

**Characteristics:**

**General Description:**

The D5290S-078 is a relay module suitable for the switching of safety related circuits, up to SIL 3 level according to IEC 61508 for high risk industries. It provides isolation between input channel and output contacts.

Three 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.
- 3) short circuit fault detection (only for Functional Safety applications with NE Relay condition): when enabled, it allows DCS/PLC to detect short circuit fault of module.

See the following pages for Functional Safety applications with related SIL value.

Mounting on standard DIN-Rail or on customized Termination Boards, in Safe Area or in Zone 2.

**Front Panel and Features:**



- SIL 3 according to IEC 61508 for Tproof = 10 / 20 years (10 / 20 % of total SIF) with PFDavg (1 year) 7.01 E-06, SFF = 99.26 % for two NE or ND loads with NE relay condition (see application n° 1, 2 and 4).
- SIL 2 according to IEC 61508 for Tproof = 7 / 14 years (10 / 20 % of total SIF) with PFDavg (1 year) 1.40 E-04, SFF = 75.83 % for four NE loads with NE relay condition (see application n° 3).
- SIL 3 according to IEC 61508 for Tproof = 6 / 12 years (10 / 20 % of total SIF) with PFDavg (1 year) 1.58 E-05, SFF = 99.10 % for ND load with ND relay condition (see application n° 5).
- SIL 2 according to IEC 61508 for Tproof = 20 yrs (10 % or more of total SIF) with PFDavg (1 year) 1.54 E-05, SFF = 98.77 % for two ND loads with ND relay condition (see application n° 6).
- Installation in Zone 2.
- 5 A SIL 3 / SIL 2 contacts for NE or ND loads with NE or ND Relay condition.
- 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 Certifications.
- Simplified installation using standard DIN-Rail and plug-in terminal blocks or customized Termination Boards.

**Ordering Information:**

Model: D5290S-078

**Technical Data:**

**Input:** 24 Vdc nom (21.6 to 27.6 Vdc) reverse polarity protected, ripple within voltage limits  $\leq 5$  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):**  $\geq 21.6$  Vdc for normal operation,  $\leq 17$  Vdc reflects a high impedance ( $\leq 10$  mA consumption) to the control device.
- 3) **Short circuit fault detection (DIP-Switch selectable and only for Functional Safety applications with NE Relay condition):** to allow DCS/PLC to detect short circuit fault of module.

**Current consumption @ 24 V:** 60 mA with relay energized, typical.

**Power dissipation:** 1.5 W with 24 V input voltage, relay energized, typical.

**Isolation (Test Voltage):** Input / All Outputs: 2.5 KV;

Out S\_1 & Out P\_1 / Out S\_3 & Out P\_2, Out S\_2, Out S\_4: 500 V;

Out S\_3 & Out P\_2 / Out S\_2, Out S\_4: 500 V;

Out S\_2 / Out S\_4: 500 V.

**Output:** 2 voltage free SPDT (= NO contact + parallel of 2 NC contacts) relay contacts identified with outputs: Out S\_1 & Out P\_1 and Out S\_3 & Out P\_2;

2 voltage free SPST (NO) relay contacts identified with: Out S\_2 and Out S\_4.

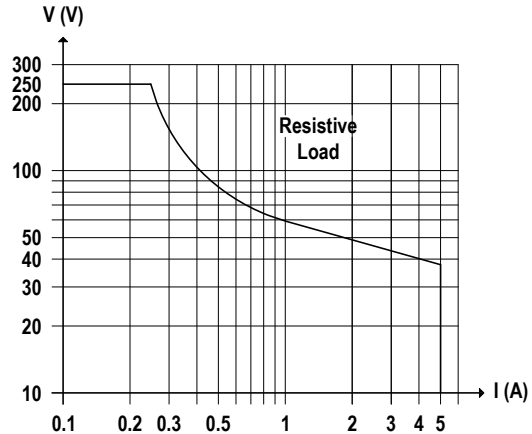
Terminals 13-14 (Out S\_1), 15-16 (Out S\_2), 21-22 (Out S\_4) and 23-24 (Out S\_3) are open when relay is de-energized, closed in energized relay condition.

Terminals 17-18 (Out P\_1) and 19-20 (Out P\_2) are: closed when relay is de-energized, open in energized relay condition.

**Contact material:** Ag Alloy (Cd free) or AgSnO<sub>2</sub>.

**Contact rating:** 5 A 250 Vac 1250 VA, 5 A 250 Vdc 175 W (resistive load).

**DC Load breaking capacity:**



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

**Bounce time NO / NC contact:** 4 / 10 ms, typical.

**Frequency response:** 10 Hz maximum.

**Compatibility:**

**CE** CE mark compliant, conforms to 94/9/EC Atex Directive and to 2004/108/CE EMC Directive.

**Environmental conditions:**

**Operating:** temperature limits - 40 to + 60 °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:** Ex nA nC IIC T4 Gc

non-sparking electrical equipment.

-40 °C  $\leq$  Ta  $\leq$  60 °C.

**Approvals:**

ATEX conforms to EN60079-15,

IECEx conforms to IEC60079-15.

SIL 2 / SIL 3 conforms to IEC61508.

**Mounting:**

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

**Weight:** about 145 g.

**Connection:** by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm<sup>2</sup>.

**Location:** Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4 installation.

**Protection class:** IP 20.

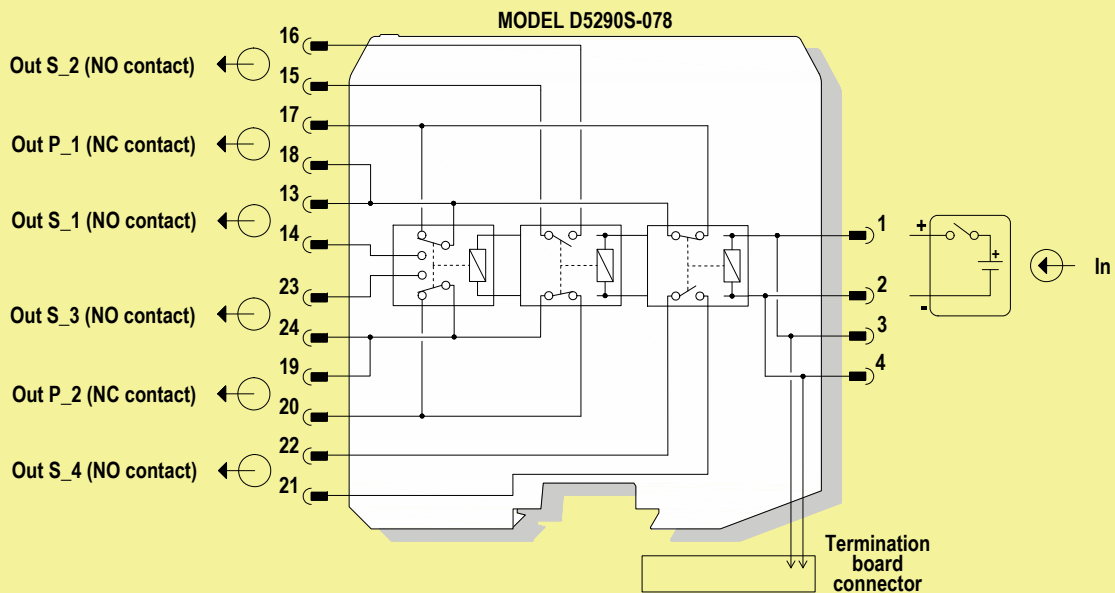
**Dimensions:** Width 22.5 mm, Depth 123 mm, Height 120 mm.

**Image:**



**Function Diagram:**

SAFE AREA, ZONE 2 GROUP IIC T4

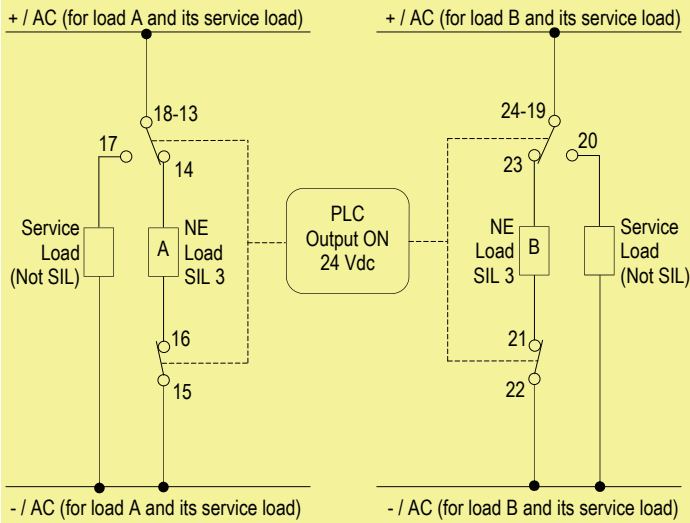


See the following pages for Functional Safety applications with related SIL value.

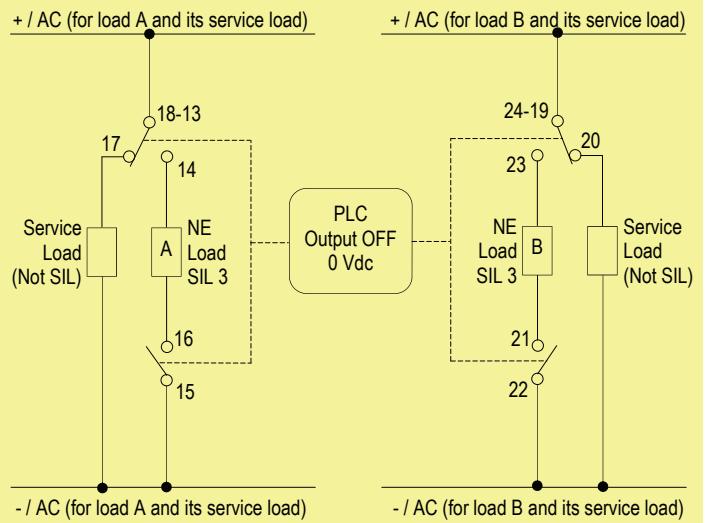
Relay contacts shown in de-energized position.  
Terminals 13-14, 15-16, 21-22 and 23-24 are open.  
Terminals 17-18 and 19-20 are closed.

**1) Application D5290S-078 - SIL 3 Load Normally Energized Condition (NE) and Normally Energized Relay: one common driving signal from PLC for both NE loads (A and B), with interruption of both load supply lines**

**Normal state operation**



**De-energized to trip operation**



**Contacts 13-14 and 15-16:** in normal operation relays are energized, contacts are closed, NE load (A) is energized.  
**Contact 17-18 (double contact in parallel):** in normal operation relay is energized, contact is open, service load for NE load (A) is de-energized.

**Contacts 21-22 and 23-24:** in normal operation relays are energized, contacts are closed, NE load (B) is energized.  
**Contact 19-20 (double contact in parallel):** in normal operation relay is energized, contact is open, service load for NE load (B) is de-energized.

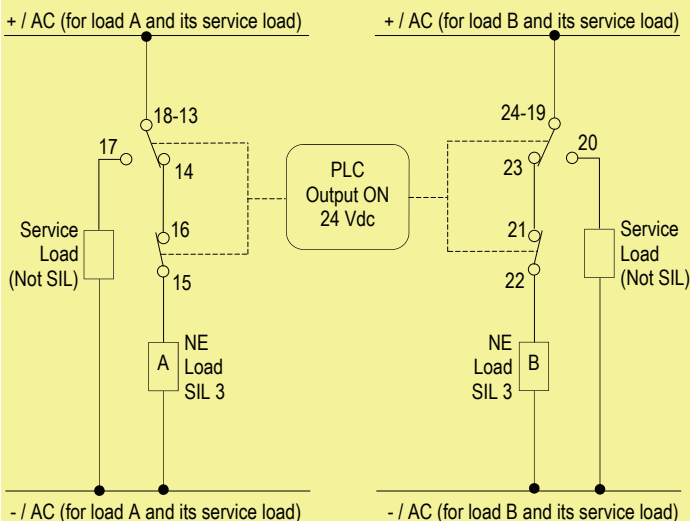
**Contacts 13-14 and 15-16:** the SIL 3 Safety Function is met when the relays are de-energized, contacts are open, NE load (A) is de-energized.  
**Contact 17-18 (double contact in parallel):** in safe state the relay is de-energized, contact is closed, service load for NE load (A) is energized.

**Contacts 21-22 and 23-24:** the SIL 3 Safety Function is met when the relays are de-energized, contacts are open, NE load (B) is de-energized.  
**Contact 19-20 (double contact in parallel):** in safe state the relay is de-energized, contact is closed, service load for NE load (B) is energized.

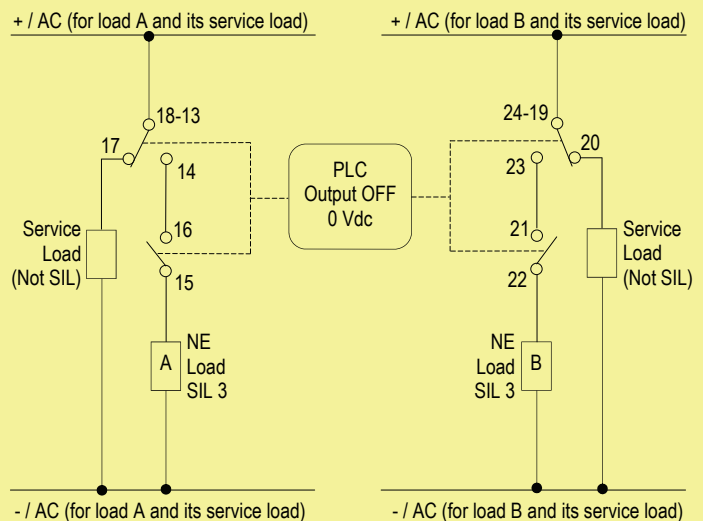
**Warning:** being an application with NE Relay condition, if DCS/PLC is set to monitor the input line current, it's appropriate to enable the short circuit fault detection so that DCS/PLC can detect short circuit fault of module (as, for example, the short circuit of a relay coil).

**2) Application D5290S-078 - SIL 3 Load Normally Energized Condition (NE) and Normally Energized Relay: one common driving signal from PLC for both NE loads (A and B), with interruption of only one load supply line**

**Normal state operation**



**De-energized to trip operation**



**Contacts 13-14 and 15-16:** in normal operation relays are energized, contacts are closed, NE load (A) is energized.  
**Contact 17-18 (double contact in parallel):** in normal operation relay is energized, contact is open, service load for NE load (A) is de-energized.

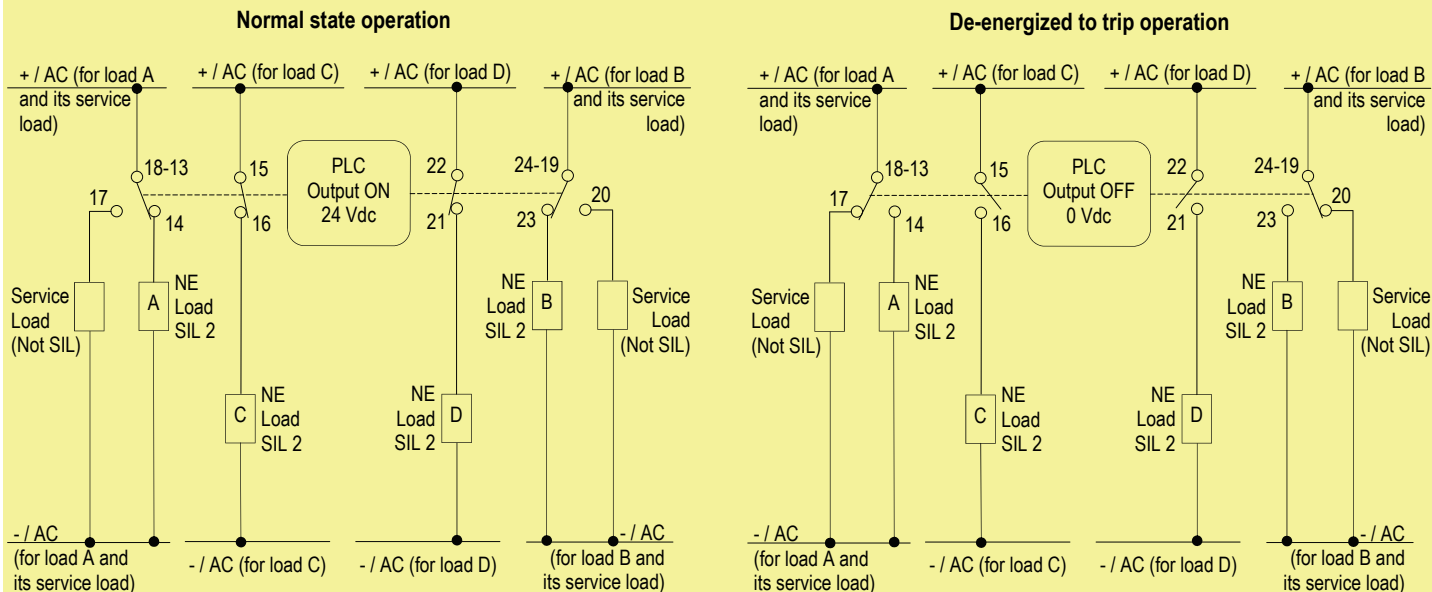
**Contacts 21-22 and 23-24:** in normal operation relays are energized, contacts are closed, NE load (B) is energized.  
**Contact 19-20 (double contact in parallel):** in normal operation relay is energized, contact is open, service load for NE load (B) is de-energized.

**Contacts 13-14 and 15-16:** the SIL 3 Safety Function is met when the relays are de-energized, contacts are open, NE load (A) is de-energized.  
**Contact 17-18 (double contact in parallel):** in safe state the relay is de-energized, contact is closed, service load for NE load (A) is energized.

**Contacts 21-22 and 23-24:** the SIL 3 Safety Function is met when the relays are de-energized, contacts are open, NE load (B) is de-energized.  
**Contact 19-20 (double contact in parallel):** in safe state the relay is de-energized, contact is closed, service load for NE load (B) is energized.

**Warning:** being an application with NE Relay condition, if DCS/PLC is set to monitor the input line current, it's appropriate to enable the short circuit fault detection so that DCS/PLC can detect short circuit fault of module (as, for example, the short circuit of a relay coil).

**3) Application D5290S-078 - SIL 2 Load Normally Energized Condition (NE) and Normally Energized Relay: one common driving signal from PLC for all NE loads (A, B, C and D), with interruption of only one load supply line**

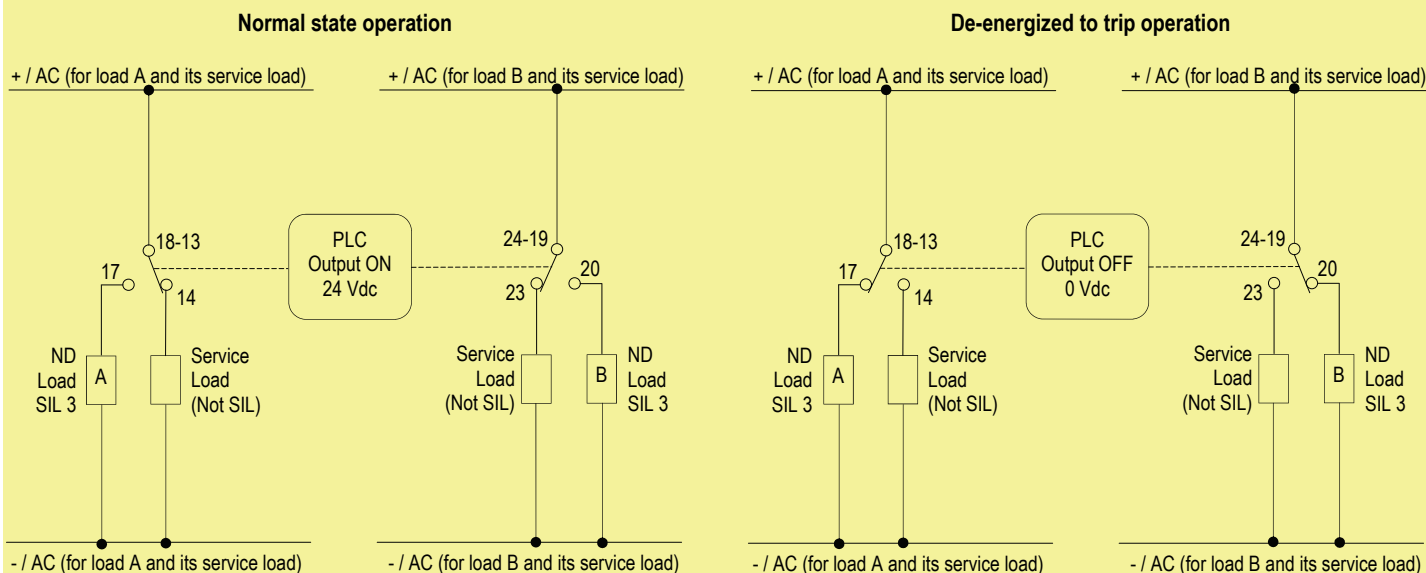


**Contacts 13-14, 15-16, 21-22 and 23-24:** in normal operation relays are energized, contacts are closed, NE loads (A, B, C and D) are energized.  
**Contact 17-18 and 19-20 (double contact in parallel):** in normal operation relays are energized, contacts are open, service loads for NE loads (A and B) are de-energized.

**Contacts 13-14, 15-16, 21-22 and 23-24:** the SIL 2 Safety Function is met when the relays are de-energized, contacts are open, NE loads (A, B, C and D) are de-energized.  
**Contact 17-18 and 19-20 (double contact in parallel):** in safe state the relays are de-energized, contacts are closed, service loads for NE loads (A and B) are energized.

**Warning:** being an application with NE Relay condition, if DCS/PLC is set to monitor the input line current, it's appropriate to enable the short circuit fault detection so that DCS/PLC can detect short circuit fault of module (as, for example, the short circuit of a relay coil).

**4) Application D5290S-078 - SIL 3 Load Normally De-energized Condition (ND) and Normally Energized Relay: one common driving signal from PLC for both ND loads (A and B), with interruption of only one load supply line**

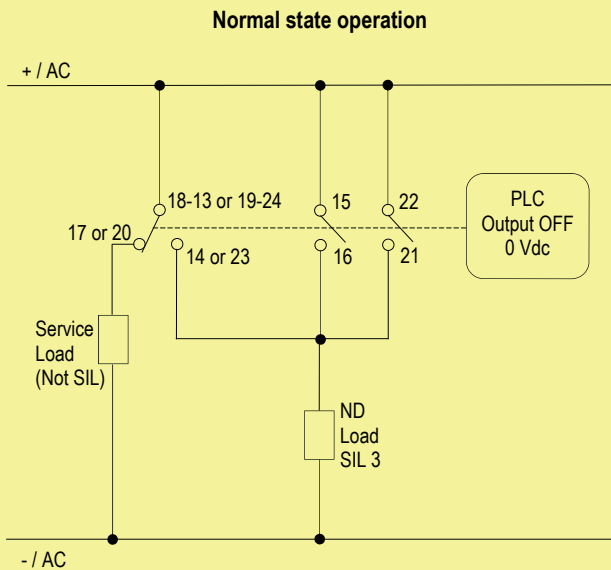


**Contact 17-18 (double contact in parallel):** in normal operation relay is energized, contact is open, ND load (A) is de-energized.  
**Contact 13-14:** in normal operation relay is energized, contact is closed, service load for ND load (A) is energized.  
**Contact 19-20 (double contact in parallel):** in normal operation relay is energized, contact is open, ND load (B) is de-energized.  
**Contact 23-24:** in normal operation relay is energized, contact is closed, service load for ND load (B) is energized.

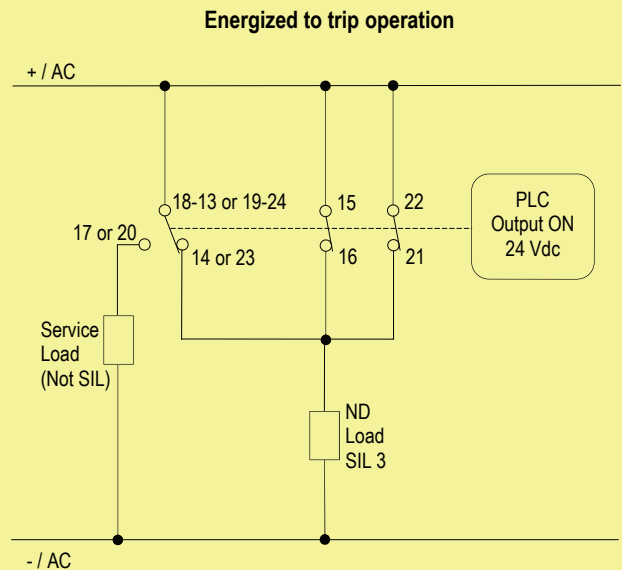
**Contact 17-18 (double contact in parallel):** the SIL 3 Safety Function is met when the relay is de-energized, contact is closed, ND load (A) is energized.  
**Contact 13-14:** in safe state the relay is de-energized, contact is open, service load for ND load (A) is de-energized.  
**Contact 19-20 (double contact in parallel):** the SIL 3 Safety Function is met when the relay is de-energized, contact is closed, ND load (B) is energized.  
**Contact 23-24:** in safe state the relay is de-energized, contact is open, service load for ND load (B) is de-energized.

**Warning:** being an application with NE Relay condition, if DCS/PLC is set to monitor the input line current, it's appropriate to enable the short circuit fault detection so that DCS/PLC can detect short circuit fault of module (as, for example, the short circuit of a relay coil).

5) Application D5290S-078 - SIL 3 Load Normally De-energized Condition (ND) and Normally De-energized Relay, with interruption of only one load supply line

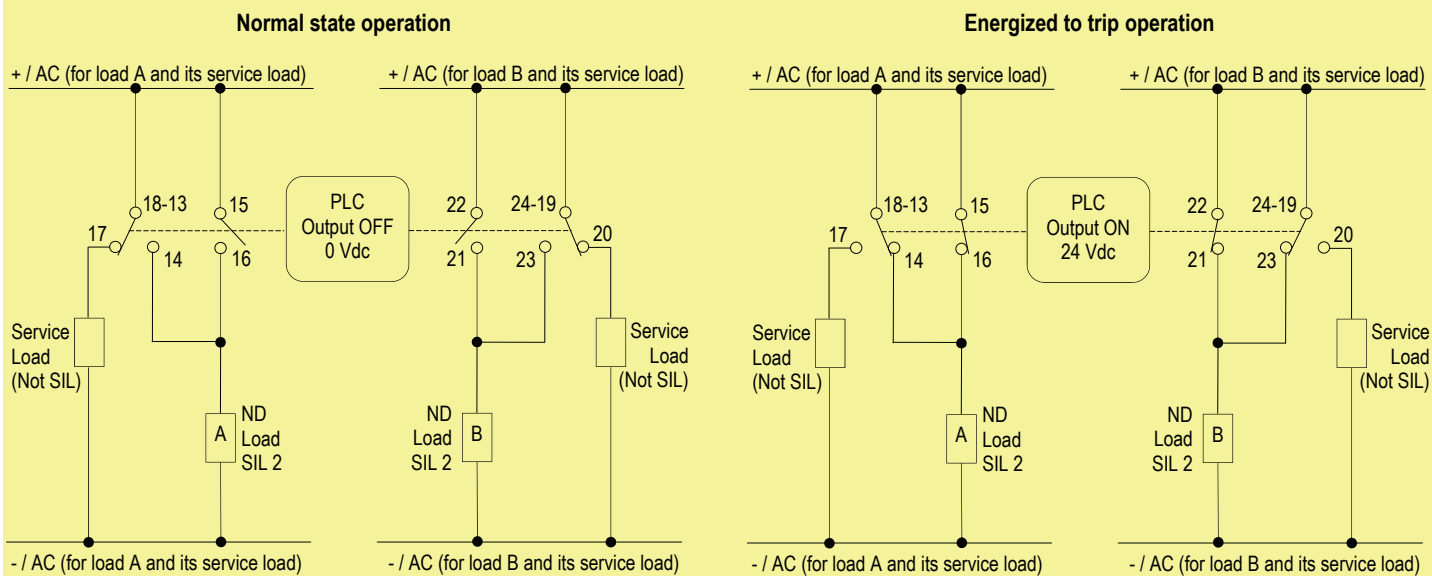


**Contacts 13-14 or 23-24, 15-16, 21-22:** in normal operation relays are de-energized, contacts are open, ND load is de-energized.  
**Contact 17-18 or 19-20 (double contact in parallel):** in normal operation relay is de-energized, contact is closed, service load for ND load is energized.



**Contacts 13-14 or 23-24, 15-16, 21-22:** the SIL 3 Safety Function is met when the relays are energized, contacts are closed, ND load is energized.  
**Contact 17-18 or 19-20 (double contact in parallel):** in safe state the relay is energized, contact is open, service load for ND load is de-energized.

**6) Application D5290S-078 - SIL 2 Load Normally De-energized Condition (ND) and Normally De-energized Relay: one common driving signal from PLC for both ND loads (A and B), with interruption of only one load supply line**



**Contacts 13-14, 15-16:** in normal operation relays are de-energized, contacts are open, ND load (A) is de-energized.  
**Contact 17-18 (double contact in parallel):** in normal operation relay is de-energized, contact is closed, service load for ND load (A) is energized.  
**Contacts 21-22, 23-24:** in normal operation relays are de-energized, contacts are open, ND load (B) is de-energized.  
**Contact 19-20 (double contact in parallel):** in normal operation relay is de-energized, contact is closed, service load for ND load (B) is energized.

**Contacts 13-14, 15-16:** the SIL 2 Safety Function is met when the relays are energized, contacts are closed, ND load (A) is energized.  
**Contact 17-18 (double contact in parallel):** in safe state the relay is energized, contact is open, service load for ND load (A) is de-energized.  
**Contacts 21-22, 23-24:** the SIL 2 Safety Function is met when the relays are energized, contacts are closed, ND load (B) is energized.  
**Contact 19-20 (double contact in parallel):** in safe state the relay is energized, contact is open, service load for ND load (B) is de-energized.