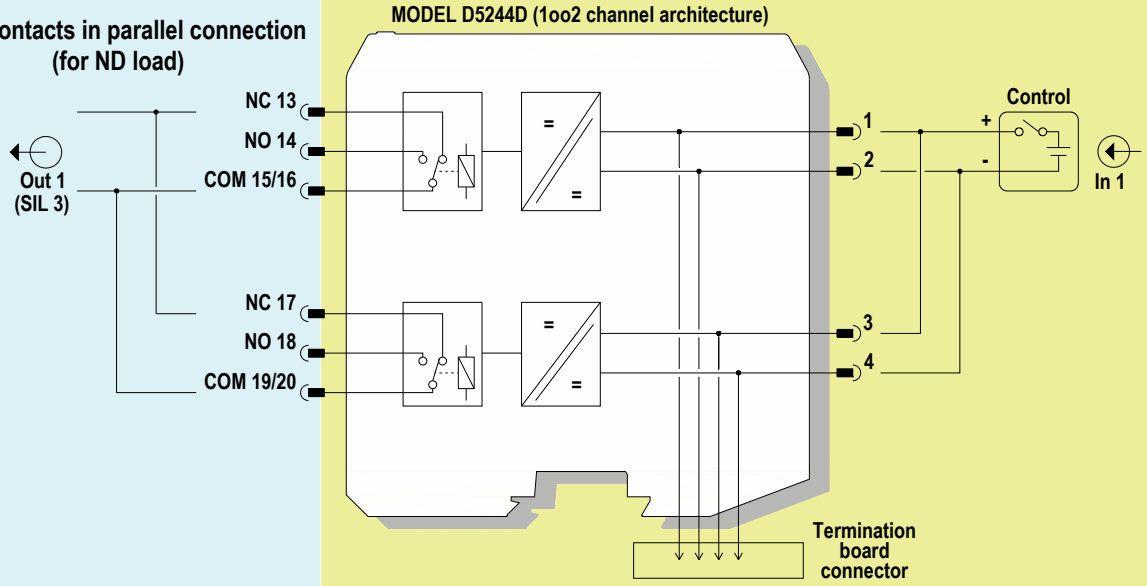
Relay contacts shown in de-energized position

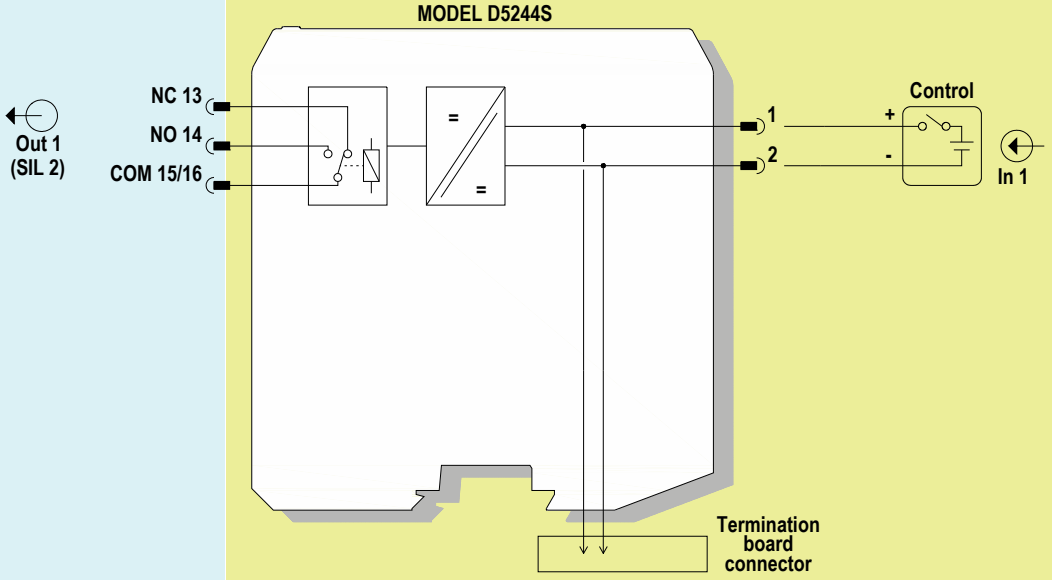
Function Diagram

HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC

SAFE AREA, ZONE 2 GROUP IIC T4

2 NC contacts in parallel connection (for ND load)



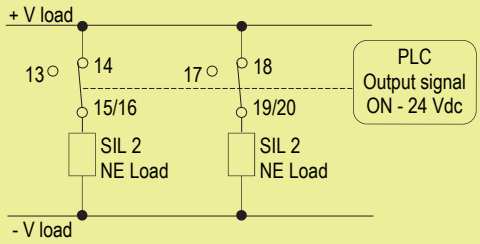


Relay contacts shown in de-energized position

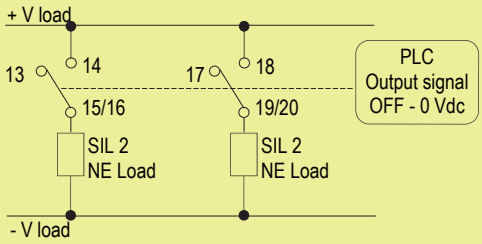
1) Application D5244D with Loop Powered Mode with independent channels

SIL 2 Normally Energized Relay Condition for NE Load

Normal state operation

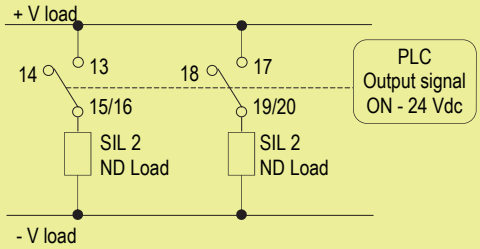


De-energized to trip operation

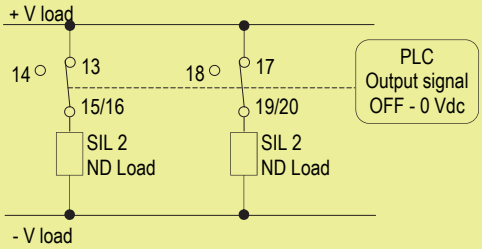


SIL 2 Normally Energized Relay Condition for ND Load

Normal state operation



De-energized to trip operation



Description:

The module is loop powered. The Input Signals from PLC/DCS are normally High (24 Vdc) and are applied to pins 1-2 (for Ch. 1) and 3-4 (for Ch. 2) in order to Normally Energize (NE) or Normally De-energize (ND) loads.
For NE loads, the Input Signals from PLC/DCS are Low (0 Vdc) during "de-energized to trip" operation, in order to de-energize the loads.
For ND loads, the Input Signals from PLC/DCS are Low (0 Vdc) during "de-energized to trip" operation, in order to energize the loads.
The following table describes the status (open or closed) of each output contact when the input signal is High or Low for both NE and ND loads.

Operation	Input Signal Pins 1 - 2 (Ch. 1) or 3 - 4 (Ch. 2)	Pins 14 - 15/16 (Ch. 1) or 18 - 19/20 (Ch. 2)	Pins 13 - 15/16 (Ch. 1) or 17 - 19/20 (Ch. 2)	NE Load (SIL2) Pins 15/16 - -Vload (Ch. 1) or 19/20 - -Vload (Ch. 2)	ND Load (SIL2) Pins 15/16 - -Vload (Ch. 1) or 19/20 - -Vload (Ch. 2)
Normal	High (24 Vdc)	Closed	Open	Energized	De-Energized
Trip	Low (0 Vdc)	Open	Closed	De-Energized	Energized

Safety Function and Failure behavior:

D5244D is considered to be operating in Low Demand mode, as a Type A module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of D5244D is described by the following definitions:

- □ Fail-Safe State: it is defined as the relay output being de-energized (that is, the NO-COM contact being open and the NC-COM contact being closed);
- □ Fail Safe: failure mode that causes the module / (sub)system to go to the defined fail-safe state without a demand from the process;
- □ Fail Dangerous: failure mode that does not respond to a demand from the process (i.e. being unable to go to the defined fail-safe state), so that the relay output remains energized (that is, the NO-COM contact remains closed and the NC-COM contact remains open);
- □ Fail "No Effect": a failure mode of a component that plays a part in implementing the safety function but is neither a safe failure nor a dangerous failure. When calculating the SFF, this failure mode is not taken into account;
- □ Fail "Not part": failure mode of a component which is not part of the safety function but which is part of the circuit diagram and is listed for completeness. When calculating the SFF, this failure mode is not taken into account.

Failure rate date: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	Failure rates (FIT)
λ_{dd} = Total Dangerous Detected failures	0.00
λ_{du} = Total Dangerous Undetected failures	35.23
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	109.72
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**144.95**
MTBF (safety function, single channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**787 years**
$\lambda_{no\ effect}$ = "No effect" failures	92.45
$\lambda_{not\ part}$ = "Not Part" failures	2.00
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**239.40**
MTBF (device, single channel) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**476 years**

Failure rates table according to IEC 61508:2010 Ed.2 :

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	SFF
0.00 FIT	109.72 FIT	0.00 FIT	35.23 FIT	75.70%

PFDavg vs T[Proof] table (assuming Proof Test coverage of 100%), with determination of SIL supposing module contributes ≤10% of total SIF dangerous failures:

T[Proof] = 1 year	T[Proof] = 6 years
PFDavg = 1.55 E-04 - Valid for **SIL 2**	PFDavg = 9.28 E-04 - Valid for **SIL 2**

PFDavg vs T[Proof] table (assuming Proof Test coverage of 100%), with determination of SIL supposing module contributes >10% of total SIF dangerous failures:

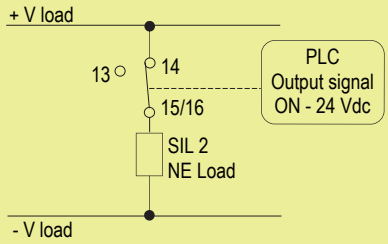
T[Proof] = 20 years
PFDavg = 3.09 E-03 - Valid for **SIL 2**

Systematic capability SIL 3.

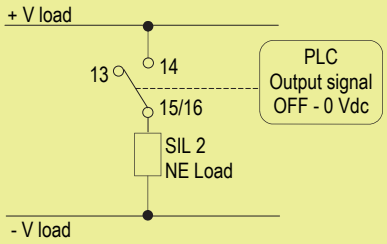
2) Application D5244S - with Loop Powered Mode

SIL 2 Normally Energized Relay Condition for NE Load

Normal state operation

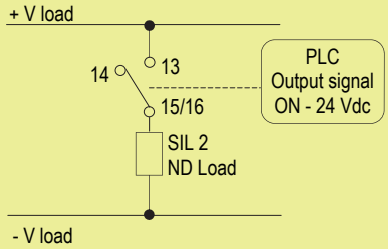


De-energized to trip operation

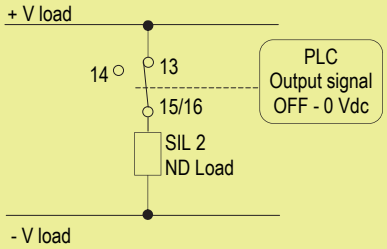


SIL 2 Normally Energized Relay Condition for ND Load

Normal state operation



De-energized to trip operation



Description:
Input Signal from PLC/DCS is normally High (24 Vdc) and it is applied to pins 1-2 in order to Normally Energize (NE) or Normally De-energize (ND) loads.
For NE load, the Input Signal from PLC/DCS is Low (0 Vdc) during "de-energized to trip" operation, in order to de-energize the load.
For ND load, the Input Signal from PLC/DCS is Low (0 Vdc) during "de-energized to trip" operation, in order to energize the load.
The following table describes the status (open or closed) of each output contact when the input signal is High or Low for both NE and ND loads.

Operation	Input Signal Pins 1 - 2	Pins 14 - 15/16	Pins 13 - 15/16	NE Load (SIL2) Pins 15/16 - -Vload	ND Load (SIL2) Pins 15/16 - -Vload
Normal	High (24 Vdc)	Closed	Open	Energized	De-Energized
Trip	Low (0 Vdc)	Open	Closed	De-Energized	Energized

Safety Function and Failure behavior:
D5244S is considered to be operating in Low Demand mode, as a Type A module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of D5244S is described by the following definitions:

- □ Fail-Safe State: it is defined as the relay output being de-energized (that is, the NO-COM contact being open and the NC-COM contact being closed);
- □ Fail Safe: failure mode that causes the module / (sub)system to go to the defined fail-safe state without a demand from the process;
- □ Fail Dangerous: failure mode that does not respond to a demand from the process (i.e. being unable to go to the defined fail-safe state), so that the relay output remains energized (that is, the NO-COM contact remains closed and the NC-COM contact remains open);
- □ Fail "No Effect": a failure mode of a component that plays a part in implementing the safety function but is neither a safe failure nor a dangerous failure. When calculating the SFF, this failure mode is not taken into account;
- □ Fail "Not part": failure mode of a component which is not part of the safety function but which is part of the circuit diagram and is listed for completeness. When calculating the SFF, this failure mode is not taken into account.

Failure rate date: taken from Siemens Standard SN29500.

Failure rate table:

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λ_{su} = Total Safe Undetected failures	109.72
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**144.95**
MTBF (safety function, single channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**787 years**
$\lambda_{no\ effect}$ = "No effect" failures	92.45
$\lambda_{not\ part}$ = "Not Part" failures	2.00
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**239.40**
MTBF (device, single channel) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**476 years**

Failure rates table according to IEC 61508:2010 Ed.2 :

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	SFF
0.00 FIT	109.72 FIT	0.00 FIT	35.23 FIT	75.70%

PFDavg vs T[Proof] table (assuming Proof Test coverage of 100%), with determination of SIL supposing module contributes ≤10% of total SIF dangerous failures:

T[Proof] = 1 year	T[Proof] = 6 years
PFDavg = 1.55 E-04 - Valid for **SIL 2**	PFDavg = 9.28 E-04 - Valid for **SIL 2**

PFDavg vs T[Proof] table (assuming Proof Test coverage of 100%), with determination of SIL supposing module contributes >10% of total SIF dangerous failures:

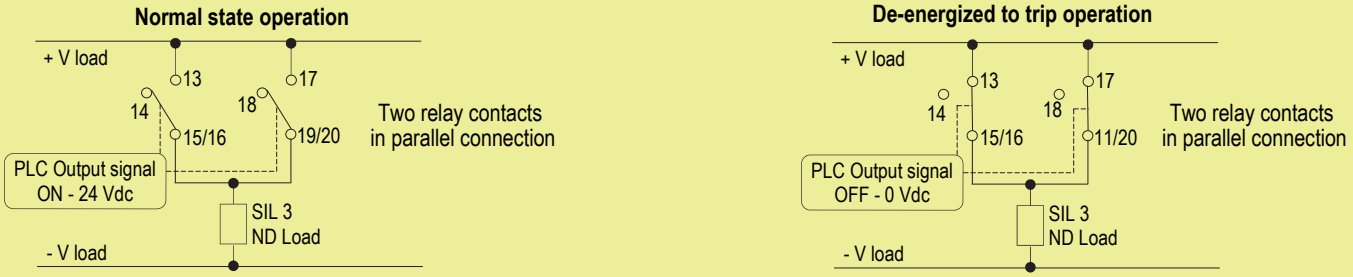
T[Proof] = 20 years
PFDavg = 3.09 E-03 - Valid for **SIL 2**

Systematic capability SIL 3.

3) Application D5244D with Loop Powered Mode and 1oo2 channel architecture

SIL 3 Normally Energized Relay Condition for NE Load

SIL 3 Normally Energized Relay Condition for ND Load



Description:

The Input Signal from PLC/DCS is normally High (24 Vdc) and is applied to pins 1-2 (Ch. 1) and 3-4 (Ch. 2) in order to Normally Energize (NE) or Normally De-energize (ND) load.
For NE load, external wiring must be connected between pins 15/16-18 in order to have two relay contacts in series connection.
For NE load, the Input Signal from PLC/DCS is Low (0 Vdc) during "de-energized to trip" operation, in order to de-energize the load.
For ND load, the Input Signal from PLC/DCS is Low (0 Vdc) during "de-energized to trip" operation, in order to energize the load.
The following tables describe the status (open or closed) of each output contact when the input signal is High or Low for both NE and ND loads.

Operation	Input Signal Pins 1 - 2 and 3 - 4	Pins 14 - 15/16 and 18 - 19/20	Pins 13 - 15/16 and 17 - 19/20	NE Load (SIL2) Pins 19/20 - -Vload	ND Load (SIL2) Pins 15/16 or 19/20 - Vload
Normal	High (24 Vdc)	Closed	Open	Energized	De-Energized
Trip	Low (0 Vdc)	Open	Closed	De-Energized	Energized

Safety Function and Failure behavior:

D5244D is considered to be operating in Low Demand mode, as a Type A module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of D5244D is described by the following definitions:

- □ Fail-Safe State: it is defined as the relay output being de-energized (that is, the NO-COM contact being open and the NC-COM contact being closed);
- □ Fail Safe: failure mode that causes the module / (sub)system to go to the defined fail-safe state without a demand from the process;
- □ Fail Dangerous: failure mode that does not respond to a demand from the process (i.e. being unable to go to the defined fail-safe state), so that the relay output remains energized (that is, the NO-COM contact remains closed and the NC-COM contact remains open);
- □ Fail "No Effect": a failure mode of a component that plays a part in implementing the safety function but is neither a safe failure nor a dangerous failure. When calculating the SFF, this failure mode is not taken into account;
- □ Fail "Not part": failure mode of a component which is not part of the safety function but which is part of the circuit diagram and is listed for completeness. When calculating the SFF, this failure mode is not taken into account.

Failure rate date: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	Failure rates (FIT)
λ_{dd} = Total Dangerous Detected failures	0.00
λ_{du} = Total Dangerous Undetected failures	1.76
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	219.44
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**221.20**
MTBF (safety function, single channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**516 years**
$\lambda_{no\ effect}$ = "No effect" failures	253.60
$\lambda_{not\ part}$ = "Not Part" failures	4.00
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**478.80**
MTBF (device, single channel) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**238 years**

Failure rates table according to IEC 61508:2010 Ed.2 :

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	SFF
0.00 FIT	219.44 FIT	0.00 FIT	1.76 FIT	99.20%

PFDavg vs T[Proof] table (assuming Proof Test coverage of 100%), with determination of SIL supposing module contributes ≤10% of total SIF dangerous failures:

T[Proof] = 1 year	T[Proof] = 12 years
PFDavg = 7.73 E-05 - Valid for **SIL 3**	PFDavg = 9.28 E-05 - Valid for **SIL 3**

PFDavg vs T[Proof] table (assuming Proof Test coverage of 100%), with determination of SIL supposing module contributes >10% of total SIF dangerous failures:

T[Proof] = 20 years
PFDavg = 1.55 E-04 - Valid for **SIL 3**

Systematic capability SIL 3.

Testing procedure at T-proof

The proof test shall be performed to reveal dangerous faults which are undetected by diagnostic. This means that it is necessary to specify how dangerous undetected fault, which have been noted during the FMEDA, can be revealed during proof test.
The Proof test consists of the following steps:

Steps	Action
1	Bypass the safety-related PLC or take any other appropriate action to avoid a false trip.
2	For the single channel, verify the input-to-output channel functionality: For the NO contact, the output load is normally energized (NE) when the input channel is enabled, while the de-activation (Safe State) of the input channel de-energizes the load; For the NC contact, the output load is normally de-energized (ND) when the input channel is enabled, while the de-activation (Safe State) of the input channel energizes the load. The channel functionality must be verified in the 18 to 30 Vdc loop supply voltage range. To enable or disable the input channel, connect a DC power supply to the input terminals. To check the ohmic continuity of the NO and NC contacts, connect an ohmmeter in series to the NO-COM output contact and another one in series with the NC-COM output contact. Perform the following procedure: 1. Do not enable (DC loop supply voltage < 15 V) the input channel (terminals 1-2 or 3-4) of the unit under test and verify that the ohmic continuity is absent at the NO-COM output contact (terminals 14-15/16 or 18-19/20), while it is present at the NC-COM output contact (terminals 13-15/16 or 17-19/20), so that the **1st requisite is verified**; 2. Enable (DC loop supply voltage ≥ 18 V) the input channel (terminals 1-2 or 3-4) of the unit under test and verify that the ohmic continuity is present at the NO-COM output contact (terminals 14-15/16 or 18-19/20), while it is absent at the NC-COM output contact (terminals 13-15/16 or 17-19/20), so that the **2nd requisite is verified**.
3	Remove the bypass from the safety-related PLC or restore normal operation.

This test will reveal approximately 100 % of possible Dangerous Undetected failures in the repeater.

Warning

D5244 series are isolated Intrinsically Safe Associated Apparatus installed into standard EN50022 T35 DIN-Rail located in Safe Area or Zone 2, Group IIC, Temperature T4, Hazardous Area (according to EN/IEC60079-15) within the specified operating temperature limits Tamb –40 to +70 °C, and connected to equipment with a maximum limit for AC power supply Um of 250 Vrms. Not to be connected to control equipment that uses or generates more than 250 Vrms or Vdc with respect to earth ground.
D5244 series must be installed, operated and maintained only by qualified personnel, in accordance to the relevant national/international installation standards (e.g. IEC/EN60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), following the established installation rules, particular care shall be given to segregation and clear identification of I.S. conductors from non I.S. ones.
De-energize power source (turn off power supply voltage) before plug or unplug the terminal blocks when installed in Hazardous Area or unless area is known to be nonhazardous.
Warning: substitution of components may impair Intrinsic Safety and suitability for Zone 2.
Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.
Explosion Hazard: to prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or unless area is known to be nonhazardous.
Failure to properly installation or use of the equipment may risk to damage the unit or severe personal injury.
The unit cannot be repaired by the end user and must be returned to the manufacturer or his authorized representative.
Any unauthorized modification must be avoided.

Operation

The single and dual channel DIN Rail and Termination Boards Digital Relay Output, models D5244S and D5244D, are loop powered digital output modules enabling a Safe Area loop voltage signal, to control a device in Hazardous Area, providing 2 port isolation (input/output). Outputs are galvanically isolated.
Typical applications include switching of Hazardous Area circuits, changing of polarities and sounder tones, calibrating of strain gauge bridges, resetting of field devices, testing of fire detectors. Each output channel provides a SPDT relay, with two contacts defined NO (Normally Open) and NC (Normally Close) when the output relay is de-energized. Considering each channel NE (Normally Energized), the output relay is energized,so that NO contact is closed (useful for NE loads or Hazardous Area circuits) and NC contact is open (useful for ND loads or Hazardous Area circuits). The safe state is reached when the channel and the output relay are de-energized, so that NO contact is open (de-energizing loads or Hazardous Area circuits) and NC contact is closed (energizing loads or Hazardous Area circuits).

Installation

D5244 series modules are housed in a plastic enclosure suitable for installation on T35 DIN-Rail according to EN50022, with or without Power Bus or on customized Termination Board. D5244 unit can be mounted with any orientation over the entire ambient temperature range.
Electrical connection of conductors up to 2.5 mm² are accommodated by polarized plug-in removable screw terminal blocks which can be plugged in/out into a powered unit without suffering or causing any damage **(for Zone 2 installations check the area to be nonhazardous before servicing)**.
The wiring cables have to be proportionate in base to the current and the length of the cable.
On the section “Function Diagram” and enclosure side a block diagram identifies all connections.
Identify the function and location of each connection terminal using the wiring diagram on the corresponding section.

Intrinsically Safe conductors must be identified and segregated from non I.S. and wired in accordance to the relevant national/international installation standards (e.g. EN/IEC60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), make sure that conductors are well isolated from each other and do not produce any unintentional connection.
The enclosure provides, according to EN60529, an IP20 minimum degree of mechanical protection (or similar to NEMA Standard 250 type 1) for indoor installation, outdoor installation requires an additional enclosure with higher degree of protection (i.e. IP54 to IP65 or NEMA type 12-13) consistent with the effective operating environment of the specific installation.
Units must be protected against dirt, dust, extreme mechanical (e.g. vibration, impact and shock) and thermal stress, and casual contacts.
If enclosure needs to be cleaned use only a cloth lightly moistened by a mixture of detergent in water.
Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of D5244E must be cleaned only with a damp or antistatic cloth.
Any penetration of cleaning liquid must be avoided to prevent damage to the unit. Any unauthorized card modification must be avoided.
According to EN61010, D5244 series must be connected to SELV or SELV-E supplies.
Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.

Start-up

Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires, also check that Intrinsically Safe conductors and cable trays are segregated (no direct contacts with other non I.S. conductors) and identified either by color coding, preferably blue, or by marking.
Check conductors for exposed wires that could touch each other causing dangerous unwanted shorts.
The status yellow LED must be in accordance with the condition of the corresponding input line.